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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. The goal of this study was to examine the relationship between age and perceptions of a Clinical Information System (CIS). 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 is inversely proportional to Perceived Ease of Use and Perceived Behavioral Control. These results are 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 (Wey Smola and Sutton 2002) 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 (Kupperschmidt 2000). Currently mains authors consider Generation Z (Prensky 2001), named also Digital Natives or Millennial Generation (born after 1985-1990) as having more "sophisticated technological skills" (Margaryan, Littlejohn et al. 2011) 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 (Jones, Ramanau et al. 2010). Furthermore, literature has not come to identify if differences in technology skills and forms of technologies uses are related to generation or age effect.

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) (Sharit and Czaja 1994). The longitudinal study conducted by Morris & Venkatesh (Morris and Venkatesh 2000) 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 "un-technological" 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 (Sharit and Czaja 1994). An older staff is negatively related to the probability of introducing new or significantly improved technologies (Meyer 2011).

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 (Davis 1989), perceived behavioral control (Venkatesh, Morris et al. 2003), anxiety (Venkatesh & Bala, 2003), system quality, information quality, service quality (Petter, DeLone et al. 2008) and trust (Cho, V. A study of the roles of trusts and risks in information-oriented online legal services using an integrated model. *Information & Management, 43*, 4 (2006), 502–520.). Ease of use and customization are main indicators of system quality (Petter, DeLone et al. 2008). 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 (Petter, DeLone et al. 2008). 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 (Wixom and Todd 2005).

Self-efficacy refers to the extent to which individuals feel able to complete specific tasks using an information system (Venkatesh, Morris et al. 2003).

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, behavioral control, 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 (Morris and Venkatesh 2000, Chau and Hu 2002, Wixom and Todd 2005, Petter, DeLone et al. 2008, Holden and Karsh 2010, Chen and Hsiao 2012), 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, customization, anxiety, ease of use, behavioral control. Nevertheless, age has no influence on trust and perceived usefulness. These results are summarized in the table below:

Item	Significance level * =<0,05 **=<0,01 ***=<0,001	Average (on Likert scale) for the different ages				Total Average
		<35	35-45	45-55	>55	
Perceived Behavioral control	***	3,44	3,71	3,98	4,33	3,79
Anxiety	***	3,17	3,73	3,63	3,41	3,49
Ease of use	***	2,85	3,32	3,57	3,33	3,25
Customization	*	3,57	3,89	3,97	3,78	3,8
Information and system quality	*	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. But, surprisingly, the relationship is not the same as expected. The impact of age factor is very strong on Perceived Ease of Use and Perceived Behavioral Control, but age is inversely proportional to Perceived Ease of Use. The growth of these relationships is continuous over the 4 age categories. This means younger staff reported to be less comfortable with technology than orders. These results may be explained by the fact that using CIS is not intuitive (Ologeanu-Taddei, Morquin, AMIA) 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. Furthermore, older staff reported more facilities to contact CIS support if they need to. Thus, the lack of sufficient clinical and organizational knowledge of younger staff predominate over general technology skills.

The impact of age is also very strong for Anxiety, but this relationship is not continuous. There are the middle categories (35-45 years and 45-55 years) that reported the higher rate of anxiety. Moreover, younger staff reported less anxiety. Both results may be explained by the fact that middle categories are more concerned by care management and different responsibility and monitoring tacks (as medical responsibility for physicians seniors while residents fulfill hospital a patient's discharge). For medical tasks, residents, which belong to the first category of age, are supervised by seniors.

The impact of age is little on Information and System Quality. This relationship is continuous. It may be correlated to the impact of age on Perceived Ease of Use. Thus, younger staff stated less Perceived ease of Use and Less Information and System Quality (perceived information security). The impact of age is also little on Customization, but there are the middle categories that reported less perceived customization. This result may be explained but the greater medical and organizational knowledge and responsibilities of these categories and, consequently, the gap between their representation 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 (Ologeanu-Taddei, Morquin, AMIA). 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. Perceived Behavioral Control, 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 showed that age does have an effect of Perceived Behavioral Control and Ease of Use but indirectly proportional. In other words, younger staff reported less Perceived Behavioral Control 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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