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Usage intensity of mobile medical apps: A tale of two methods☆

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ABSTRACT

Web 2.0 technologies have changed the traditional relationship model between doctors and third parties, and a plethora of apps are now available for the medical profession. This study presents unpublished findings about the potential drivers that currently influence mobile medical app usage intensity. Logistic regression and fuzzy-set qualitative comparative analysis (fsQCA) are both used to examine usage intensity. By using two research methods, rather than just one, the findings are greatly enhanced. Logistic regression results show that high usage intensity is explained by high perceived usefulness and high perceived ease of use. FsQCA, on the other hand, highlights that the combinations of multiple conditions are also significant, leading to the finding that low mobile medical app usage intensity is associated with low perceived ease of use, high perceived usefulness, low peer influence, high seniority, and younger female doctors.

1. Introduction

The health sector is extremely complex and heavily regulated. A range of activities is used to market the pharmaceutical industry, including direct contact with prescribers, specialized magazines, electronic mail, and direct advertising to the final consumer. All of these activities are profoundly regulated by both national and international legislation, which, for example, does not authorize the pharmaceutical industry to directly promote prescription drugs to consumers. Alkateeb and Doucette (2009) confirm that the competition for the length of time of contact with a doctor is intense, obliging salespersons to find alternative channels. It is no surprise that interest in the Internet as a tool for health information and communication has grown considerably in recent years (Korp, 2006). As empirical evidence of this trend, note that 40,000 healthcare apps were available in the U.S. Apple iTunes store in 2015 (Silva, Rodrigues, de la Torre Díez, & López-Coronado, 2015).

Web 2.0 challenges the traditional communication model, and it can, therefore, be said to significantly change the way communication is conducted in this area (Chou, Prestin, Lyons, & Wen, 2013). Bullock (2014) argues that these tools can facilitate the sharing of knowledge, values, and expectations throughout the medical community. With the increase in use of smartphones and apps by the medical community (Franko & Tirrell, 2012), mobile-health has become an indispensable tool for communication in the health sector (Ventola, 2014), with professionals benefitting from greater convenience, precision, efficiency, productivity, and cutting-edge technology, resulting in even better clinical decision-making. Clinical practice has been transformed using these devices, due to the need for better communication resources and information in healthcare locations, as well as omnipresence (Bullock, 2014; Ventola, 2014). Wendy (2016) concludes that health organizations and health professionals from France, the UK, and the USA are increasingly using mobile applications.

Mobile health success depends heavily on its adoption by the medical profession (Gagnon, Ngangue, Payne-Gagnon, & Desmartis, 2016). Arguably, all these professionals possess mobile apps installed on their mobile devices. However, this does not necessarily mean that they use the apps frequently. Considering both the communication restrictions experienced by the pharmaceutical industry and the ongoing debate regarding the advantages of mobile health, there is a need to assess the factors that enable medical mobile apps usage by the medical profession.

Research regarding the motivational factors that lead to the adoption and usage of health apps by professionals is expanding (Gagnon et al., 2016; Kwon, Mun, Lee, McLeod, & D'Angelo, 2016; Silva et al., 2015), but is still scarce regarding the impact of certain individual factors – peer influence, seniority, and demographic characteristics. This scarcity raises the research question: Which factors or configurations of factors drive mobile medical app (MMA) usage intensity in the medical profession? This paper addresses this question using both logistic regression (LR) and fuzzy-set qualitative comparative analysis (fsQCA). Ordanini, Parasuraman, and Rubera (2014) and Grohs, Raies, Koll, and Mühlbacher (2016) argue that single antecedent conditions are rarely necessary or sufficient to predict an outcome. Furthermore, as Grohs et al. (2016) suggest, the configurations of factors that enable

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MMA usage intensity found by LR could be different from those found by fsQCA, as each method has its own perspectives and assumptions about data. Whereas LR shows one combination symmetric relationship between predictor variables and the outcome variable, fsQCA analyzes combinations of levels of predictor variables that lead to a higher level of outcome, in a potential asymmetric relationship. By using two research methods, rather than just one, the findings are enhanced (Woodside, 2015), contributing to a better understanding of the factors that influence usage intensity of MMAs. This paper also responds to QCA analysts' request to have their method included as part of a multi-method approach (Grendstad, 2007).

2. Mobile health-related app usage intensity

MMAs turn smartphones into useful tools for health practice (Mosa, Yoo, & Sheets, 2012). However, only limited research exists regarding the use of healthcare apps by doctors or medical students (Ozdalga, Ozdalga, & Ahuja, 2012). Previous research on MMA usage by doctors produced mixed results. Smartphones are already used regularly by doctors to perform their job (O'Connor et al., 2013), and they are becoming increasingly popular among medical students for mobile learning (Masika et al., 2015). Likewise, they are often used as drug guides and medical calculators (Franko & Tirrell, 2012). However, research also shows that the increasing penetration rate of smartphone ownership among doctors does not necessarily equate to higher usage of MMAs to support their clinical practice (Liu et al., 2016; Rung, Warnke, & Mattheos, 2014).

The existing literature shows that MMA research has focused largely on its effectiveness. MMA has been investigated in terms of its convenience and effectiveness in controlling obesity (Carter, Burley, & Nykjaer, 2013), modifying behaviors (Willems, Willemsen, & Nagelhout, 2013), and managing disease (Arsand, Tufano, & Ralston, 2008). Research is still scarce regarding the factors that promote MMA usage intensity among doctors.

Previous research identifies some causes for the adoption of new technologies. Davies, Kotadia, Mughal, Hannan, and Alqarni (2015) argue that the reliability of information, app security, and technical difficulties are important barriers to app usage. On the other hand, they observe that ease of use, reliability, security, regulated information, cost, fun, and impact on battery life are also ideal characteristics for an MMA. Similarly, Bidmon, Terlutter, and Röttl's (2014) study of patients in the USA and Germany highlights that perceived ease of use, age, and gender significantly affect the adoption of mobile physician-rating apps. Well before mobile apps existed, Davis (1989) asserted that the acceptance of new technologies depends on perceived utility and perceived ease of use. Orruño, Gagnon, Asua, and Abdeljelil (2011) argue that extrinsic factors, such as peer influence, condition the adoption of new technologies.

This study investigates the factors that are often associated with the adoption of new mobile technologies (see Gagnon et al., 2016, for a systematic review of mobile health adoption barriers and facilitators): perceived ease of use, perceived usefulness, and peer influence. Seniority, age, and gender are used as control variables.

2.1. Perceived ease of use

Perceived ease of use relates to the belief that using a technology is effortless (Davis, Bagozzi, & Warshaw, 1989; Tung, Chang, & Chou, 2008). Conversely, the more difficult it is to get information, the longer the adoption period will be (Alkateeb & Doucette, 2009). Gleason (2001) argues that doctors use e-detailings because they find them intuitive to use and easy to access. Kim and Chang (2007) and Gagnon et al. (2016) also defend the idea that perceived ease of use favors the adoption of technology in healthcare. In the same line of thought, a recent study of antecedents of mobile app usage among smartphone users (Kim, Yoon, & Han, 2016) shows that perceived ease of use positively influences app usage. On the contrary, Hur, Lee, and Choo (2017) found a significantly negative direct effect of perceived ease of use on innovative apps usage intention among millennial and mature consumers. However, they argue that, while ease of use does increase app usage intention, other emotion factors also contribute. Based on the above, the following proposition is posited:

P1.. *Perceived ease of use is positively associated with intensity of MMA usage.*

2.2. Perceived usefulness

Perceived usefulness is the degree of belief that using a technology enhances performance (Davis, 1989), and is therefore associated with efficiency and effectiveness (Tan & Teo, 2000). Many authors (e.g., Agarwal & Karahanna, 2000; Venkatesh & Davis, 2000; Wu & Wang, 2005) argue that perceived usefulness has a direct impact on usage intention. In a study more specifically related to health information on the Internet, Kim and Chang (2007) defend the idea that perceived usefulness is a key factor in accepting information technology. In the same line of thought, Hur et al. (2017) conclude that perceived usefulness has a direct impact on app usage intention. Gagnon et al. (2016) show that perceived usefulness is the most recurrent adoption factor for the adoption of mobile health. Considering these findings, this study postulates that:

P2.. *Perceived usefulness is positively associated with intensity of MMA usage.*

2.3. Peer influence

Fishbein and Ajzen (1975) define social influence as being the perception of what most people consider should or should not be done. Similarly, Venkatesh, Morris, Davis, and Davis (2003) consider social influence as the degree to which an individual perceives that it is important that others believe he or she should use a new technology. An extensive study in social psychology maintains that peer influence can indeed impact behavior (Gunther, Bolt, & Borzekowski, 2006). Xue, Yen, and Chang (2012) also conclude that subjective norms significantly predict adoption intentions for the use of info-health technologies. Alkateeb and Doucette (2009) defend the idea that doctors discuss with their peers the advantages and disadvantages of new technologies. Thus, the more doctors perceive peer norms as being supportive, the more likely they are to use MMA. Therefore, the following proposition is posited:

P3.. *Peer influence is positively associated with intensity of MMA usage.*

2.4. Seniority

There is a lack of research relating the use of MMA to seniority (i.e., comparing usage between medical students and fully-qualified doctors). One of the few available studies shows no differences between the two cohorts in terms of the ownership of health applications (Payne, Wharrad, & Watts, 2012). Furthermore, the groups show similar trends of using apps several times a day. Given the scant research available on the impact of seniority on MMA usage intensity, the following proposition is formulated:

P4.. *Seniority is positively associated with intensity of MMA usage.*

2.5. Age

The literature suggests that the older the doctor, the lesser the willingness to adopt new technologies. Alkateeb and Doucette (2009) note that younger doctors adopt new technologies if they were exposed