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Eun Hee Park
Old Dominion University, epark@odu.edu

Ghiyoung P. Im

Jing Zhang
Old Dominion University, j3zhang@odu.edu

Young Hwan Lee

Kyung Hee Chun

See next page for additional authors

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The Impact of Role Overload and Role Conflict on Physicians' Technology Adoption

Eun Hee Park
Old Dominion University, VA, USA
epark@odu.edu

Ghiyoung P. Im
University of Louisville, KY, USA

Jing Zhang
Old Dominion University, VA, USA

Young Hwan Lee
Yeungnam University, Republic of Korea

Kyung Hee Chun
Konyang University, Republic of Korea

Young Soon Park
Catholic Kwandong University, Republic of Korea

Abstract

Technology adoption is an important solution for physicians to increase work efficiency, and thus deal with role conflict among their multiple job roles. Prior studies have not investigated how multiple job roles and role conflict influence physicians' technology adoption intentions. Based on role strain theory and role identity theory, we present a model of physicians' technology adoption intentions to support their primary (clinical care) versus secondary (teaching or research) job roles. We test the model using surveys with 156 physicians at nine medical schools in Korea. The results of our data analysis largely support our hypotheses. Role overload in each of their job roles increases role conflict between any pair of associated roles. Furthermore, role conflict between a physician's primary and secondary role is affected more by role overload in the secondary role than by overload in the primary role. Moreover, the impact of role conflict on technology adoption intentions is also influenced by the hierarchical relationship between two roles. This study contributes to technology adoption research by demonstrating how physicians' job characteristics affect technology adoption.

Key words: Physicians' technology adoption, multiple roles, role overload, role conflict.

1 Introduction

Physicians need to undertake multiple job roles. In their role as clinicians, they take care of patients; in their role as teachers, they train medical students; and in their role as researchers, they conduct research in their areas of expertise. Given their limited time and energy, managing multiple roles requires physicians to maintain extremely busy work schedules. When they are focusing on one role, physicians are less capable of meeting the expectations of their other roles (Lenaghan & Sengupta, 2007; O'Dowd et al., 2018); this can cause role conflict among the associated roles.

Researchers have recognized physicians' information technology (IT) adoption as an important solution for improving their work efficiency and for reducing their job stress (Turan

& Koç, 2022). Research on physician IT adoption has largely relied on the frameworks of the technology acceptance model (TAM) (e.g., Turan & Koç, 2022), the theory of planned behavior (TPB) (e.g., Deng, Zheng, Lu, Zeng, & Liu, 2021), and the unified theory of acceptance and use of technology (UTAUT) (e.g., Jayaseelan, Prasanth, & Pichandy, 2020). While these studies have recognized the importance of economic, social, and psychological factors that influence the IT adoption behavior of physicians, they have neglected an important contextual factor: the job characteristics of physicians (Venkatesh, 2006). Because multiple job roles are one of the key job characteristics of physicians (Ma et al., 2020; Steinert, O'Sullivan, & Irby, 2019) and technology adoption may help physicians reduce their job stress from multiple roles (Turan & Koç, 2022), it is important to ask the following overarching question: *What is the impact of physician role characteristics on IT adoption?*

To address this question, we ask three sub-questions. For the inquiry, we rely on role strain theory (e.g., Berger & Bruch, 2021; Goode, 1960; Sumra & Schillaci, 2015) to identify the role strain of physicians with multiple roles and its impact on physicians' IT adoption intentions. Role strain refers to the perceived difficulty of fulfilling role demands and obligations (Sumra & Schillaci, 2015). Role strain theory is a useful lens because it offers two well studied sub-constructs—role overload and role conflict (Barnett & Baruch, 1985; Edwards, Zarit, Stephens, & Townsend, 2002)—that help us understand physicians' multiple roles and challenges. Furthermore, role strain theory allows us to integrate physicians' job context and IT, given physicians' multiple job roles (Ma et al., 2020; Steinert et al., 2019) and the possibility of IT to reduce their job stress from multiple roles (Jayaseelan et al., 2020; Turan & Koç, 2022). Consistent with Coverman (1989), this study conceptualizes role strain caused by multiple roles as a sequence of first role overload and then role conflict. The association between role overload and role conflict has been investigated mostly in the context of women's (Marks & MacDermid, 1996), students' (Lenaghan & Sengupta, 2007), and workers' multiple roles (e.g., Eatough, Chang, Miloslavic, & Johnson, 2011). Exploring the association in the job context of physicians is important because the findings will offer valuable insights, both into the factors that cause physicians' role strain and into its mitigation mechanisms. This leads to the first sub-research question: *What is the impact of role overload on role conflict in the job context of physicians?*

In addition, we investigate the relative impact of each role overload on role conflict between the associated roles. Role identity theory (Gruber & MacMillan, 2017; Owens, Robinson, & Smith-Lovin, 2010) suggests that multiple roles are associated with multiple identities. Those identities form a hierarchy, and one identity becomes prominent for a given situation (Gruber & MacMillan, 2017; Owens et al., 2010). For their primary identity, physicians show more commitment, receive more support from their schools, and are better rewarded. Therefore, when physicians face overload in their multiple roles, they would expect that some roles have more prominence over others and thus exert different impacts on role conflict. This leads to the second sub-research question: *What is the relative impact of each role overload on role conflict in the job context of physicians*? Role strain research suggests that people engage in various strategies to deal with role strain caused by their multiple roles (Marks & MacDermid, 1996). Previous studies suggest that IT is one of the best means that physicians can use to boost their work performance (Davidson & Chismar, 2007; Goldschmidt, 2005). We consider that these advantages of IT motivate physicians to adopt technology when looking for solutions to role conflicts. This leads to the third sub-research question: *What is the impact of role conflict on the IT adoption intentions of physicians?*

Our empirical context is physicians in medical schools (PMSs) in Korea. We conducted preliminary interviews with PMSs and then collected questionnaires from 156 physicians at nine medical schools in Korea. The results of our data analysis largely support our hypotheses. First, overload in each role increases the conflict between any pair of associated roles. Second, role conflict between a physician's primary and secondary role is affected more by role overload in the secondary role than by overload in the primary role. Finally, the impact of role conflict on technology adoption intentions is influenced by the hierarchy between the two roles.

This study advances technology adoption research by investigating the impacts of multiple roles on technology adoption. It reveals interesting dynamics among role overload, role conflict, and technology adoption intentions. Our finding that role overload from multiple roles does not contribute equally to role conflicts offers a new perspective in explaining role strain. Moreover, this study extends IT adoption research by showing that the impact of role conflict on technology adoption intentions is determined by the relationship between the pair of roles in conflict. This study suggests that technology adoption research should consider a new influential factor: the hierarchy of multiple roles and the conflicts between them.

2 Literature Review

2.1 Technology Adoption Research on Physicians

Research has paid a considerable amount of attention to evaluating the impacts of various job/role characteristics on technology adoption and use (e.g., Ansong & Boateng, 2018; Leidner, Sutanto, & Goutas, 2022). The investigated job contexts include work-family conflict (Ahuja, 2002), role clarity (Speier & Venkatesh, 2002), job fit (Venkatesh, Morris, Davis, & Davis, 2003), job relevance (Kim, 2008), job autonomy (Seppänen, Pajarre, & Kuparinen, 2015), and mental load (Shamsi, Iakovleva, Olsen, & Bagozzi, 2021).

Despite such progress, little is known about how such job characteristics (e.g., role, overload, and role conflict) could impact physicians' technology adoption. Most research on technology adoption by physicians has employed economic, social, and psychological theories. Three major theories have been used in the research: TAM (technology acceptance model), UTAUT (unified theory of acceptance and use of technology), and TPB (theory of planned behavior) (see Appendix A for the literature search approach). First, drawing on TAM (e.g., F. D. Davis, 1989), research investigates the effects of perceived ease of use, perceived usefulness, and attitude on physicians' intentions to use health information technologies. For instance, Hu et al. (1999) find that perceived usefulness positively influences physicians' attitudes and intentions to use telemedicine technology. Dünnebeil et al. (2012) modify TAM to investigate physicians' adoption of electronic health in an ambulatory care environment. Turan and Koç (2022) explore physicians' health information technology (HIT) adoption in a developing country.

Second, UTAUT (e.g., Aria & Archer, 2018; Venkatesh et al., 2003) has been used to develop richer theoretical explanations. For example, Venkatesh et al. (2011) investigate physicians' adoption behaviors toward electronic medical record (EMR) systems. They test both an original and a modified UTAUT, finding that the modified UTAUT performs better in explaining physicians' adoption behaviors. The results indicate that performance expectancy, effort expectancy, social influence, and facilitating conditions positively affect behavioral intentions and use behavior. Jayaseelan et al. (2020) investigate medical doctors' information

and communication technology adoption in India and find that effort expectancy and social influence positively drive behavioral intentions.

Finally, TPB (e.g., Ajzen, 1991) provides an additional explanation for technology adoption by physicians. For instance, Chau and Hu (2001) investigate the acceptance of telemedicine technology. After comparing results across TAM, TPB, and a decomposed TPB, they find that perceived behavioral control from TPB and perceived usefulness from TAM positively influence behavioral intentions. Deng et al. (2021) investigate physicians' adoption of contrast enhanced ultrasound technology for liver cancer by integrating TPB and TAM. They find that subjective norms, perceived behavioral control, and perceived usefulness positively impact their intentions and utilization behaviors.

Despite such progress, prior studies (e.g., Chau & Hu, 2001; Deng et al., 2021) recognize that these major theories have limitations in explaining physicians' technology adoption behaviors, and they urge future researchers to investigate novel and potential constructs to explain physicians' behavioral intentions.

2.2 Role Overload and Role Conflict

Role strain research provides a novel perspective to develop a theoretical model of physicians' technology adoption intentions (e.g., Berger & Bruch, 2021; Goode, 1960; Marks, 1977; Sumra & Schillaci, 2015). Role strain takes place when physicians perceive challenges in fulfilling multiple role demands and obligations (Sumra & Schillaci, 2015). Role strain can be understood as a sequence of first role overload and then role conflict (Coverman, 1989). *Role overload* occurs when an individual performs multiple roles without having adequate resources to fulfill them (Marks, 1977). In this situation, a person's roles demand more resources and skills than the job holder can handle (Mittal & Bhakar, 2018). Research has largely conceptualized role overload in two ways. Some studies (e.g., Barnett & Baruch, 1985; Edwards et al., 2002; Mittal & Bhakar, 2018) focus on the perception of the collective, overall overload due to multiple roles. For example, Mittal and Bhakar (2018) investigate women's multiple roles as employee, mother, and wife and their distress in taking on the combined three roles. Other studies (e.g., Marshall & Barnett, 1993) have been concerned with the perception of role overload in terms of each individual role a person plays, among the multiple roles involved. This approach aligns with Sieber's (1974) suggestion that the different types of roles involved should be delineated and examined.

Role conflict is experienced when individuals face incompatible expectations from their multiple roles (Ma et al., 2020; Marks, 1977). Research conceptualizes role conflict in two different ways. Some studies (e.g., Barnett & Baruch, 1985; Ma et al., 2020) are concerned with the perception of overall role conflict without distinguishing among individual roles. For example, in a study of physicians' multiple roles, Ma et al. (2020) examine the perception of the overall role conflict that occurred among multiple roles (clinical doctor, teacher, and researcher). Other studies (e.g., Bolino & Turnley, 2005; Coverman, 1989) have focused on the perception of role conflict that occurs in a pair of roles. This approach allows researchers to identify the unique impact of each pair of roles on the target outcome (Coverman, 1989). For example, in a study of women's and men's multiple roles, Coverman (1989) evaluates the impact of a pair of conflicts – work and family role conflict – on job satisfaction and marital satisfaction.

While investigating this phenomenon, research has employed either the scarcity or the expansion approach (Marks, 1977). Adopting the majority scarcity approach, our study assumes that individuals inherently possess scarce and finite quantities of natural energy, and that they struggle to properly allocate such limited resources across their different roles, which can lead to psycho-physical problems (Coser, 1974). Individuals' physio-psychological well-being can deteriorate with their increased number of roles, leading to role overload and role conflict (Baruch & Barnett, 1986). In contrast, the expansion approach assumes that individuals' energy is profuse and expandable because it is generated from socio-cultural variables rather than from biological nature (Baruch & Barnett, 1986; Marks, 1977; Sumra & Schillaci, 2015).

Table 1 displays representative studies on role overload and role conflict in workplaces (see Appendix A for the literature search approach). Two research gaps are identified. First, the research does not investigate the impacts of role overload and role conflict on technology adoption. Next, research on the influence of physicians' multiple roles on technology adoption in workplaces is rarely conducted. Instead, some studies have investigated the predictors (e.g., power distance, satisfaction, mobile technology use, and technostress creator) of role overload and role conflict in the context of multiple roles among physicians and nurses'(Belias, Koustelios, Sdrolias, & Aspridis, 2015; Pullins, Tarafdar, & Pham, 2020; Román, Rodríguez, & Jaramillo, 2018). Other studies have explored such outcomes as role overload and/or role conflict, including strain (Ayyagari, Grover, & Purvis, 2011), citizen behavior (Eatough et al., 2011), burnout (Dasgupta, 2012; Jiang, Ma, Jia, Wu, & Wu, 2022; Kilroy, Flood, Bosak, & Chênevert, 2016), occupational stress (Karimi, Omar, Alipour, & Karimi, 2014), innovative work behavior (Clarke & Higgs, 2020), job satisfaction (Rorong, 2021), and organizational culture (Bhalla, Qazi, & Miralam, 2019).

Source	Context	Predictor(s)	Outcome(s)	Major Finding(s)
Engle & Prince (2005)	Workers in US and Canada	• Role strain (including role conflict)	• Job performance/ satisfaction	• Job strain has a more negative impact on job performance and satisfaction in US than Canada.
Tarafdar et al. (2007)	Workers who use technology	• Technostress • Role stress	• Role overload • Role conflict	• Indirect influence of technostress on role overload and role conflict through its effect on role stress.
Schaufeli et al. (2009)	Junior doctors	• Workaholism • Job demands • Role conflict	• Well-being • Burnout	• Role conflict mediating between workaholism/job demands and well-being/burnout.
Ayyagari et al. (2011)	Workers who use technology	• Presenteeism • Work-home conflict • Work overload • Role ambiguity	• Strain	• Positive relationship between presenteeism and work-home conflict, work overload, and/or role ambiguity as well as between these factors and strain.
Eatough et al. (2011)	Employees in organizations	• Role overload • Role conflict • Job satisfaction	• Organizational citizenship behavior	• Negative relationship between role overload, role conflict and/or job satisfaction as well as between role conflict and citizenship behavior.
Dasgupta (2012)	Private hospital nurses	• Role overload • Role conflict • Self-efficacy	• Burnout	• Positive relationship between role overload and/or role conflict and burnout

Source	Context	Predictor(s)	Outcome(s)	Major Finding(s)
				(disengagement and exhaustion).
Karimi et al. (2014)	Nurses in Iranian hospitals	• Role overload • Role conflict	• Occupational stress	• Positive relationships between role overload and/or role conflict and occupational stress.
Belias et al. (2015)	Employees in Greek banking organization	• Job satisfaction • Autonomy	• Role conflict	• Negative relationship between role conflict and job satisfaction, and the moderating role of autonomy
Kilroy et al. (2016)	Employees in hospital	• High-involvement work practices (HIWP) • Job demands	• Burnout	• Negative relationship between HIWP and job demands and/or burnout • Role conflict and/or role overload mediating the relationship between HIWP and burnout
Rubel et al. (2017)	Employees in organizations	• Role conflict, overload, etc. • Work-family conflict (WFC)	• Turnover intention	• WFC mediating the relationship between role conflict and/or role overload and turnover intention
Román et al. (2018)	Sales professionals	• Mobile technology use	• Role stress • Job satisfaction	• Role stress (role conflict, overload, etc.) mediating the relationship between mobile tech use and job satisfaction
Bhalla et al. (2019)	Employees in service sector	• Organizational role stress	• Organizational culture	• Negative relationship between organizational role stress and its culture
Venkatesh et al. (2019)	Parents on children's internet addiction	• Family-work conflict • Internet addiction, etc.	• Job outcomes (e.g., job satisfaction)	• Positive relationship between internet addiction and conflict, as well as negative relationship between work overload and/or stress and job satisfaction
Clarke & Higgs (2020)	Employees in public sector	• Role overload	• Innovative work behavior	• Positive relationship between role overload and innovative work behavior
Pullins et al. (2020)	Sales professionals	• Technostress creator, inhibitors, etc.	• Role stress (role conflict, overload), etc.	• Positive relationship between technostress creators and role stress
Khalid et al. (2021)	Employees in organizations	• Work-family conflict • After-hours work related technology use	• Interpersonal/ organizational deviance, etc.	• Positive relationship between tech use and work-family conflict as well as between conflict and interpersonal/ organizational deviance
Rorong (2021)	Employees working from home	• Supervisor support, etc. • Role stress	• Job satisfaction	• Negative relationships between supervisor support and role stress as well as between stress and job satisfaction
Jiang et al. (2022)	Mobile tech use	• Excessive use of mobile technology • Technology–work conflict • Role overload	• Job burnout	• Positive relationship between excess use of mobile technology, conflict, and role overload as well as between conflict/ role overload and job burnout

Table 1. Research on Role Overload and Role Conflict in Workplaces

2.3 Role Overload and Role Conflict and Information Technologies

Physicians experiencing role overload and role conflicts suffer when they cannot properly fulfill their roles and if they receive sanctions due to poor work performance. Their psycho-physical well-being also deteriorates with role overload and role conflict (e.g., Baruch & Barnett, 1986; Karimi et al., 2014; Kilroy et al., 2016). What solutions can they seek when they are in this kind of challenging situation? Research suggests that, to cope with role conflict, people implement various solutions (Hall, 1972; Marks & MacDermid, 1996). First, they look for outside support to take over some of their role activities. Second, they seek support from role senders (someone who establishes role expectations) about the fulfillment of necessary activities (Hall, 1972). Third, they involve role senders to find and determine a solution to their role conflicts. Fourth, they increase the efficiency of their role performance through better planning and organizing. Finally, they work harder to fulfill all the demands on their various roles by devoting more time and energy.

We suggest that IT can be one of the best solutions that physicians can employ to increase their work efficiency and resolve role conflicts (Jayaseelan et al., 2020; Turan & Koç, 2022). Information technologies are known to minimize errors and to increase the efficiency and quality of physicians' practices across multiple role activities, thereby relieving role conflict among those roles (Mechanic, 2003). In our research context, physicians use *clinical technologies* on the front line, where they directly treat patients. For example, physicians use EMR to trace the medical history of each patient and to share and transfer records with other physicians. *Educational technologies* are used when physicians teach medical students. One example is simulation role play tools that offer students opportunities to conduct surgeries in a virtual environment, which is safe and less costly. Finally, physicians use *research technologies* to conducti research. For example, molecular biology experiment tools can be used to isolate and manipulate molecular components in organisms.

Table 2 outlines the major tasks associated with the three roles physicians play and the technologies that support them. These qualitative data were collected via preliminary interviews and open-ended questions in our main survey. The exemplar technologies consist of those currently in use and those in consideration for adoption in the near future.

Multiple Roles	Major Task	Function of Technology		Examples
Clinician	• Physical exam • History taking • Laboratory tests • Diagnosis • Teaching patients • Operation • Medication orders • Physician instructions	Clinical technology	Data management	Electronic medical records (EMR), Cloud server, order communication systems (OCS), picture archiving and communication systems (PACS), and computerized physician order entry (CPOE)
			Diagnosis support	Polymerase chain reaction (PCR), real-time quantitative PCR (RQPCR), ultrasonography, and telemedicine systems
			Operation	Robot operation systems, teleoperation systems
			Supplementary presentation & training	Video, live surgery, new treatment

Teacher	• Teaching (e.g., lecture, bedside teaching) • Development of teaching skills • Management of students (e.g., mentoring, coaching) • Program evaluation • Preparation for accreditation of medical education programs	Educational technology	Learning management	Learning management systems, learning content management systems, united messaging systems
			Assessment support	Question bank, computer-based test, web test, voting systems, testing apps
			Education method	U-class, e-learning, virtual classrooms, flipped learning tools, Zoom
			Knowledge presentation	Audio, video, digital cameras, video cameras, LCD projector, interactive whiteboard tools, PowerPoint, Prezi
			Task structuring support	Microscope, clinical practice tools, simulation role play, simulation technology, webcams
Researcher	• Medical lab tasks, (e.g., testing, monitoring, assessing trials) • Funding research project • Completing IRB • Data collection & analysis • Reviewing literature and writing research paper • Participating in conferences, workshops, etc.	Research technology	Research support	E-IRB, university research management systems, research management systems, clinical research support systems
			Data management	DBMS, data warehouse, data mining tools, Excel, EndNote
			Data collection & analysis	Medical statistic support systems, statistical analysis programs (e.g., SPSS)
			Experiment support	Animal experiment tools, molecular biology experiment tools, genetic research tools, 3D mapping programs, clinical trial support technology

Table 2. PMSs' Multiple Role Involvement and Supporting Technologies

2.4 Multiple Roles and Role Identities

Physicians in medical schools have multiple job roles (Ma et al., 2020; Steinert et al., 2019). O'Brodovich et al. (2003) identify a typical profile of a PMS: a clinician-teacher-researcher[1]. In this profile, physicians make a major commitment to clinical care, reducing their commitment to education and/or research (Bunton et al., 2012). When one or more of these roles are overloaded and considered simultaneously, the impact on role conflict will not be identical, because the different roles occupy different levels of prominence in the role hierarchy. According to role identity theory, multiple roles lead to multiple identities (Burke & Stets, 2009; Gruber & MacMillan, 2017; Owens et al., 2010). Multiple identities are placed in a hierarchy, and one identity becomes more prominent in a given situation (Burke & Stets, 2009). This prominence hierarchy reflects "how individuals like to see themselves given their ideals, desires, or what is central or important to them" (Burke & Stets, 2009, p. 40). One identity's prominence over other identities is determined by support, commitment, and reward. Support can be built by the self (self-support) or received from others. Commitment is made by the self,

[1] O'Brodovich et al. (2003) identify various physician job profiles with different commitments to different roles, including "clinician-specialist" (primary being clinical care and secondary being education and/or research), "clinician-teacher" (primary being clinical care and secondary teaching), and "clinician-scientist" (primary being research), among others.

who invests in a role identity in order to achieve positive feelings or esteem. Rewards (extrinsic and intrinsic) are given to the individual for the maintenance of the identity.

For PMSs, their clinician identity (i.e., role) is more prominent than their other role identities, such as teacher, researcher, and administrator (Steinert et al., 2019). Thus, individuals display more commitment to that role, achieve more support from their medical school and staff, and are rewarded more based on their performance as a clinician. Such varying levels of role prominence (i.e., primary or secondary) have different impacts on role conflict when an individual is faced with overload from multiple job roles (Burke & Stets, 2009).

3 Hypotheses Development

Figure 1 presents the theoretical model. Drawing on role strain theory and role identity theory (e.g., Berger & Bruch, 2021; Goode, 1960; Sumra & Schillaci, 2015), this study investigates the impact of physician role characteristics on IT adoption. Role strain theory provides a theoretical basis for the two important constructs (role overload and conflict) and their relationships. Role identity theory offers a theoretical basis that multiple roles imply multiple identities and that multiple identities are structured in a hierarchy (Burke & Stets, 2009). Specifically, the study examines 1) the influence of role overload on role conflicts, 2) the relative impact of each role overload on role conflict, and 3) the impact of role conflict on the IT adoption intentions of physicians. Concerning role overload, we follow the approach of focusing on overload in each individual role, among the multiple roles involved. This approach helps to identify the unique aspects of overload that are involved in each role (Sieber, 1974). As for role conflict, we focus on conflict between pairs of job roles (i.e., teacher and clinician, teacher and researcher, and clinician and researcher). These approaches regarding role overload and role conflict provide a more granular understanding of the phenomenon. This study focuses on the three types of roles (i.e., clinician, teacher, and researcher) that are known to be the PMSs' most common job roles (Bunton et al., 2012; Ma et al., 2020; O'Brodovich et al., 2003).

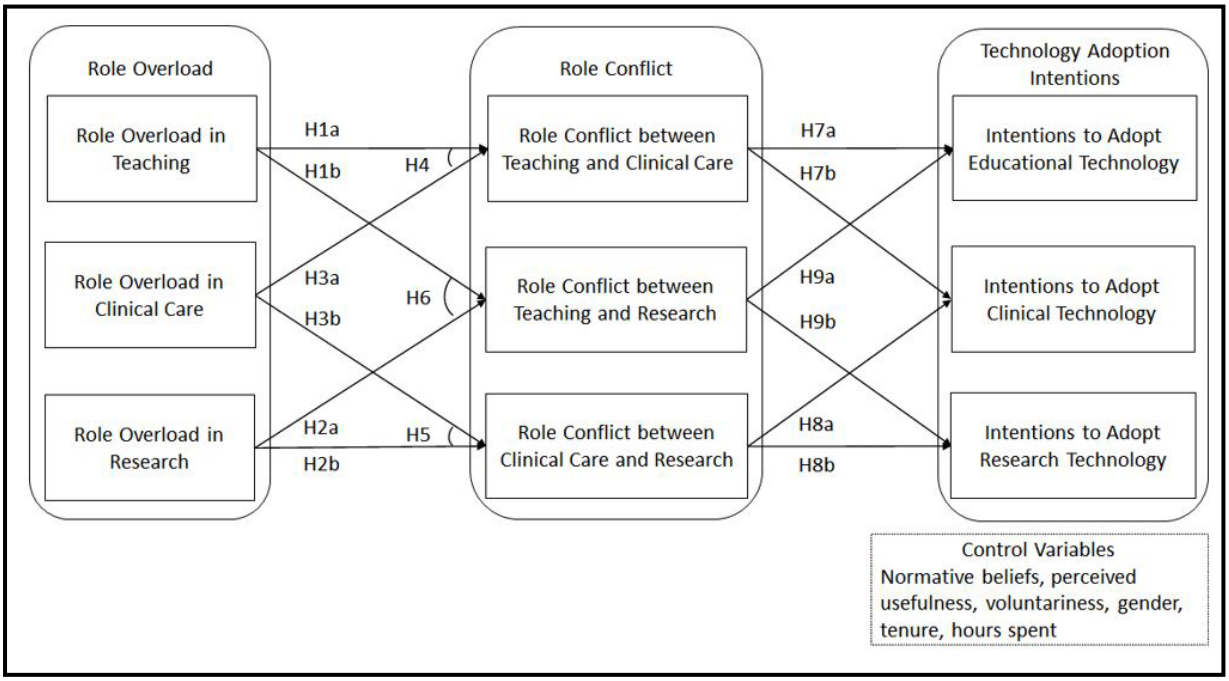

Figure 1. Research Model

3.1 Physicians in Medical Schools in Korea

We conceptualized our research model and collected empirical data from medical schools in Korea. This investigative context serves our research objectives well. The work of PMSs in Korea is split into three major roles (Park et al., 2012). Traditionally, clinical care has been a physician's core role (Park et al., 2012), and is better supported and rewarded, when compared with their research and teaching roles. Seo et al. (2012) find that PMSs in Korea are satisfied with the number of patients, consultation hours, and quality of hospital information system support from their schools.

Research is also crucial because of the schools' identity as research and teaching institutions and as institutions that provide clinical care (Park et al., 2012). Physicians are rewarded, partially based on their research productivity. However, the level of support and reward for research is not commensurate with that for clinical care. Most physicians exhibit low satisfaction with the number of research projects, research funding, administrative supporting systems, and information system support (Seo et al., 2012). In addition, they display lower satisfaction with the lab environments and incentive systems.

Conversely, teaching is gaining growing importance among medical schools (Jeon & Kim, 2017). Medical schools in Korea have recently emphasized the importance of medical education, innovative curricula, and student career development (Jeon & Kim, 2017). Support and rewards for teaching performance have increased, but they are not commensurate with the level offered for clinical care. Physicians are not particularly satisfied with the information systems' support they receive from the schools (Seo et al., 2012).

3.2 Physicians' Role Overload and Role Conflict

We assert that, overall, role overload will lead to role conflict. Specifically, we argue that role overload in teaching, clinical care, and research will bring about role conflict between any pair of the three roles. We put forward two reasons. First, physicians have limited resources. Specifically, they have limited time to fulfill the obligations of their multiple roles (C. R. Ward, 1986). When physicians spend a lot of time fulfilling one role, the resource pool available for other roles will diminish, due to role overload. Hence, they will not be able to fulfill the obligations and expectations of the other roles (Lenaghan & Sengupta, 2007; Marks, 1977), causing role conflict. Next, physicians are not free from job stress that can affect performance in their different roles. When physicians face role overload, they experience anxiety and tension given high expectations from various social parties (e.g., patients, medical students, the university) involved in their job roles (Martikainen, 1995). Such psychological challenges may reduce their ability to meet the demands of one or more of their roles. This makes it difficult for an individual to fulfill other roles properly and hence leads to role conflict (Lenaghan & Sengupta, 2007). Specifically, as their teaching becomes overloaded , physicians may have difficulty fulfilling their clinician role properly, given limited resources (Marks, 1977). Thus, role conflict between teacher and clinician is more likely to arise (Coverman, 1989; Ma et al., 2020). In a similar vein, as their teaching overload increases, role conflict between teacher and researcher is also likely to occur. Thus:

H1: *Role overload in teaching is positively associated with role conflict between a) teaching and clinical care, and b) teaching and research.*

We apply the same reasoning to the effect of role overload in research on role conflict. Typically, PMSs spend less time on research activities than on clinical care (Ellinas et al., 2019; Marks & MacDermid, 1996; Thomas et al., 2004). However, PMSs hardly avoid research and associated scholarly activities (e.g., data collection, experiments, and data analysis) as their performance in the activities influences their job performance evaluation and promotion (Ellinas et al., 2019). When physicians spend more time fulfilling their researcher role, the role overload in their research activities increases. This in turn means that the time and resources available to meet the expectations of their other roles dwindles (Ellinas et al., 2019; C. R. Ward, 1986). Here, they may experience role conflict between their teacher and researcher roles as they struggle to meet the commitment and expectations of the second role (Lenaghan & Sengupta, 2007). Similarly, role conflict between clinician and researcher may occur as their research overload increases. Thus:

H2: *Role overload in research is positively associated with role conflict between a) teacher and researcher, and b) clinician and researcher*.

We also argue that the same positive association from role overload in clinical care on role conflict occurs. Prior studies show that PMSs spend the majority of their time as clinicians and less time on teaching or research (Marks & MacDermid, 1996; Steinert et al., 2019; Thomas et al., 2004). Thus, one may argue that because their clinical job role takes so much of their time, it may not cause role conflict with their teaching or research roles. Although teaching and research activities are minor roles in PMS role systems (Marks & MacDermid, 1996; O'Brodovich et al., 2003; Thomas et al., 2004), both roles are unavoidable and not easy-to-exit since their job performance evaluation criteria includes both their clinician performance and their teaching and research performance. Further, performance assessment results are tightly tied to faculty salary increases and tenure evaluation (Barzansky & Kenagy, 2010; Ellinas et al., 2019; Svider et al., 2013). A prior study finds that the salience of a role to a person does not reduce stress, but that a person's conception that a role is easy-to-exit reduces stress (Thoits, 1992). When clinician role overload increases, the physicians role system become less balanced (Marks & MacDermid, 1996). Although clinician is a major role and teacher or researcher is a minor role, the minor roles are those that are "difficult-to exit" from the role system (Thoits, 1992). An increase in overload in the clinician role means more demands on clinicians' activities and hence physicians face more difficulty meeting the demands of their other roles (Barzansky & Kenagy, 2010). Thus, role conflict is inevitable (Coverman, 1989; Yang et al., 2021). Thus:

H3: *Role overload in clinical care is positively associated with role conflict between a) teaching and clinical care, and b) research and clinical care.*

In the next three hypotheses, we discuss the relative impact of role overload between two roles on role conflict. As role identity theory states, the argument is based on the discussion that individuals who have multiple roles have multiple identities in a hierarchy (Burke & Stets, 2009; Owens et al., 2010). We argue that when there is role conflict between the primary role (clinical care) and the secondary role (teaching or research), role conflict will be higher with role overload in the secondary role than in the primary role. First, when role overload in the secondary role increases, physicians find less time for their primary role (Ellinas et al., 2019). They will be less committed to clinical care and their primary identity will be challenged. Such a situation may make them less competent and less well-rewarded, and they may receive less support from their schools because their core competency is in clinical care (O'Brodovich,

Beyene, Tallett, MacGregor, & Rosenblum, 2007). Despite an increase in the importance of secondary roles, as demanded by medical schools (e.g., Ahmady et al., 2007; O'Brodovich et al., 2007), clinical care is central in obtaining career development opportunities, monetary and other long-term stable rewards, and support. Second, when role overload in the primary role increases, physicians find less time for their secondary role (Ellinas et al., 2019). In this situation, physicians find less role conflict because their primary identity is not jeopardized, and they are less disadvantaged with respect to support and reward from their schools. In contrast, physicians may make use of that role overload to justify actions that strengthen their primary role identity and competency in the workplace. Thus:

H4: *Role conflict between teaching and clinical care is more influenced by an overload in teaching than by an overload in clinical care.*

H5: *Role conflict between research and clinical care is more influenced by an overload in research than by an overload in clinical care.*

Concerning role conflict between secondary roles (teaching and research), we argue that role overload in the secondary roles will have similar effects on the role conflict between them. When role overload in a secondary role increases, physicians will find less time for the other secondary role, committing less to the other secondary role because of limited resources (C. R. Ward, 1986). In this situation, increasing activities in a secondary role will not greatly decrease the competency attributed to the other secondary role. The secondary roles have lower prominence in the role hierarchy (Marks & MacDermid, 1996; O'Brodovich et al., 2003), and physicians receive less support and fewer rewards for those roles, as compared with their primary role (Thun et al.,, 2018). Thus, physicians will be less affected by a decrease in their activities when there is role overload in a secondary role. Thus:

H6: *Role conflict between teaching and research is similarly influenced by an overload in teaching and by an overload in research.*

We hypothesize that role conflict between a pair of job roles fosters physicians' intentions to adopt IT in each job role. Physicians strive to lower role conflict by enhancing the efficiency of the tasks involved in multiple roles (Hall, 1972; Marks & MacDermid, 1996). As shown in Table 2, technologies can support the diagnosis and treatment of patients, as well as the teaching and research activities of physicians, and they offer enormous opportunities for physicians to enhance their work performance (e.g., Deng et al., 2021; Jayaseelan et al., 2020).

First, physicians facing role conflict between their teaching and clinical care roles would adopt educational technology. For example, medical instructional technology helps physicians save time and energy by allowing them to easily integrate learning materials, organize online classes, facilitate discussions through online tools, and enhance learning processes (Hopkins et al., 2018; Mostaghimi et al., 2006). Thus, by recognizing the advantages of technology, physicians who experience role conflict between teaching and clinical care look for solutions and likely adopt educational technologies.

Next, physicians experiencing role conflict between teaching and clinical care would adopt clinical technology. For example, physician order entry systems help reduce time and errors in the medication process and provide effective medication to patients (Davidson & Chismar, 2007). Such clinical IT allows physicians to save time by managing all of their clinical jobs automatically (e.g., Shah et al., 2020; Zobair et al., 2021). For example, telehealth and telemedicine systems allow physicians to remotely treat patients and monitor their progress,

hence providing better care coordination and treatment outcomes (Ahmad et al., 2021; Zobair et al., 2021). In sum, the adoption of both types of technologies ease role conflict by helping physicians balance both roles. Thus:

H7: *Role conflict between teaching and clinical care is positively associated with intentions to adopt a) educational technology, and b) clinical technology.*

Physicians experiencing role conflict between clinical care and research intend to adopt clinical and research technologies. Physicians in role conflict seek to adopt clinical technologies that automate many parts of the clinical practice process, and thus, save time and effort. For instance, physicians make use of electronic prescription technology to manage patient care, to automate prescriptions and medication refills, to receive lab results, and to coordinate with specialists and hospitals outside their primary care facility (Bulut et al., 2019; K. Davis et al., 2009).

The researcher role brings conflict to the clinician role because, given the extent of their clinical care, physicians struggle to find time to conduct research and generate research outcomes (Goldschmidt, 2005). Such tension leads physicians to adopt research technologies that can facilitate information gathering, record keeping, summarizing, ordering, and the sharing of data among researchers (Goldschmidt, 2005; Harrer et al., 2019). Also, the use of research technology allows physicians to mine huge amounts of medical data for research purposes, to quickly discover the causes and epidemiology of diseases, and to easily monitor and assess the effectiveness of new clinical trials (Goldschmidt, 2005). Thus, the adoption of clinical and research technologies will alleviate the role conflict between clinical care and research. Hence:

H8: *Role conflict between clinical care and research is positively associated with intentions to adopt a) clinical technology, and b) research technology.*

Similarly, physicians experiencing role conflict between teaching and research would intend to adopt educational and research technologies. Educational technologies facilitate educational activities (e.g., lecture preparation and delivery and the management of assessment and exams) (Hopkins et al., 2018; J. Ward et al., 2001). The technologies offer advanced, convenient, and customized tools that support physicians in fulfilling their teaching obligations and expectations. For instance, e-learning technologies such as podcasts, online-problem based learning modules, and educational websites offer efficiency in the delivery of teaching content across physical distance and unlimited viewing (Hopkins et al., 2018).

Research technologies promote research activities (e.g., searching and collecting data, monitoring trials, assessing tests, and sharing data with other researchers) (Goldschmidt, 2005; Harrer et al., 2019). For example, artificial intelligence (AI) based clinical trial support technology allows physicians to save time and effort by supporting optimized cohort composition, patient recruitment through automatic eligibility assessment and trial recommendation, and patient monitoring through record keeping (Harrer et al., 2019). Physicians experiencing role conflict between the roles seek to obtain the above-mentioned benefits and alleviate the role conflict. Thus:

H9: *Role conflict between teaching and research is positively associated with intentions to adopt a) educational technology, and b) research technology.*

4 Research Methodology

4.1 Sample and Data Collection

This study is the result of engaged scholarship, pursued over several years, that sought to understand the job context of PMSs and the drivers in their adoption of IT. The data collection involved two phases: (1) preliminary interviews and pilot surveys, and (2) the main survey. The preliminary interviews were conducted with five physicians who had ten to thirty years' experience (with an average of seventeen years), who work in different specialties in two medical schools in Korea (see Appendix B for the preliminary interview protocol). The interviews offered insightful information about the multiple job roles of the physicians and their intentions to adopt IT solutions. A preliminary list of clinical, educational, and research technologies was developed (Table 2). Pilot surveys were performed with three PMSs to refine the survey instrument with respect to accuracy, syntax, and relevance. Role identity questions (Appendix D) were added to filter out responses from physicians whose prominent role was not clinical care. Since the measures were adapted from existing research, we translated them into Korean, and then had a professional translator translated them back into English. The back-translation process helped us pay particular attention to sensitive translation problems across cultures (Beaton et al., 2000).

Second, we conducted the main surveys using the finalized instrument. The data collection was conducted in two phases. In the first phase, the survey was mailed to the departments of medical education at nine Korean medical schools for distribution to the physicians at each school. We sent a total of 180 surveys and received 134 responses. We retained 128 of the responses for data analysis after removing those that did not indicate clinical care as the respondent's primary role. This was necessary because clinical care role is considered to be more prominent than other roles in PMSs (Steinert et al., 2019).

We performed the second phase of data collection after the Covid pandemic. Owing to Covid 19 restrictions, fewer sites were available to participate. A total of 30 surveys was sent to three medical schools, resulting in 28 responses. Taken together, we obtained a total of 156 responses from nine medical schools (total effective response rate = 74%). Our data shows that, on average, clinical care, teaching, and research occupy 48%, 29%, and 23%, of PMSs' time. The majority of the participants were male (76%), and their average tenure was 22 years, ranging between 1 and 39 years. The sample demographics are presented in Table 3.

The survey instrument included open-ended questions that asked physicians to specify the information technologies that they use to accomplish their multiple roles and job functions (see Appendix C). The answers were used to further refine and validate the list of clinical, educational, and research technologies created during the preliminary interviews (Table 2).

Finally, we conducted in-depth cognitive interviews (Beatty & Willis, 2007) with five interviewees to address common method bias and to better understand the factors that hinder adoption intentions (Appendix E). The five interviewees were physicians from two medical schools who had 15 to 30 years' tenure in the schools and had not participated in the earlier data collection.

Demographic Categories	Percent (N=156)
Gender	
Male	76.28
Female	23.72
Age, Years	
20-29	1.92
30-39	19.23
40-49	44.23
50-59	31.41
60-69	3.21
Tenure, Years	
1-9	7.69
10-19	27.56
20-29	42.95
30-39	21.79

Table 3. Sample Demographics

4.2 Measurement and Controls

All the measures were based on existing measures and were modified, as necessary, to fit our physician context. Below, we supply details regarding the way in which some of our key constructs were measured, in order to illustrate important aspects of our measurement strategy. The full details of the instrument are outlined in Appendix D. We measured *intentions to adopt technology* by asking "intention to adopt" or "would like to adopt" each of the three types of technology –clinical, educational, and research (Karahanna et al., 1999; Teo et al., 2003). At the beginning of the questionnaire, we defined the three technologies and provided an example list of each (Appendix C) so that the respondents would not confuse the classification of the technologies.

To measure *role overload*, we asked four questions for each job role (Marshall & Barnett, 1993). We adopted the measurement approach of assessing the perception of role overload for each individual role (Sieber, 1974). This approach helps us distinguish the different types of roles involved. *Role conflict* was measured with three questions for each pair of job roles – teaching and clinical care, clinical care and research, and teaching and research (Bolino & Turnley, 2005; Coverman, 1989). Similar to the role overload measure, this granular approach allowed us to recognize the unique impact of each role conflict, in a pair of roles, on the target outcome (Coverman, 1989).

The following controls were measured: normative beliefs about adopting IT, perceived usefulness (or relative advantage), age, gender, tenure, voluntariness, and hours spent in roles. Prior studies have found that normative beliefs from top management, peers, and the department positively influence individuals' behavioral intentions to adopt and use technology (Karahanna et al., 1999). Also, prior studies have suggested that physicians who perceive the usefulness of technology (Chau & Hu, 2001; Hu et al., 1999) are more likely to have an intention to use it. We also controlled for age, gender, tenure (a surrogate for experience), and voluntariness that are identified as significant factors in technology adoption (Venkatesh et al., 2003). Hours spent in roles are also included because physicians in medical schools were more disposed to technology acceptance depending on the time spent in each of their roles (Ozdemir & Trott, 2009).

5 DATA ANALYSIS AND RESULTS

In order to test our hypotheses, we performed multivariate analyses using Stata for measure validation and ordinary least squares (OLS) regression. Before testing the hypothesized model, the psychometric properties of the measures were evaluated for reliability and for convergent and discriminant validity.

5.1 Psychometric Properties of Measures

First, Cronbach's alpha was assessed for each of the measures, and the minimum of the scale reliability coefficients was 0.90, exceeding the suggested minimum value of 0.70 (Hair, Black, Babin, Anderson, & Tatham, 2010). Also, the composite reliability was calculated using the standardized factor loadings, and the respected error variance for each measure. The reliability coefficients exceed the minimum threshold of 0.70 (Table 4).

Variable	1	2	3	4	5	6	7	8	9	10	11
1. Intentions to adopt T	-										
2. Intentions to adopt C	0.46	-									
3. Intentions to adopt R	0.51	0.44	-								
4. Role conflict TC	0.33	0.11	0.16	-							
5. Role conflict CR	0.28	0.36	0.36	0.40	-						
6. Role conflict TR	0.26	0.05	0.21	0.60	0.51	-					
7. Overload T	0.22	-0.02	0.08	0.55	0.19	0.46	-				
8. Overload C	0.10	0.11	0.19	0.44	0.36	0.32	0.38	-			
9. Overload R	0.07	0.09	0.22	0.25	0.48	0.41	0.31	0.40	-		
10. Gender	0.07	0.09	0.09	0.07	0.12	0.16	0.01	-0.01	-0.03	-	
11. Tenure	0.06	0.22	0.12	0.01	0.23	0.04	0.02	0.04	0.14	0.14	-
Mean	5.48	5.73	5.43	4.34	4.58	3.93	3.84	4.81	4.08	1.24	21.77
S. D.	1.04	0.97	1.10	1.18	1.29	1.30	1.22	1.36	1.30	0.43	8.42
AVE	0.70	0.71	0.64	0.66	0.73	0.74	0.76	0.81	0.76		
Comp. reliability	0.82	0.83	0.78	0.85	0.89	0.89	0.93	0.94	0.93		

Note. 1. N=156. All correlations greater than or equal to 0.19 are significant at the 0.05 level.
2. T: teaching/educational technology; C: clinical care/clinical technology; R: research/research technology. TC: teacher and clinician; TR: teacher and researcher; CR: clinician and researcher.

Table 4. Descriptive Statistics and Correlations

Second, convergent and discriminant validity was assessed by examining the average variance extracted for each measure and factor loadings. The average variance extracted for each measure was calculated according to the procedure (Fornell & Larcker, 1981). The calculated statistics all surpass the minimum threshold of 0.50 (Table 4). We compared the average variance extracted for each measure with the shared variance between all possible pairs of measures. The average variance extracted for each measure was higher than the squared correlation between the measure pairs. Next, we ran a factor analysis with varimax rotation. The initial factor analysis showed that the control variable "perceived usefulness" was loaded into the same construct with compatibility. Thus, we excluded compatibility from further analysis. The rotated pattern matrix showed that all items had high loadings on their respective constructs and that no item loaded higher on constructs that it was not aimed to measure.

Overall, the developed measurement instruments exhibited sufficiently strong psychometric properties to support valid testing of the proposed research model. Table 4 presents the descriptive statistics and the correlations among the constructs for the 156 responses.

5.2 Common Method Bias Analysis

We tested for common method bias using the marker variable approach developed by Lindell and Whitney (2001) and compared in Malhotra et al. (2006). A marker variable is theoretically unrelated to at least one variable in the model and is used to adjust the correlations between the substantive variables and the dependent variable for common method variance (Lindell & Whitney, 2001). This approach can be administered without the identification of the marker variable, a priori. A good candidate for the marker variable is the one with the smallest correlation with the manifest variables. Self-perceived energy in the workplace was selected as the marker variable, and the average correlation among the variables was 0.057 (average p-value = 0.51). Adjusting for the marker variable (Malhotra et al., 2006), all correlations among the substantive variables showed no change when rounded up to two decimal places (average correlation change = 0.006). These findings indicate that common method bias was not a serious concern with our data.

Next, we conducted cognitive interviews (Beatty & Willis, 2007) to address common method bias potentially caused by item context effects (i.e., response in relation to other items in an instrument) and by measurement context effects (i.e., the same context when the measures were collected) (Podsakoff et al., 2003) (findings presented in Appendix E).

5.3 Hypothesis Testing

Hypothesis testing was conducted using Stata. First, we examined the assumptions of normality and linearity. As for the normality of residuals, researchers suggest that normality is not necessary for obtaining unbiased estimates of the regression coefficients (Cohen, West, & Aiken, 2014). Cohen et al. (2014) emphasize the importance of graphical evaluation to identify the degree of non-normality. After regression analyses, residuals were calculated using the *predict* command in Stata. Then, we obtained a standardized normal probability plot using the *pnorm* command. From the results, we did not find any indication of the violation of normality. We found slight deviations from normality at the lower or upper tails. However, those deviations seem to be minor. Next, we evaluated the assumption of linearity. We plotted the residuals against the predictor variables in the regression equations. The plots did not show any strong indication of departure from linearity. We also generated augmented partial residual plots. We found few problematic areas partially attributed to influential observations. Overall, they looked minor and did not indicate any violation of linearity.

Next, we conducted hypothesis testing. In the regression equation, age and tenure showed moderate multicollinearity with a variance inflation factor close to 5. Thus, we dropped age from the equation. Table 5 summarizes the results of the regression analyses for the hypotheses.

Hypotheses	**H1a, H3a, H4**	**H2b, H3b, H5**	**H1b, H2a, H6**	**H7a, H9a**	**H7b, H8a**	**H8b, H9b**
DV	**Role Conflict TC**	**Role Conflict CR**	**Role Conflict TR**	**Intentions to Adopt T**	**Intentions to Adopt C**	**Intentions to Adopt R**
Controls						
Gender	0.195 (0.182)	0.316^{+} (0.207)	0.466* (0.205)	0.154 (0.153)	-0.016 (0.145)	0.102 (0.162)
Tenure	-0.002 (0.009)	0.023* (0.011)	-0.004 (0.011)	0.008 (0.008)	0.010^{+} (0.008)	0.003 (0.008)
Hours Spent T	0.016 (0.051)		-0.017 (0.056)	0.065^{+} (0.040)		
Hours Spent C	-0.001 (0.005)	-0.002 (0.005)			0.001 (0.004)	
Hours Spent R		-0.029* (0.017)	-0.044** (0.016)			0.023* (0.012)
Norm. Belief T				0.389** (0.062)		
Norm. Belief C					0.231** (0.055)	
Norm. Belief R						0.211** (0.074)
Per. Usefulness T				0.270** (0.067)		
Per. Usefulness C					0.418** (0.068)	
Per. Usefulness R						0.467** (0.067)
Voluntariness T				-0.066 (0.076)		
Voluntariness C					0.015 (0.088)	
Voluntariness R						0.149^{+} (0.103)
Main Effects						
Overload T	0.427** (0.071)		0.393** (0.077)			
Overload C	0.245** (0.063)	0.196** (0.071)				
Overload R		0.415** (0.077)	0.361** (0.074)			
Role Conflict TC				0.172** (0.067)	-0.067 (0.057)	
Role Conflict TR				-0.045 (0.062)		-0.055 (0.063)
Role Conflict CR					0.156** (0.054)	0.125* (0.067)
N	156	156	156	156	156	156
adj. R^2	0.351	0.293	0.323	0.426	0.403	0.413

Notes. 1. Unstandardized coefficients are shown with standard errors in parentheses.

2. +p < 0.10, *p < 0.05, **p <0.01 for one-tailed tests given directional hypotheses.

3. T: teaching/educational technology; C: clinical care/clinical technology; R: research/research technology. TC: teacher and clinician; TR: teacher and researcher; CR: clinician and researcher.

Table 5. Results of Hypotheses Tests

Hypotheses 1 to 3 suggested that role overload would lead to role conflicts between teacher and clinician, teacher and researcher, and clinician and researcher. We tested the hypotheses after adding three control variables (gender, tenure, and hours spent). The results in Table 5 indicate that all of the role overload coefficients are significant at the $p < 0.05$ level.

Hypotheses 4 to 6 suggested that role conflict will be higher when role overload affects the secondary role more than the primary role. We tested the hypotheses after adding three control variables (gender, tenure, and hours spent). For the testing of these hypotheses, we compared the regression coefficients for role overload in the two roles. The results showed marginal support of hypothesis 4 for the difference between teaching and clinical care ($F = 2.57$, $p = .056$), support of hypothesis 5 for the difference between clinical care and research ($F = 3.11$, $p = .04$), and support of hypothesis 6 for the difference between teaching and research ($F = 0.07$, p = .40).

Next, hypotheses 7 to 9 posited that intentions to adopt educational, clinical, or research technology were determined by role conflicts. These hypotheses were tested after including six control variables. The results indicated support of hypothesis 7a (role conflict between clinical care and teaching → intentions to adopt educational technology), hypothesis 8a (role conflict between clinical care and research → intentions to adopt clinical technology), and hypothesis 8b (role conflict between clinical care and research ◎ intentions to adopt research technology) at the p < .05 level. In contrast, hypotheses 7b, 9a, and 9b were not supported.

5.4 Mediation Tests

In addition, we conducted mediation tests using Stata's *sem* command for significant relationships to evaluate whether mediators (role conflicts) carried the influence of independent variables to dependent variables (MacKinnon et al., 2002). We found that role conflict between teaching and clinical care fully mediated the effect of role overload in teaching and clinical care on physicians' intentions to adopt educational technology (coef.=.078, p =.012; coef.=.044, p=.025). Role conflict between clinical care and research fully mediated the effect of role overload in clinical care and research on physicians' intentions to adopt clinical technology (coef.=.035, p=.034; coef.=.075, p=.005). Finally, role conflict between clinical care and research fully mediated the effect of role overload in clinical care and research on intentions to adopt research technology (coef.=.042, p=.046; coef.=.089, p=.012).

6 Discussion

This study investigates IT adoption intentions of physicians, given their multiple job roles and role conflicts in their workplaces. Overall, the results largely support the hypotheses concerning the relationships among role overload, role conflict, and IT adoption intentions. We found that physicians' role overload in clinical care, teaching, and research significantly impacts role conflict between any pair of associated roles. We also found that role conflict between the primary (clinical care) and secondary (teaching or research) roles is influenced more by an overload in the secondary role than by overload in the primary role. Role conflict between secondary roles is impacted similarly by each of the secondary roles. Further, role conflict between clinical care and teaching was found to significantly impact physicians' intentions to adopt technology that supports their teaching (secondary role), but role conflict between teaching and research does not influence intentions to adopt technology that supports either secondary role. Also, we note that role conflict between clinical care and research affects intentions to adopt technology that can support both roles.

6.1 Discussion of the Findings

From the testing of hypotheses 1 to 3, our findings show positive relationships between physicians' role overload and role conflicts. These findings are consistent with prior studies (Lenaghan & Sengupta, 2007; Marks, 1977). For example, in the context of college students who have multiple roles as both workers and students, Lenaghan and Sengupta (2007) found that role overload is more likely to increase role conflict, due to the interference of work on school. Rubel et al. (2017) report a positive relationship between employees' role overload and work-family conflict. However, our study goes beyond existing research by offering a more granular level of understanding of role strain. First, prior studies have typically examined the impact of overall role overload caused by multiple roles (Barnett & Baruch, 1985; Edwards et al., 2002; Lenaghan & Sengupta, 2007). In contrast, we evaluated the impact of role overload in each individual role (i.e., teacher, clinician, or researcher). This approach allows us to identify the unique impact of each role overload when multiple roles are involved. Second, prior multiple job role studies have examined a simpler concept of role conflict, such as conflict between work and family roles (e.g., Coverman, 1989) or between work and school roles (e.g., Lenaghan & Sengupta, 2007). In contrast, our study identifies the three job roles of physicians who work in medical schools and conceptualizes three types of role conflicts. Such fine-grained conceptualization allows us to investigate which types of role conflict could lead to technology adoption. Following our work, hospital managers will be better able to diagnose the factors that hinder technology adoption and will be able to determine ways to both promote technology adoption and enhance physician performance.

From the testing of hypotheses 4 to 6, we found a stronger effect from the secondary role on the role conflict than the primary role. The literature shows some attention to the relationships among multiple roles. Research on role identity (Burke & Stets, 2009; Owens et al., 2010) suggests that individuals with multiple roles frequently have competing role identities. Research on multiple roles and their outcomes shows that college students who bear the multiple roles of worker and student experience more role conflict due to the interference of work on school (Lenaghan & Sengupta, 2007). Our study goes beyond existing research by identifying the differential impacts of primary and secondary roles on role conflict. Prior studies on multiple roles (Lenaghan & Sengupta, 2007; Marks, 1977) suggest that the pressure from limited resources makes people feel that it is difficult to accomplish multiple roles appropriately, and this can lead to role conflict. Building on these studies, our study showed that each of the roles in the role hierarchy exerts a different influence on role conflict. The primary role, toward which more commitment is placed, forms the core identity of individuals, and support and reward systems are designed to support it (Burke & Stets, 2009). Thus, individuals perceive less conflict when they are overloaded in their primary role (Burke & Stets, 2009).

From the testing of hypotheses 7 to 9, we found that role conflict is an important determinant of physicians' technology adoption intentions. First, role conflict between the primary role (clinical care) and the secondary role (teaching or research) significantly impacts physicians' intentions to adopt technology that supports their secondary role (H7a and H8b). In the context of PMSs in Korea, the clinical care role is the more established role. Thus, the results indicate that physicians are more interested in routinizing less-established roles by introducing IT, so that their primary role is not disrupted. In addition, when considering their clinical care, physicians often think that they do not need additional technologies for clinical care. Next, our results showed that conflict between clinical care and research fosters

intentions to adopt clinical technologies that support the primary role (H8a). We suggest that this result can be attributed to the close relationship between clinical care and research. That is, clinical care generates data that physicians can use in their research. Their adoption of clinical technologies will strengthen their future research.

We tested the mediation effect of the significant relationships found in the model. We found that in all six possible mediation pathways, the effect of role overload on intentions to adopt technology was *fully mediated* by role conflict between the roles. This finding confirms the value of our conceptualization of role strain into the two sub-components of role overload and role conflict (Coverman, 1989; Lenaghan & Sengupta, 2007; Rubel et al., 2017) and their significant influence on intentions to adopt technology.

However, our findings also show three non-significant relationships. First, role conflict between teacher and clinician is not significant in fostering intentions to adopt clinical technologies (H7b). During the cognitive interviews, PMSs offered two factors as to why PMSs are not willing to adopt clinical technologies: (1) perceived self-sufficiency in expertise and (2) institutional barriers. The former is a belief that they have sufficient expertise in clinical care and thus do not need support from technology. The latter is the bureaucracy associated with technology adoption, requiring a complicated decision-making process which can involve many different units. Bretschneider and Wittmer (1993) similarly report that complex internal organizational decision-making procedures (i.e., red tape, complicated procurement rules) hinder and slow new technology adoption in organizations. Next, role conflict between teacher and researcher was not significant in promoting intentions to adopt either educational or research technology (H9a, H9b). This finding runs counter to our argument and indicates that conflict between supporting roles does not engender, in physicians, an urgency to adopt technology. The physicians in the cognitive interviews mentioned (1) extra burden and (2) incompatibility of technology with practice. That is, some physicians do not see the necessity in learning new educational or research technologies, since they believe that they already have enough technology that they have mastered with sufficient skills and knowledge to fulfill either job role. Hence, it is an extra burden to learn new technologies. Further, some perceived that some technologies are not compatible with medical practices. Prior studies report similar findings. For example, Poon et al. (2004) suggest that a perceived negative influence on physicians' workflow leads to resistance to technology adoption. Chau and Hu (2001) find that, compared to regular technology users, physicians tend to be very pragmatic and consider the compatibility of technology with practice a critical factor in influencing their technology acceptance. Considering the interview results, we conclude that, despite the enormous potential to resolve role conflict, some physicians are more swayed by negative aspects associated with adopting clinical, educational, or research technologies.

6.2 Implications for Theory

This study contributes to physicians' IT adoption research by examining a new influential factor: their multiple job roles. Prior research has heavily relied on TAM (Dünnebeil et al., 2012; Hu et al., 1999; Turan & Koç, 2022), TPB (Chau & Hu, 2001; Deng et al., 2021), and UTAUT (Jayaseelan et al., 2020; Venkatesh et al., 2011) to explain the IT adoption behaviors of physicians. These studies have focused on the impacts of technological factors (Dünnebeil et al., 2012; Turan & Koç, 2022) and organizational and social factors (Deng et al., 2021; Jayaseelan et al., 2020; Venkatesh et al., 2011) on physicians' technology adoption. Also, prior studies of physicians have focused on the impact of physicians' cognitive and emotional factors, such as

the perceived usefulness of technology (Hu et al., 1999), ease of use (Dünnebeil et al., 2012), performance expectancy, effort expectancy, social influence, and facilitating conditions (Venkatesh et al., 2011). However, the job contexts of physicians have been largely neglected. Our study echoes a call by Chau and Hu (2001) who argue that studying IT adoption by physicians requires a different theoretical framework because physicians are different in "general competence, adaptability to new technologies, mental and cognitive capacity, and work arrangement and nature" from comparison groups (e.g., IT professionals, technology users in a company) (Chau & Hu, 2001, p. 712). In general, our study suggests that IT adoption research should study the effects of the prominent characteristics of the jobs of interest. Our study, to our knowledge, is the first attempt to investigate the impact of role conflict on physicians' technology adoption.

Also, our study extends role strain research in two ways. First, there is a lack of research regarding the impact of role strain on technology adoption. Prior research on role strain investigated the predictors of role overload and conflict and their impacts on strain and job outcomes. For example, research examined the impacts of technostress and role stress on role overload and conflict in the context of workers' technology use (Tarafdar et al., 2007), the impacts of work-home conflict and work overload on strain of technology workers (Ayyagari et al., 2011), the roles of child's internet addiction and family-work conflict on parents' job satisfaction (Venkatesh et al., 2019), and the impact of excessive use of mobile technology, technology work conflict, and role overload on job burnout (Jiang et al., 2022). Here, our study contributes to role strain research by showing that physicians' role overload and role conflict influence their intentions to technology adoption.

Second, our study provides insights to role strain theory by offering important insights regarding the relationship between role overload and role conflict. Hall (1972) found that people should prioritize roles in their role systems such that role overload in a major role would reduce role conflict with minor roles. In our context, physicians spend more time in their role as clinicians and are less involved as teachers and researchers. However, their minor roles as teachers and researchers cannot be less emphasized, because they directly influence salary increases, as well as tenure and promotion. Thus, contrary to Hall's (1972) findings, role overload in major and minor roles does not contribute to a decrease in role conflicts.

Finally, our study extends role identity research by identifying the three distinct role identities of PMSs and by finding that their impacts on role conflict and technology adoption are dependent on their position in the role hierarchy. Role identity theory suggests that multiple roles creates multiple identities in individuals (Burke & Stets, 2009; Gruber & MacMillan, 2017; Owens et al., 2010). Multiple identities are developed into a hierarchical structure, in which one identity becomes more dominant than the others (Burke & Stets, 2009). Prior studies identified various role identities of physicians. However, these studies fall short of investigating the hierarchy among the roles and its implications. For example, Reay et al. (2017) identified the four different identities of physicians (expert, decision maker, authority holder, and government representative). They found that physicians' role identities are changed via their social interactions in institutional contexts. Touati et al. (2019) reported the significant impacts of three physicians' role identities (medical expert, care coordinator, and team member) on medical collaboration. Unlike these studies, our study identifies the primary role identity (clinician) and the secondary role identities (teacher and researcher) and shows the relative impact of roles in the hierarchy on role conflict and technology adoption.

6.3 Implications for Practice

Our study has two important implications for practitioners. First, understanding the barriers and facilitators of IT adoption has been an important concern to medical professionals for years (e.g., Palacholla et al., 2019). Our findings offer crucial insights to administrators at medical schools on how better promote IT adoption. The findings show that technology adoption needs to be promoted selectively to different groups of physicians, depending on their job roles and role conflicts. For instance, the role conflict between clinical care and research promotes the adoption of both clinical and research technologies. This implies that administrations should encourage the adoption of both types of technology by those who are active in both clinical and research roles.

Second, research recognizes that people have multiple roles when they are members of social groups (Burke & Stets, 2009). Our findings indicate that multiple roles operate in a hierarchy, and that physicians place more emphasis on fulfilling their primary role of clinician. Their secondary roles (teaching and research) are gaining in importance over time, since physicians' performance (measured by salary and tenure) is tied to these roles (Svider et al., 2013). However, these roles still have lower prominence in the role hierarchy, and physicians do not experience a significant increase in their core competency by excelling in these areas. Therefore, even as they emphasize the primary role, medical schools should not neglect support for the secondary roles, because those roles exert a stronger influence on physicians' role conflict than that of the primary role. Also, they should recognize that role conflicts between the primary and secondary roles affect technology adoption decisions.

6.4 Limitations and Future Research

The findings should be interpreted in the light of limitations. This study has limited external validity (Im & Straub, 2015) in that the setting focuses on physicians in medical schools in Korea. However, generalizing the theoretical framework to other medical school contexts is feasible, given the generalizable nature of the key constructs and the prominent role of clinical care among physicians (Ahmady et al., 2007). Also, the study can be generalized to other types of jobs that involve multiple roles.

Our study sets the groundwork for future research. First, one interesting factor is the role of the perceived self-sufficiency of physicians on technology adoption. When physicians have a high sense of perceived self-sufficiency regarding their knowledge and their expertise about current supporting technologies, they may be less willing to accommodate new technologies. Second, research needs to explore how IT adoption and usage can alleviate role strain (i.e., role overload and role conflict). Finally, research needs to probe the possibility of role conflict caused by the characteristics of roles (e.g., the tasks, logic, processes, and interactions).

7 Conclusion

This study explores the impact of role overload and role conflict among multiple roles on IT adoption. Physicians in medical schools are involved in handling multiple job roles. To better serve their job roles as clinicians, teachers, and researchers, they face the decision of whether to adopt IT and if so, which technologies—technologies that support clinical care, teaching, or research. The findings show that the multiple roles of physicians and role conflicts significantly influence the technology adoption intentions of PMSs.

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Appendix A. Literature Review Approach

1. Technology Adoption Research on Physicians

We followed Leidner and Kayworth's (2006) methodological approach for systematic literature review. First, develop criteria on which studies need to be incorporated into our analysis. Second, develop a strategy to search the literature. Third, plan how to document and analyze the selected studies. We followed Wiener et al.'s (2016) four-step search strategy: (a) searched Google Scholar with keywords such as technology, adoption, use, acceptance, physicians, and medical faculty; (b) searched a database of information systems journals with keywords; (c) performed a similar keyword search in Web of Science, Science Direct, and PubMed; and (d) identified key articles that cited other technology adoption studies as extracted from Google Scholar. For the inclusion criteria, studies published during the period of 1990 to 2022 were targeted. Studies written in the English language were retrieved. The following exclusion criteria were used: articles with less than 20 references, review articles, articles that did not employ a theory of technology adoption/use behavior as the main theory basis, and articles published before 1990. A total of 439 articles remained for the literature review in this study. Table A summarizes the results.

Major Theory Used	# of Articles	Major Predictors
Technology acceptance model (TAM)	209	Perceived usefulness, perceived ease of use, etc.
United Theory of Acceptance and Use of Technology (UTAUT)	142	Performance expectancy, effort expectancy, social influence, facilitating conditions, gender, age, experience, voluntariness of use, etc.
Theory of planned behavior (TPB)	88	Subjective norms, perceived behavioral control, attitude toward behavior, etc.

*Note: Some studies used a combination of these theories, but they were not classified separately because our objective is to identify the major theories used and the major predictors of technology adoption by physicians.

Table A. Summary of Physicians' Technology Adoption Research

2. Role Overload and Role Conflict Research

The same methodological approach mentioned above was used for the literature search. We first searched Google Scholar and the Web of Science, Science Direct, and PubMed databases with keywords such as technology adoption, role overload and role conflict, workplace, physicians, and medical faculty. No articles were retrieved, indicating the research gap. Then, we extended our search by removing the keywords of physicians and medical faculty from the previous keyword set, resulting in research on role overload and/or role conflict in a variety of workplace contexts. For the inclusion criteria, studies written in the English languages and published between 2005 and 2022 were searched. We used the same exclusion criteria mentioned in Appendix A: articles with less than 20 references, review articles, articles that did not employ a theory related to role strain/stress (which is grounded in the concepts of role overload and role conflict) as the main theory basis, and articles published before 2005. A total of 345 articles remained for literature review in the study. Table 1 in the main text outlines the major studies.

Appendix B. Preliminary Interview Protocol

- What are the major tasks as a clinician, as educator, and as researcher?
- What types of clinical technology are you and your colleagues currently using or intend to adopt in the near future? What are the functions of the technologies?

- What types of educational technology are you and your colleagues currently using or intend to adopt in the near future? What are the functions of the technologies?
- What types of research technology are you and your colleagues currently using or intend to adopt in the near future? What are the functions of the technologies?
- How do multiple job roles influence technology adoption intentions?
- In the multiple role involvement, what are the factors that influence medical school faculties' technology adoption intentions?

Appendix C. Open-Ended Questions in the Main Survey

Please, list the types of technologies that you are currently using or intend to adopt in the near future.

- Clinical technology is used for clinical purposes. Physicians use this technology at the front line where they directly face patients and treat them. Examples include electronic medical record systems, telemedicine systems, and robot operation systems. (This list is incomplete.)
- Educational technology is used for education purposes. Physicians use this technology when they prepare to teach medical students in classes. The technology also supports students' educational activities. Examples include University research management systems, database management systems, and statistical analysis programs. (This list is incomplete.)
- Research technology is used for research purposes. Physicians use this technology at the front line for the purpose of their research projects. Examples include learning management systems, virtual classrooms, and voting systems. (This list is incomplete.)

Type	Existing	New (Adoption in consideration)
Clinical care		
Teaching		
Research		

Appendix D. Measurements

Construct	Measures	Resource
Role Overload	For teaching/ [clinical care]/ [research], The things I do add up to being just too much. The amount of work I am expected to do is too great. I never seem to have enough time to get everything done at work. It often seems like I have too much work for one person to do.	Barnett & Baruch (1985); Marshall & Barnett (1993); Bolino & Turnley (2005)
Role Conflict	How often do you have to juggle different obligations [teaching and clinical care/ [clinical care and research]/ [research and teaching]) that conflict with one another and give you a pulled-apart feeling? How much do your jobs of teaching and clinician interfere with each other? How often are you stressed trying to balance your responsibilities (teaching and clinical care) that conflict with one another?	Barnett & Baruch (1985); Coverman (1989); Bolino & Turnley (2005)

Intentions to Adopt Technology	I intend to adopt new educational (/[clinical] /[research]) technologies in my job within [the next six months]. I am likely to adopt new educational (/[clinical] /[research]) technologies in [a year's time].	Karahanna et al. (1999); Teo et al. (2003)
Role Identity	As a physician I consider myself as a teacher/ [clinician]/ [researcher]. Percentage of each among 100 %	Callero (1992)

Appendix E. Analysis of Cognitive Interviews

Methods

Cognitive interviews of five interviewees were performed by two interviewers. The cognitive interviewers used a standardized interview protocol to ask probing follow-up questions, in order to obtain verbal information about why the physicians would not intend to adopt education/clinical/research technology, given their role conflicts (Beatty & Willis, 2007). The interviews confirmed that their opinions of "no intention to adopt technology" was not ascribed to item context or to measurement context effects. These confirm that common method bias played a minimal role with our data.

Analysis of Cognitive Interviews

After the hypothesis testing, we conducted cognitive interviews to better understand the statistical findings. Five physicians explained why they and their colleagues would not like to adopt IT, providing insights into unsupported hypotheses. The interviews suggest that the challenges they face while considering technology adoption can be classified into the four types: 1) extra burden, 2) perceived self-sufficiency, 3) technology incompatibility, and 4) institutional barriers. Table B summarizes the challenges and reasons for technology non-adoption intentions.

Type of Challenge	Reason(s)	Description
Extra Burden	Additional work	Adopting new educational technology may create additional work.
	Time conflict in multiple job roles	Adopting new educational or research technology may create conflicts in time management among multiple job roles.
Perceived Self-Sufficiency	Reliance on one's own expertise	Some physicians think that they already have enough knowledge and expertise and thus do not need to adopt new educational or clinical technology to support their work.
	Reliance on traditional methods/tools	Some physicians hold the view that traditional educational tools are enough to prepare teaching and instruct students.
	Tenure	Some senior faculty members think that new educational or research technology is for junior faculty members to improve their performance, rather than for senior faculty members.
Technology Incompatibility	Incompatibility of technologies with practice	Some physicians see a gap between educational technology and actual application to practice.
Institutional Barriers	Bureaucracy involved in technology adoption	Adopting clinical technology involves a complicated decision making process that goes through many different units, such as the department, the medical school, and the university.

Table B. Summary of Cognitive Interviews

(1) Extra Burden

To some physicians, adopting new technology is burdensome and creates a new role conflict, rather than reduce one. Thus, they foresee further role conflict, which leads to their technology non-adoption intentions.

Additional work. In some cases, adopting educational technology is considered to be additional work for physicians, unless the adoption is mandatory.

> *Adopting new educational technology is likely to add additional work (associated with the adoption) to physicians who experience a role conflict between teacher and researcher unless physicians have a particular interest in education and beliefs on educator's role (Interviewee: Physician 4).*

Time conflict in multiple job roles. Adopting either educational or research technology may create time conflicts in the multiple job roles of physicians and may even undermine work efficiency.

> *Physicians have to teach a lot of knowledge within a limited time. So adopting and learning new educational technology is likely to be very often time-consuming and may not increase efficiency in teaching activities (Physician 2).*
>
> *Learning new research technology requires additional time, which creates conflicts in physicians' time management efforts in multiple job roles (Physician 3).*

(2) Perceived Self-Sufficiency

Some physicians think that new technology is not necessary to resolving their role conflicts. The reasons for their perceived self-sufficiency reflect the characteristics of their role, expertise, and tenure.

Reliance on one's own expertise. The level of physicians' knowledge and expertise for the job role may negatively impact their intentions to adopt educational or clinical technology.

> *If physicians believe they already have enough experiences and skills in handling teaching materials, they are less likely to think that they need to adopt new educational technology to support their teaching (Physician 1).*
>
> *If physicians consider their major role as a clinician and believe that they have enough knowledge and expertise in their specialties, they will have low intentions to adopt new clinical technology. In contrast, physicians are more likely to learn and adopt educational technology, because they often think they lack knowledge and tools in handling teaching materials, thus adopting educational technology may help to improve their teaching efficiency (Physician 2).*

Reliance on traditional methods/tools. Some physicians believe that existing educational tools are enough to fulfill their job as a teacher, and thus additional educational technology is unnecessary.

> *It is often observed that physicians who have more than 20 years educational experiences view adopting new educational technology, such as web-based or online educational technology as unnecessary. They think that they have already had enough traditional teaching tools to prepare teaching and instruct students (Physician 2).*
>
> *Most frequently used traditional teaching tools include PPT and a projector in classroom teaching. Physicians with support of residents also do bedside teaching for senior level students*

in clinical practice, where paper-based charts are often used to check and describe patient's historical data. These physicians are less likely to adopt new educational technology, since the existing tools are sufficient to support their teaching needs (Physician 4).

Tenure. Physicians' tenure may make them complacent in their position and may make them less inclined to take initiative in adopting new technologies. Specifically, this perception may influence both educational and research technologies.

It may be different based on the faculty's tenure position. Physicians who think that they reach a high level of expertise in their specialty areas are less likely to adopt new clinical technology. This phenomenon can be evident as the position of faculty rises from assistant professor, associate professor to full professor (Physician 1).

Compared with assistant professors, full professors who have lots of experiences in research and teaching activities are less likely to adopt new research and educational technologies. They think that adopting new research and educational technologies is an opportunity for junior faculties to improve their performance. Full professors often have a sense of stability resulted from their tenure position and lots of experiences accumulated over years (Physician 4).

(3) Technology Incompatibility

Physicians often use educational technologies (e.g., simulator) to understand the scientific basis of medicine. A challenge in such educational technology is whether the technology is compatible with practice. Incompatibility to practice could explain a low intention to adopt educational technology.

Some physicians even think that newly introduced dummy technologies and multimedia educational technologies are not good enough to replace traditional instruction methodologies. There is a gap between teaching students with such educational technology and real world clinical practice. In that sense, educational technology may have a limitation to teach medical students (Physician 2).

Simulation technology does not always create real-life situations. Some situations are left out from simulators. Learning and using such educational technology may lead students to underperform in medical training with incorrect diagnosis (Physician 5).

(4) Institutional Barriers

Bureaucracy in an organization is one procedural characteristic that is formulated based on the organizational hierarchical structure and bureaucrat culture (Ho et al., 2011; Moon & Bretschneiber, 2002). Such institutional factors may also lead to physicians' technology non-adoption intentions.

Compared with adopting educational technology, adopting clinical technology is quite expensive and thus becomes too much of a hassle. It involves very complicated and difficult decision-making processes, which required approvals from every relevant party in the department, medical school, and university (Physician 4).

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