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Sujin Kim
University of Kentucky, sujinkim@uky.edu

Donghee Sinn
University at Albany - State University of New York

Sue Yeon Syn
The Catholic University of America

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Personal health information management by college students: patterns of inaction

Sujin Kim, Donghee Sinn and Sue Yeon Syn.

Introduction. College students' diverse health information management activities are rarely studied within a personal health context. Our study identified an inactive group of college students and their information management activities to understand what factors determine inactivity.
Methods. An online questionnaire was distributed to college students enrolled in a state-owned university in the USA between January and March 2017. A total of eighty-four questions on twelve information management activities grouped by seven types of personal health information were used to identify inactive performers within our student sample. Additionally, potential factors regarding demographics, academics, information resource types, and information workload were tested.
Analysis. Our study sample includes 1,408 student responses. K-means clustering segmented the sample into two groups (inactive and active). Group differences between inactive and active personal health information managers were compared. Binary logistic regression was also performed to determine key factors predicting inactivity.
Results. The inactive group (N=772, 54.80%) identified more male students, less clinic visits, and health information primarily sought through the Internet and mass media. Additionally, the awareness of personal health information management and training perceptions were found to be significant determinants of the inactivity. The inactive group proved to be lacking in most information management activities, except for discarding, and showed less interests in all types of health documents.
Conclusion. Based on the inactive personal health information management group, how to

collect, organize, retrieve, backup and migrate personal health documents, should be integrated into a formal college curriculum.

Introduction

Health information technology has greatly improved individuals' access to their personal health information. Personal health record systems, a patient version of electronic medical records, expedite individuals' ability to manage a wide array of personal medical information, including health histories, laboratory results, medications, and treatments, and financial information, such as health insurance policies and employee health-related benefits (Detmer et al., 2008). As such, the health information management of individuals is more important than ever. Personal health information management is defined as an entire spectrum of information management activities by individuals for use in their own health matters. The diverse information management activities individuals perform include information curation activities, the acquisition of information from one or more sources, the custodianship and distribution of that information to those who need it, and its ultimate outcome through archiving or deletion (Agarwal et al., 2009).

Health information seeking activities stems from uncertainty management, with reducing uncertainty as one of five drivers for information seeking (Boot et al., 2010). Personal health information management, therefore, might be an individual organizing their own health documents in an understandable way to reduce uncertainty. In this sense, individuals may come to understand their health issues better as they manage their diverse health documents. With no clear urgency or motivation to reduce uncertainty about their health, many healthy individuals may lack the drive to manage their personal health information. Consequently, personal health information management research does not pay close attention to those who are less motivated in their health information seeking. For instance, healthy college students do not seek out health information actively, so personal health information management is not their main concern. However, managing health information could be an important life habit from a preventive health education perspective. In this study, we argue that inactivity and lack of motivation are an important for personal health information management and health literacy. Specifically, information professionals who work closely with college students or young adults should understand health information seeking activities, particularly personal health information management. Our study focused on college students to explore the characteristics of inactive patterns of personal health information management in terms of demographics, academics, perception, and information workload.

Literature review

The following sections review diverse activities that existing research identifies as essential skills for personal health information management. Additionally, health information seeking and management research that suggests the inactivity of college students' regarding personal health information management is reviewed. Finally, literature on how individuals perceive different aspects of personal health information management awareness, ownership, difficulty, technology, and training issues is briefly reviewed.

Personal health information management activities

Relatively speaking, searching or finding information from public sources, such as the Internet or libraries, has been thoroughly studied in health information seeking and management research. However, little is known about how individuals manage their medical records and archive them for future use. Some scoping studies identify information management activities of chronic patients, but do not investigate the relationships among the entire spectrum of information management activities or other influencing factors of those activities (Cocosila and Archer, 2014; Sun and Belkin, 2016). In either health information seeking behaviour or personal health information management research, there has been no agreement on the information management activities that individuals should master. Previously, we tested the combined diverse information management activities from health information seeking behaviour and personal health information management research (Kim, 2015; Kim et al., 2018). Personal health information management involves three essential activities: collection, organization, and retrieval. As such, core tasks of personal health information management are mainly to search, find, and re-find previously encountered information from both personal and shared spaces. Because lay individuals are not trained as information professionals, they may not grasp the entire spectrum of information management activities. Particularly, there are some specific personal health information management activities that individuals may find difficult to perform. For instance, librarians or archivists collect information based on their collection development policy or weeding policy. While information professionals anticipate information values for their clients, individuals may not know whether the health information they collect has value for their care management. Consequently, they may not be sure when or what to remove unnecessary information from their bulky personal archives.

As such, practicing personal health information management is not a solitary searching or retrieving process, but rather, a systematic one. It involves a holistic health information seeking behaviour or personal health information management process. It starts with decisions on where to store and what to collect (Jones, 2007; Marshall, 2011; Jones and Ackerman, 2016). It moves to curatorial or organizational decision making that requires evaluating the future value of content (Jones and Ackerman, 2016). Forecasting future needs (Bruce, 2005) is identified as a burden related to curatorial decisions (Marshall and Shipman, 2011). In this stage, activities like creating clues by labelling, categorising, arranging, or organizing are interchangeably used to denote information curation activity. This evolves to using these cues (such as file names and folders) to re-find the information (Copeland, 2011). When information is ready for sharing or using, it has real value. For instance, when a college student knows which information should be discussed when visiting a college health clinic, his or her personal health information management activity is actively practiced. Less motivated college students might not know how to best perform each specific activity for better self-care management.

College students as inactive performers

There has been some literature supporting that college students are inactive personal health information managers. As a broader theoretical framework, Boot et al.'s (2010) informational drives can supply important initiatives to connect health information seeking activities to an inactive personal health information management drive. For example, research among college students reports less interest and low activity for seeking health information. The college years are a relatively healthy time, so college students' chances of seeking healthcare are low in comparison to other age groups.

Nationwide college health surveys report that most young adults in the United States ages eighteen to twenty-four have relatively low rates of health insurance and preventive care utilisation (Brown, 2008; Nguyen et al., 2016; University of Minnesota, 2017). This further implies that young adults are less likely to identify a usual place for medical care (University of Minnesota, 2017) and more likely to seek health information through non-medical sources such as the Internet (Basch et al., 2018). In other words, their health information resources are often likely from the anonymised environment of the Internet or non-professional human sources such as family members or peer students. Furthermore, students become inactive when the health topics are sensitive (Fajiram, 2010) and they have concerns related to negative outcomes, including social consequences (Syn and Kim, 2016). Again, these findings have been focused on seeking, rather than an entire spectrum of individuals' health-focused information management activities.

Besides health information seeking behaviour research, health literacy (or so-called eHealth literacy) research also provides insights into college students' inactivity patterns of personal health information management (Stewart and Basic, 2014). Numerous health literacy studies have noted that informed health consumers could better manage health conditions and that personal health record systems can act as a central hub for health information (Tang et al., 2006; Archer et al., 2011). Unlike professionals who understand document types, uses, and values throughout the course of care, inexperienced individuals have difficulty managing their own documents. Particularly, those who are not motivated and minors who depend on parents for their care management are less likely to practice personal health information management activities (Forster et al., 2015; Hawley et al., 2014).

In our previous studies, we reported that younger populations and a lower rate of healthcare utilisation were highly associated with inactivity (Kim and Real, 2016; Kim, 2015). Moreover, the variety of consumer health information technology applications provide individuals information on their current state of health, but utility is limited to the technology savvy group. Several studies raised concerns about lack of training on record management to obtain optimal use of newly provided personal health record systems (Detmer et al., 2008; Reti et al., 2009; Tang et al., 2006). For example, student health records provide limited electronic access to student health documents that only matter within the college years. This is complicated by the fact that students could also see off-campus healthcare providers, so fragments of student health records are subject to consolidation. Evidently, low utility of student health records can contribute to personal health information management inactivity. However, no college health services have been focused on health information management issues for their student population.

Factors affecting inactivity

There are several potential factors that might impact personal health information management inactivity among college students. In health information seeking and management research demographic characteristics such as age, sex and ethnicity can impact college students' information activities. It has been generally found that non-Hispanic Whites, the young and highly educated, high-income, and females are more likely to seek health information (Jung, 2014). Female students (Jung, 2014) and Blacks and Hispanics (Escoffery et al., 2005) are especially likely to search for health information online. In their recent research, Basch et al. (2018) found that male college students seem to behave passively when consuming online health information. In this paper, male students were less likely to use the Internet for health information ($p=.030$), to consult a health or medical professional ($p=.042$), and to confirm the health information they find with a medical professional ($p=0.028$)

(Basch et al., 2018). While White students reported spending significantly less time on the Internet ($p<0.001$) and on social media ($p<0.001$), non-White students were significantly more likely to use the Internet to find health information ($p=0.039$).

In academia, personal health information management activities should be related to students' learning outcomes. Hanik and Stellefson (2011) found that students of advanced academic status (e.g., juniors and seniors) scored higher overall for e-health literacy than their younger counterparts ($F(4,140) = 2.597$, $p = 0.039$). The finding highlights the relevance of personal health information management activities and literacy level to academic performance. Considering the learning environment in academia, college students and their academic success or health and wellness might be associated with personal health information management during college. In a research on college students' personal information management practices, the implication of library service through information literacy training was emphasized (Osae Otopah and Dadzie, 2013). Personal information management is related to information literacy and thus, knowing how users manage their health information would be useful in providing better library services in academic setting. Although it is not specifically focused on personal health context, a study by Gabridge, Gaskell, and Stout (2008) reiterates the implication of college library service, which can promote college students' personal information management or personal digital preservation.

There are several perceptional factors that are associated with diverse information management activities. For the awareness of personal health information management, if someone thinks that their personal information may be important in a different context (e.g., financial, academic, personal history), then he or she may make more of an effort to preserve that specific information (Sinn et al., 2011; Kaye, et al., 2006; Sinn et al., 2014). For technological perception, individual knowledge about diverse information technology tools and methods was found to be associated with individuals' optimal personal health information management performance (Sinn et al., 2017; Williams et al., 2008; Sinn et al., 2011). With regard to difficulty perception, Bruce (2005) noted that individuals have difficulty in determining the future value of digital content (Bruce et al., 2004; Hardof-Jaffe et al., 2009; Marshall, 2011). Additionally, the sense of possession or ownership may influence personal health information management activities (Marshall and Shipman, 2011; Kaye et al., 2006). To achieve a satisfying level of information retrieval for individuals' needs, some types of assistance, whether technological or professional, might be useful (Sinn et al., 2017; Williams et al., 2008; Sinn et al., 2011). Further details on personal health information management perception and measures used can be found in our previous work (Kim et al., 2018; Sinn et al., 2019).

This study aims to investigate inactive patterns of college students' personal health information management activities, and in particular, these two research questions:

1. What are the distinct characteristics of inactive personal health information management performers in comparison to active performers?
2. Are there any predictors of inactive personal health information management performance in terms of individuals' demographic variations, academic status and information resources sought, information workload and perceptions of personal health information management activities?

Material and methods

Study setting

An online questionnaire was distributed to college students enrolled in a state-owned university in the USA between January and March 2017. The target population was contacted by e-mail and invited to the online survey. Participants were informed about the purpose of the study, institutional review board approval, and participation incentives in the invitation letter. A total of 1,408 responses were valid for analysis. The others were deemed invalid due to incomplete responses. There were 852 undergraduate students (60.5%) and 426 graduate or certificate students (30.3%) included in this study sample (Missing and others = 130, 9.2%).

Outcome variables

Within our student sample, we first identified inactive personal health information managers by measuring their inactivity patterns based on eighty-four survey questions. Students were provided with a hypothetical scenario to base their survey answers on. The scenario was:

> You are moving to a campus town to start a new life as a University freshman and many things need to be arranged, including establishing your regular visits to a health care provider in your new neighbourhood. When you are seeking a doctor to set up your routine appointments for medical checkups and other visits, you need health records about your medical history. Please answer the following questions regarding how you would treat information for new doctor's visits. If you have not been in this situation, please assume as if you are.

Based on the scenario, twelve personal health information management activities for seven different health record types were investigated: creating, collecting, knowing, discarding, organizing, categorising, arranging, labelling, owning, finding, sharing and using. The seven document types were: immunisation records, family medical histories, emergency information, surgery records, drug information, insurance and patient education. The study measures were developed based on previous systematic review and scoping literature (Agarwal and Khuntia, 2009; Tang et al., 2006; Archer et al., 2011; Barreu et al., 2008). All eighty-four survey items were measured on a five-point scale ranging from 1 (strongly disagree) to 5 (strongly agree). Higher scores indicate more active performers in our samples. Further details of each activity and associated survey questions and data types are described in Appendix B: Survey Measurements and Variables – Part I.

Using the k-means clustering method based on Euclidean distance, a relatively homogeneous group of inactive student performers was identified. K-means clustering was used because it is one of the simplest and most popular unsupervised machine learning algorithms that identifies k number of centroids. In our study, we have two clusters of interest, Inactive (1) and Active (0) groups. With k-means clustering analysis, two cluster memberships were formed: the inactive (N=772, 54.80%) and the active performers (N=636, 45.20%). Once the two groups were identified, their distinct characteristics including demographics, academics, and perceptions were compared. As an outcome measure, the inactivity membership (Inactive = 1 or Active = 0) was used in our binary logistic regression analysis to identify predictors of inactivity within our student sample.

Predictor variables

This study included general characteristics of college students as predictors. There were five groups of predictors measured: (1) demographics, (2) academic variations, (3) preferred health information

resources, (4) personal health information management perceptions, and (5) information workload. For all variables, the scale was between 1 (strongly disagree) and 5 (strongly agree). Demographics included age, sex, and ethnicity while academics measured status, grade point average, and relationship. Preferred health information resources, such as professionals, family, friends, colleagues, Internet, social media, mass media, government, and libraries, were also measured. These measures were adopted from health information seeking studies and personal digital archive literature as well as college health research (Kim and Real, 2016; Vader et al., 2011; Park et al., 2006; Mulye et al., 2009). Mostly, the literature cited is scoping literature. We also constructed a new measure called information workload to assess whether the inactivity is correlated positively or negatively with the amount of information that students receive (Eppler and Mengis, 2004). This measure included the four survey questions about number of digital devices owned, number of smartphones owned, number of courses taken, and frequency of clinic visits last year.

Additionally, we developed sixteen perception questions adopted from general personal information management literature. The awareness of personal health information management activities was modified from Kim and Real (2016). Four perceptions variable were measured, each grounded in relevant literature and research: difficulty, from Jones (2007); ownership, based on Marshall and Shipman (2011); assistance, using Copeland and Barreau (2011); and technology from Syn and Kim (2016) and Sinn et al. (2017). Additionally, other information seeking behaviour measures reported in Kim and Real (2016) were used to identify major determinants of inactivity predictors. Among the above-mentioned perception variables, Cronbach's alpha for two variables was higher than 0.7: Awareness (0.716) and Assistance (0.85). Therefore, the remaining three variables with lower alpha values (< 0.7) were removed from our binary logistic analyses. A complete list of perception measures and references can be found in Appendix B: Survey Measurements and Variables – Part II.

Results

> RQ1: Characteristics of inactive personal health information management activities group versus active group

The first research question sought to identify an inactive personal health information management activities group and their personal health information management activities according to record type. Initially, a total of 1,408 valid respondents were clustered into two groups representing an inactive group (N=772, 54.80%) and an active group (N=636, 45.20%) using k-means clustering. For the twelve personal health information management activity constructs tested, Cronbach's alpha measurements of scale reliability were very reliable, ranging from 0.89 to 0.92. As shown in Table 1, the inactive group members scored lower than the active group members in the majority of activities measured. The average sum of twelve individual activities for seven document types was calculated, ranging from seven (least personal health information management activities performed) to thirty-five (most performed). The one-way analysis of variance between two groups was statistically significant at $p < 0.05$ level for eleven out of twelve personal health information management activities, excepting the discarding activity ($F=0.083$, $p = >0.001$). The largest difference between groups was found in curatorial activities, such as labelling, arranging, and organizing. Interestingly, the inactive group scored slightly higher in the discarding activity than the active group, but the statistical difference was not significant. The inactive group was less likely to perform personal health information management activities than the active group in all seven types of health information.

Notably, patient education materials were the lowest score in both groups among the seven document types.

Table 1: Personal health information management activities by two groups

Activities	Inactive group (N=772, 54.80%) Mean (S.Dev.)	Active group (N=636, 45.20%) Mean (S.Dev.)	F.	Sig.	Mean difference
Creating	19.81 (5.39)	28.21 (4.62)	956.91	0.00*	-8.40
Collecting	18.46 (6.09)	27.57 (5.58)	834.59	0.00*	-9.11
Knowing	21.83 (6.89)	29.52 (4.72)	569.78	0.00*	-7.69
Discarding	16.19 (6.49)	16.08 (7.28)	0.08	0.77	0.11
Organizing	17.38 (6.47)	27.70 (5.54)	998.92	0.00*	-10.32
Categorising	12.99 (5.22)	21.95 (7.31)	697.81	0.00*	-8.96
Arranging	16.43 (6.01)	27.64 (4.97)	1396.52	0.00*	-11.21
Labeling	14.61 (5.86)	26.90 (5.88)	1485.72	0.00*	-12.29
Owning	17.81 (6.01)	27.40 (5.54)	936.54	0.00*	-9.59
Finding	19.25 (6.24)	28.83 (4.53)	1038.46	0.00*	-9.58
Sharing	19.35 (6.45)	28.30 (4.68)	845.06	0.00*	-8.95
Using	20.16 (6.23)	28.03 (4.61)	693.43	0.00*	-7.87

*denotes significant at $P < 0.01$.

Additionally, demographic and academic variables as well as the preferred health information resources and information workload were included for descriptive analysis in the Appendix, Table 1. For demographic differences, the average age of our student sample is 24.65 (S.Dev.=7.12), which is very similar to the active group members (Ave.=24.9, S.Dev.=7.66). Although the difference of the age of two groups was statistically insignificant, they had a statistically significant difference in sex ($p < 0.05$). The inactive group has more male students (N=215, 60.70%) than the active group. Our sample is White-dominant (N=1,023, 72.66%) and there were no significant differences between the two groups regarding ethnicity. The inactive group had slightly more single students (N=381, 55.30%), while married or domestic partner relationships were more common in the active group. Neither academic status nor grade point average showed any significant difference between groups. While housing type was not significant between groups, more students in the inactive group responded that they depended on their parent's health insurance. The use of parents' health insurance status showed statistical significance, so it was added for further regression analysis.

Information workload was indirectly measured through four variables in our survey questions: the number of digital devices owned, the number of smartphones owned, the number of courses taken, and the number of clinic visits in the past year. In our sample, college students in the inactive group owned more digital devices, but this significance is not statistically meaningful at p =<<0.001.As expected, the inactive group (Ave.=3.94, S.Dev.=5.285) visited clinics less than the active group (Ave.=4.76, S.Dev.=7.366) for the past year and the difference was statistically significant (p = <0.001). Implicitly, the inactive personal health information managers do not use healthcare services as much as the active group does, so they do not have as many health documents to manage. Among

the four information workload variables, we decided to add the number of clinic visits in our binary logistic regression as a potential predictor.

The respondents were then asked to rank the most preferred to the least preferred health information resource among nine types we provided. Our findings suggest that the respondents prefer to reach out to family as their first source for health matters in both student groups. Students access their health services through parents' health insurance as they are in still transitioning to adulthood, and from informational dependency on their family. Therefore, this transition might have affected their trusted information resources. Internet and mass media scored highly and the difference between these two resources between groups showed statistical significance at $p < 0.05$. Interestingly, these two resources are more preferred resources in the inactive groups in comparison to the active group.

As a set of study measures, we asked sixteen questions about perceptions of personal health information management activities, including awareness, difficulty, ownership, assistance, and technology. The inactive group had higher means in some of the personal health information management activities difficulty questions. It appears that our inactive college students are not aware of potential personal health information management activities. However, both the active and inactive groups felt similar difficulty (mean=3.55) for curatorial decisions regarding what to keep and what to delete. For the ownership-related perception, the inactive students scored slightly lower than the active group, but this is true for only one of the three questions. The inactive group wanted to have more assistance as they have higher means in all three personal health information management activities assistance questions. For the technology perception questions, only the question about technology assistance had a significant difference in the mean. Among these variables, we created constructs for each category for further analysis with binary logistic regression. However, not all categories proved to be valid as a consistent construct. We only selected awareness (0.75) and assistance (0.84) as constructs because they have Cronbach's alpha scores higher than 0.70. Table 2 shows group differences among the sixteen personal health information management activities perceptions tested.

Table 2: Personal information management perceptions by two groups

Perceptions	Inactive group Mean (S.Dev.)	Active group Mean (S.Dev.)	F	Sig.	Mean difference
Awareness 1	4.18 (0.76)	4.40 (0.68)	31.62	0.00*	-0.22
Awareness 2	4.08 (0.8)	4.31 (0.76)	30.72	0.00*	-0.23
Awareness 3	4.07 (0.85)	4.35 (0.76)	39.41	0.00*	-0.28
Awareness 4	4.00 (0.86)	4.21 (0.82)	22.06	0.00*	-0.21
Difficulty 1	3.55 (1.05)	3.55 (1.02)	0.02	0.90	-0.00
Difficulty 2	3.38 (1.13)	2.95 (1.13)	48.94	0.00*	0.43
Difficulty 3	3.13 (1.11)	2.60 (1.13)	78.02	0.00*	0.53
Ownership 1	2.61 (1.09)	2.64 (1.14)	0.22	0.64	0.03
Ownership 2	3.76 (0.91)	4.00 (0.85)	23.91	0.00*	0.24
Ownership 3	2.93 (1.05)	2.95 (1.08)	0.15	0.70	0.02
Assistance 1	3.52 (0.98)	3.35 (1.04)	9.79	0.00*	0.17
Assistance 2	3.26 (1.06)	3.12 (1.11)	5.78	0.02*	0.14

Assistance 3	3.46 (0.99)	3.34 (1.06)	5.05	0.03*	0.12
Technology 1	2.45 (1.03)	2.40 (1.09)	0.76	0.38	0.05
Technology 2	3.24 (1.07)	3.08 (1.10)	7.42	0.01*	0.16
Technology 3	3.87 (0.85)	3.91 (0.86)	0.55	0.46	0.04

*denotes significant at P = <0.05.

RQ2: Predictors of inactive personal health information management performances

A binary logistic regression analysis was performed to predict the inactivity status of the respondents using gender, number of clinic visits, professional sources sought, fellow patient sources sought, awareness, and assistance as predictors. These predictors were chosen based on the significance of analyses done for RQ1. A test of the full model against a constant-only model was statistically significant, indicating that the predictors as a set reliably distinguished between inactive and active performers (X^2 = 96.014, P = < 0.001 with DF = 6). The pseudo R-squared value, Nagelkerke's R^2 of 0.108, suggests that about 10.8% of the variability of overall cases was explained by the set of predictors. The model was able to classify 64.1% of overall cases (78.2% for the inactive performers and 46.2% for active performers). The Wald criterion demonstrated that sex, preferred information resources (e.g., professionals, peer patients), awareness, and assistance variables made significant contributions to prediction (p = <0.05 and p = <0.001 levels), while the number of clinic visits were not statistically significant predictors (p=0.135). The exponentiation of the coefficients, Exp(B), indicates that when assistance is slightly raised by one unit, the odds ratio is 1.099 times as large. Therefore, this perception influences personal health information management inactivity. Table 3 shows the logistics results.

Table 3: Binary logistic regression result

	B	**S.E.**	**Wald**	**df**	**Sig.**	**Exp(B)**	**95% C.I. for EXP(B)**	
							Lower	**Upper**
Sex	-0.32	0.14	4.99	1	0.03*	0.73	0.55	0.96
Number of clinic visits	-0.02	0.01	2.24	1	0.16	0.99	0.97	1.01
Preferred resource: professionals	-0.16	0.04	16.71	1	0.00*	0.85	0.79	0.92
Preferred resources: other patients	-0.12	0.04	8.13	1	0.00*	0.89	0.82	0.96
Awareness	-0.18	0.03	41.95	1	0.00*	0.84	0.79	0.88
Assistance	0.09	0.02	16.82	1	0.00*	1.10	1.05	1.15
Constant	4.47	0.62	51.56	1	0.00*	87.57		

*denotes significant at P < 0.05.
In the first row in table heading, B is the coefficient for the constant called the intercept in the null model.
S.E. is the standard error around the coefficient for the constant.
Wald is the Wald Chi-squared test that tests the null hypothesis that the constant equals 0. This hypothesis is rejected if the p-value listed in the column called 'Sig.' is smaller than the critical p-value of .05 in our analysis.
The df is the degrees of freedom for the Wald Chi-squared test. There is only one degree of freedom because there is only one predictor in the model, namely the constant.
Exp(B) is the exponentiation of the B coefficient, which is an odds ratio. This value is given by default because odds ratios can be easier to interpret than the coefficient, which is in log-odds units.
95% C.I. for EXP(B) stands for lower and upper bound of the 95% confidence interval.

Discussion

Our study findings highlight the following implications, which explain the characteristics of inactive personal health information management performers among our college student respondents. We also examined predictors of inactivity in the college student sample. We focused our subgroup analyses on the five personal health information management activity constructs in relation to demographics, academic variations, information sources, information workload, and perceptions. First, our findings identified that the inactivity occurred in most personal health information management activities we tested. Interestingly, discarding requires proactive behaviour that involves aggressive decision-making, which makes greater differences in performance, and our study found that there was no significant difference between the two groups. This is consistent with previous studies that the decision to delete or not is an intensive cognitive process that is difficult for other populations (Kim et al., 2007; Kim et al., 2009; Lober et al., 2006; Kim et al., 2018; Marshall, 2011). As highlighted by Mizrachi and Bates (2013), decision metrics such as consideration of time and task-urgency, can be applied in discarding or archival decisions. Our finding further suggests that college literacy training should cover the entire spectrum of information management activities and special attention should be given to discarding.

Secondly, among seven record types, insurance records were highly managed by both groups, while health education materials were the least managed. The insurance materials contain not only health documents, but also financial documents that increase the significance of the records. Young adults who are becoming independent from their parents during their college years seem to have opportunities to take care of formal documents, such as insurance records or immunisation certificate by themselves. This would be the beginning of an independent personal health information management practice. Our finding also implies that college education does not effectively deliver health education and that preventive or self-help education through personal information management has not been taught. In their qualitative study, Nguyen et al. (2016) highlighted that young adults expected the use of personal health record systems to play a role in '*maintaining good health, and exhibited an awareness and recognition of the role of lifestyle choices, such as diet and physical activity, in preventing diseases*' (p. 471). Furthermore, college health centres or educators should include a comprehensive plan for personal health information management education at several levels (Vader et al., 2011). To further clarify the utility of diverse health education materials, future studies might look at effective personal health information management by subgroups.

Measuring individuals' preferred health information is a popular variable in health information seeking studies (Basch et al., 2018; Vader et al., 2011). In our finding, the inactive group preferred to seek out help from the Internet and mass media, while the active group looked to professionals and fellow patients for assistance. This result was interesting in that the inactive personal health information managers sought out non-human sources for information, while the active performers considered human resources useful. As previous research has indicated, public health information sources, such as libraries or government agencies, were the least favoured (Vader et al., 2011). This distinction becomes an issue because college students are relatively healthy. As their healthcare service use is low, so is their personal health information management support. In other words, health education should cover how to evaluate anonymous or unofficial sources sought by college students.

We also found that parents were indicated as important health information sources by the inactive college students in our sample. Limitedly, our research supports previous findings that parents are important health information sources among college students (Vader et al., 2011). Relatively speaking, the inactive students are more likely seek out unstructured or unorganised sources, while the active students rely on information from medical sources. This finding further signifies parent and

child communication, which could potentially improve personal health information management inactivity among college students. As noted by Vader, 'colleges may have less control over the quality of information provided by parents' (Vader et al., 2011). However, parental information should not be overlooked because most students are still under their parents' insurance. In addition, parents are a unique source for a student's medical history unless information is accessible through hospital archives.

Next, our study newly introduced information workload in personal health context. We included four variables in our analysis and found a significant variable, frequency of clinic visits, for further analysis. As reported in early work on the information non-seeker (Ramanadhan and Viswanath, 2006), we anticipated that degree of illness plays a role in information management activities. However, this variable was not statistically significant in determining personal health information management inactivity. Further studies should validate our survey items used and suggest more reliable and valid variables to measure how much information is loaded per individual student.

Lastly and most importantly, we measured personal health information management perceptions that applied to personal health information management settings in college students. Five perceptions were measured and only the two key measures of awareness and assistance in personal health information management perceptions were distinguished in our prediction analysis. This finding suggests that the inactive group is less likely to be aware of the importance of personal health information management, while the active group showed significantly higher awareness. In addition, the inactive students were less likely to demand expert or technological support for their personal health information management activities. In designing personal health information management support, whether through offering training courses or technological application development, efforts should start with information management awareness education. Technological support in information management is still being researched in the general population, especially in an ageing population (Kim, 2015; Kim and Real, 2016). Motivational education for this relatively less health-conscious young population could be improved.

Other study predictors used in other research were found to be less critical in our analysis. For instance, difficulty was found to be a significant factor interfering with personal health information management activities adoption in a geriatric patient population, as well as in a population of patients who are veterans. However, the findings did not support the predictor for distinguishing inactivity pattern in our sample. As expected, the inactive group reported more difficulty in personal health information management activities than the active group, while the former sought less assistance in personal health information management. Indeed, the ownership and technology measurements showed mixed results, signifying that they are not critical predictors for the personal health information management inactivity pattern recognition among our study sample. As new cloud technology becomes popular in daily digital life, individuals store and access their digital files more actively in external spaces, rather than their local or personal storage devices. Although digital ownership is not clear at this time, the management of digital health records stored in cloud spaces is inevitable. Further study could be beneficial to understand the digital ownership with relevance to information security.

There are some limitations to this study. First, our survey method employed a convenience sampling within a single university. Therefore, the sample does not reflect the general population of college students. Secondly, because of the lack of previous research studies on the topic of personal health information management, our research combined and modified variables measuring diverse

information management activities from information seeking behaviour, health literacy, and personal information management literature. Further studies should validate the newly created survey questions in other college student settings. Lastly, we provided a case scenario, so our data does not represent real use-cases of college students. If the health context in different use-cases occurs, the findings of our study might be different.

Conclusion

Managing personal health information is a complex issue that has never been a major concern in current literacy research or college health education. Particularly, a full range of information management activities in a personal health context has not been a focus of information science research. Research measures identifying inactive managers of health information have rarely been tested. Based on health information seeking and literacy research, our study tested twelve information management activities to detect inactive performers and their distinct characteristics. A profile of inactive performers within our sample shows more male and ethnic minority students, as well as international students. This finding is inconsistent with other studies highlighting active use of the Internet by non-white students. Additionally, our study identified factors that can potentially predict those who may not actively perform personal health information management. Though statistically insignificant, our finding suggests that students are more likely to be inactive if they depend on parents (e.g., under parent insurance, living with parents, and receiving tuition support by parents). Further study should consider if parental dependency could impact students' information management activities.

Relatively speaking, college students are a healthy population who show less desire to seek help with health information seeking. They might not recognize a full range of information management activities, which differ from a simple search on the Internet. In most information seeking research, the focus has been on finding relevant information from personal clutter archives or the individuals' contexts of personal information regarding preservation and finding cues to retrieve the stored information. As a health communication tool, individual patient records have been conventionally archived and managed by hospital record management professionals for clinical or archival use. However, neither college health nor information professionals pay attention to learning and applying information management techniques for use in patient care or educational activities. Therefore, this study is important because our findings highlight a spectrum of information management skills that identify those college students inactively perform personal health document management. When designing a personal health literacy education or intervention, these findings will be further useful because one can target a specific skillset for improvement. With the collaboration of college health professionals, a proactive education program about personal health record management could be of great benefit to young students in developing optimal self-care management strategies.

About the authors

Dr. Sujin Kim is an Associate Professor in the Division of Biomedical Informatics in the University of Kentucky College of Medicine, UK Medical Center MN 150, Lexington KY, USA 40536-0298. Dr. Kim’s current research includes consumer health informatics, personal health information management, and health information seeking behaviour. She uses clinical natural language professing techniques and survey methodologies to better understand patients’ health knowledge and their health

information uses and behaviour. She can be contacted at sujinkim@uky.edu
Dr. Donghee Sinn is an Associate Professor in Information Science, College of Emergency Preparedness, Homeland Security, and Cybersecurity, University at Albany, Draper Hall Room 015, 135 Western Avenue, Albany, NY 12203. Her current research interests include personal digital archiving, information literacy and management for personal records, digital presence of archival materials for historical events, and archival documentation and appraisal in government context. Her contact address is dsinn@albany.edu
Dr. Sue Yeon Syn is an Associate Professor of Department of Library and Information Science at the Catholic University of America, 620 Michigan Ave., N.E., Washington, DC 20064. Her research interests focus on user information behaviour in the aspect of users' involvement in information creation and sharing on social web. She applies various methods to make the best use of user generated information for different purposes such as information organization, information seeking and sharing and information preservation. Her current research projects include investigating health information behaviour on social media, personal history archiving and management, and use of folksonomy in relation to the linked data. She can be contacted at syn@cua.edu

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Appendices

Appendix A - Table 1. Demographics, academics, resources, and information workload by group

Variable		Inactive group (772, 54.8%)	Active group (636, 45.2%)	F	Sig.	% Difference
Age	Mean (S.Dev.)	24.44 (6.62)	24.9 (7.66)	1.4	0.24	-1.04
		N (%)	**N (%)**			
Sex	Male	215 (60.70)	139 (39.30)	7.23	0.01*	21.40
	Female	501 (52.40)	455 (47.60)			4.80
Ethnicity	White	550 (53.80)	473 (46.20)	2.04	0.84	7.60
	Black	47 (56.60)	36 (43.40)			13.20
	Hispanic	31 (58.50)	22 (41.50)			17.00
	Asian	62 (58.50)	44 (41.50)			17.00
	Native	1 (33.30)	2 (66.70)			-33.40
	Other	25 (56.80)	19 (43.20)			13.60
International	Yes	51 (59.30)	35 (40.70)	0.87	0.35	18.60
Housing type	Residence hall	166 (52.70)	149 (47.30)	2.26	0.81	5.40
	Fraternity or sorority	15 (50.00)	15 (50.00)			0.00
	Other campus	22 (61.10)	14 (38.90)			22.20
	Off-campus	452 (54.90)	372 (45.10)			9.80
Relationship	Parent	42 (59.20)	29 (40.80)			18.40
	Other	19 (50.00)	19 (50.00)			0.00
	Single	381 (55.30)	308 (44.70)	13.28	0.04*	10.60
	Married	88 (46.80)	100 (53.20)			-6.40
	Committed	231 (57.30)	172 (42.70)			14.60
	Separated	6 (75.00)	2 (25.00)			50.00
	Divorced	5 (38.50)	8 (61.50)			-23.00
	Widowed	2 (100.00)	0 (0.00)			100.00
	Other	4 (30.8.00)	9 (69.20)			-38.40
Academic status	1y-undergraduate	114 (48.10)	123 (51.90)	8.11	0.42	-3.80
	2y-undergraduate	113 (57.40)	84 (42.60)			14.80
	3y-undergraduate	101 (53.40)	88 (46.60)			6.80
	4y-undergraduate	95 (54.90)	78 (45.10)			9.80

	>5y-undergraduate	31 (55.40)	25 (44.60)			10.80
	Master's	87 (56.50)	67 (43.50)			13.00
	Doctoral	157 (58.80)	110 (41.20)			17.60
	Certification	2 (40.00)	3 (60.00)			-20.00
	Other	17 (47.20)	19 (52.80)			-5.60
Grade point average	A	448 (56.00)	352 (44.00)	2.28	0.52	12.00
	B	218 (52.80)	195 (47.20)			5.60
	C	44 (50.60)	43 (49.40)			1.20
	D/F	6(66.70)	3 (33.30)			33.40
Tuition support	Parents	266 (51.10)	255 (48.90)	2.20		
	Student loans	267 (52.50)	242 (47.50)			5.00
	Self	230 (52.20)	211 (47.80)			4.40
	Your employer	47 (50.00)	47 (50.00)			0.00
	Scholarships	412 (60.30)	271 (39.70)			20.60
	Parent's insurance	428 (54.40)	359 (45.60)	14.24	0.05*	8.80
Health insurance	Employment	86 (48.60)	91 (51.40)			-2.80
	Student health	130 (63.10)	76 (36.90)			26.20
	Obamacare	11 (64.70)	6 (35.30)			29.40
	Catastrophic	2 (100.00)	0 (0.00)			100.00
	Medicaid	30 (44.10)	38 (55.90)			-11.80
	Not insured	12 (52.20)	11 (47.80)			4.40
	Other	12 (50.00)	12 (50.00)			0.00
		Mean (Std. Dev.)	**Mean (Std. Dev.)**	**F**	**Sig.**	**% Difference**
Information resources sought	Professional	7.70 (1.55)	7.33 (1.65)	1.62	0.00*	0.37
	Family	8.00 (1.40)	8.06 (1.47)	1.44	0.44	-0.06
	Friend	6.36 (1.35)	6.38 (1.43)	1.39	0.79	-0.02
	Fellow patients	5.64 (1.38)	5.37 (1.56)	1.49	0.00*	0.27
	Internet	6.23 (1.58)	6.54 (1.59)	1.59	0.00*	-0.31
	Social media	3.42 (1.33)	3.47 (1.31)	1.31	0.50	-0.05
	Mass media	2.71 (1.11)	2.89 (1.15)	1.13	0.01*	-0.18
	Government	2.61 (1.57)	2.78 (1.77)	1.69	0.08	-0.17
	Libraries	2.24 (1.66)	2.11 (1.58)	1.62	0.15	0.13
Information workload	N digital devices	3.21 (1.73)	3.15 (2.09)	1.93	0.53	0.06
	N smartphones	3.19 (2.71)	3.88 (15.97)	11.94	0.29	-0.69
	N Courses	26.47 (23.84)	27.6 (21.58)	22.64	0.39	-1.13
	N Clinic visits	4.76 (7.37)	3.94 (5.29)	6.33	0.02*	0.82

*denotes significant at $P < 0.05$.

Appendix B: Survey measurements and variables

I. Personal health information management perceptions

Measured with 5-Likert scale from Strongly Disagree to Strongly Agree.

Variables	Measurement	References
Awareness of PIM 1	I think it is important to keep my personal records for future use.	Sinn et al., 2011; Kaye et al., 2006; Sinn et al., 2014
Awareness of PIM 2	It is critical to collect my academic records for my future career.	
Awareness of PIM 3	It is essential to store my health records to better manage my health.	
Awareness of PIM 4	My digital files help me keep track of my personal history.	
Difficulty 1	It takes considerable time to look through my personal records to determine what to keep and what to delete.	Marshall, 2011; Bruce et al., 2004
Difficulty 2	I find it difficult to know how I should organize my personal records.	
Difficulty 3	I confident about how to back-up my personal records. (negative measure)	
Ownership 1	As long as I can access to my personal records, it does not matter where my personal records are stored.	Marshall and Shipman, 2011; Kaye et al., 2006
Ownership 2	I believe it is important that I have my personal records in my possession.	
Ownership 3	As long as I know where my personal records are stored, I do not need to have them in my possession.	
Assistance 1	If I have professional assistance, I think I will be able to manage my personal records better.	Sinn et al., 2017; Williams et al., 2008; Sinn et al., 2011
Assistance 2	I would like professional advice about managing personal records.	
Assistance 3	Training would be useful to manage my personal records better.	
Technology 1	I find it difficult to use technology to manage my personal records.	Sinn et al., 2017; Williamson, et al., 2008; Sinn et al., 2011).
Technology 2	I would like to have technology assistance to manage my personal records.	
Technology 3	Technology helps me better manage my personal records.	

II. Personal health information management activities and data types

This section includes a scenario for a personal health context. The survey statements are measured with 5-Likert scale from Strongly Disagree (1) to Strongly Agree (5).

Measure	Question	Data types
Creating	I already have a collection of _____.	• Immunization records • Family medical history • Emergency information (e.g., contact, allergies) • Surgical history • Medication information (e.g., prescriptions, over-the-counter medicines) • Insurance information (e.g., policy, card, coverage) • Health education materials (e.g., stress management, sexually transmitted diseases.)
Collecting	I have a habit of collecting _____ whenever providing for my health.	
Knowing	I know which of _____ are needed for my doctor's visit.	
Discarding	I discard _____ when they are no longer needed.	
Organizing	I have my own method to manage and organize _____.	
Categorizing	I categorize _____ on a regular basis.	
Arranging	I arrange _____ effectively so that I can find it easily for my doctor's appointment.	
Labeling	I label _____ in a meaningful way so I can find it easily for later use for my doctor's appointment.	
Owning	Usually, I try to personally own a copy of _____ in my possession.	
Finding	I can easily find _____ in an efficient manner.	
Sharing	I can easily share my _____ records, when needed.	
Using	I use _____ when I discuss my health matters with a health professional.	

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