A framework for investigating pet owners' health information behaviour intervention

Niloofar Solhjoo*, Nader Naghshineh⁂, Fatima Fahimnia* & Amir R. Ameri-naeini†

*Department of Information Sciences and Knowledge Studies, Faculty of Management, University of Tehran, Tehran, Iran,

⁂Information Studies Laboratory, Central Library and Documentation Center, University of Tehran, Tehran, Iran,

† Department of Small Animal Internal Medicine, Faculty of Veterinary Science, Islamic of Azad University Science and Research branch,Tehran, Iran

Abstract

Objective: This study is a part of a research aiming to determine whether an information prescription given by veterinarians in a general pet clinic would change the behaviours of pet owners about using pet health information resources on the internet. For this purpose, we develop a model to intervene and evaluate pet owner's online health information seeking behaviour (HISB). **Methods**: The framework emerges from a systematic literature review and qualitative content analysis. NVivo 10 was used in this paper as an analysis tool for coding text and for supporting framework generation through identifying patterns. **Results**: We indicate the most influencing factors on online HISB of pet owners, including human-pet relationship, veterinary-client interactions, and pet owner's health literacy. **Discussion**: We strengthen our findings further by learning from health behaviour models which lead to a better pet health promotion. Based on adaption of the Interaction model of client health behaviour (IMCHB), we developed our initial model. **Conclusion**: this model serves as an initial step to engage information scientists and veterinarians for planning on pet health information outreach. However, future research needs to test the proposed model in various case studies and populations.

Keywords: Health Information seeking behaviour, Information prescribing, Internet, Pet owners, Models

Key messages

- In working with pet health information issues veterinary librarians should draw on models which can identify and quantify specific aspects of human-animal bond, veterinarian-client relationship, and pet owner's health literacy.
- The findings suggest that pet health outcomes of information interventions should be measured by assessing pet owners from health information evaluation skills, self-efficacy for health information seeking, number of times client discussed online health information with vet, and their pet health status.
- Program's success in pet health information efforts requires not only multidisciplinary model, but also attention to partnerships of libraries with animal health organizations and veterinary centers.
- Good studies are needed that provide evidence of the efficacy of the proposed model in engaging information scientists and veterinarians for planning and evaluation pet health information outreach.

Background

Paying attention to the wellbeing of companion animals has increasingly been growing in Iran in the past decade. Unfortunately, accurate statistics on the population of pets and their owners, their geographical distribution, their common diseases and the cost of annual treatment and healthcare of pets are not available in Iran. According to the news based on sales of veterinary vaccination, the number of domestic animals and pets in the country is increasing. Nutrition, conservation, health and treatment are objectives that their owners are looking for. Sixty animal hospitals are launched in Iran (15 hospitals in Tehran) that provide the most important services to animals (Hashemzadeh, 2017). Only in Tehran we have 250 veterinary clinics for small animals (Iran Veterinary Organization, 2017). These reports reveal the increasing importance of pets for Tehran citizens.

Today, Internet has become a primary source of health information that potentially provides many benefits both for human and animal. In 2016, according to a national survey, 64 percent of the families in Tehran had Internet access at their locations (Statistical Center of Iran, 2016). General population of Tehran, among the most common sources of health information, refer to the Internet as one of the main resources and the use of it is growing (Alishahi-Tabriz & et al., 2013). Moreover, according to the Center for Information Technology and Digital Media Ministry of Iran, 53 percent of people are members of at least one social network (Mousavian, 2016) and more than half the population is using social networks for health issues (Mahdavi & et al., 2016). Although studies have suggested that most health care consumers perceive health care professionals as the main source of health information, the rapid expansion of the Internet and increase in internet access via computers or mobile phones has resulted in a growing number of people that seek health information both for humans and companion animals from sources beyond the health care professional (Kogan & et al., 2010; Cotton & Gupta, 2004).

Just as medical science, veterinary science is constantly adapted to new technologies. Some veterinarians professionally are using tools of Web 2.0 to seek and share health information about

animals, interact with pet owners, contact with other partners, and promote research and marketing (Chretien & Kind, 2013). Moreover, people use the internet, especially social media to find health information about their pets, express their experiences and describe the events related to their pets' disease process and as well as raising awareness about animal rights (Golbeck, 2011; White, 2015). So that since 2007 Facebook added two pet-oriented social networks, called *Catbook* and *Dogbook*, for pet owners to create profile pages for their animals. Also in Iran websites such as Dampezeshkan.com, online communities like *Iranspca*[1], forums such as *Persianpet*[2] and social networking sites like *Vetrade*[3] have been launched in Farsi to search and share information about pet's health. In connection with online health information seeking behaviour (HISB), many researches have been reported in Iran and all around the world, but little have been done on HISB of pet owners, especially on the internet (Kogan & et al., 2010; Kogan & et al., 2012; Chen, Hung & Peng, 2012; Hofmeister & et al., 2008). As far as we know, no similar studies have been carried out in Iran.

Objectives

There is a lack of comprehensive frameworks, theories and model to intervene and evaluate online HISB of pet owners. According to a review of theoretically grounded studies of health information seeking on the web, we need studies that are anchored in a conceptual framework, possibly derived from theories that have been successful in accounting for health, information, or communication behaviours (Marton & Wei Choo, 2012). This study is a part of a research aiming to determine whether an Information prescription given by veterinarians in a general pet clinic would change the attitudes and behaviours of pet owners about using Internet pet health information resources. For this purpose, we needed to search in theories to build our conceptual framework as there was no such framework. Therefore, the aim of this paper is to develop a framework for intervening in pet owners' HISB. The framework emerges from a qualitative content analysis based literature review.

Methods

Qualitative content analysis attempt to allow for "the subjective interpretation of the content of text data" while maintaining "the systematic classification process of coding and identifying themes or patterns" (Hsieh & Shannon, 2005). Therefore, application of a qualitative data analysis tool in a literature review process can increase representation: "the ability to extract adequate meaning from the underlying data" (Leech & Onwuegbuzie, 2007). *NVivo 10* was used in this paper as an analysis tool for coding text and for supporting framework generation through identifying patterns. Moreover, a personal reference database programs (*EndNote X7.0.1*) were used, and we used *Adobe Acrobat XI Pro* to read, search and index the papers we extracted.

[1] www.iranspca.com
[2] www.persianpet.org/forum
[3] www.vetrade.ir

Systematic identification and extraction of articles

Our articles selection has two main criteria: (1) the sources and (2) the search strategy. PHISB intervention is a multidisciplinary subject, hence, we must borrow from many areas. Thus, the study context and the goal of the literature helped us to identify which domains should be included in the searching process.

Electronic databases available through the libraries at the researchers' institution were used to perform the search queries. We selected the following six subjects that were closely related to our topic; they were as follows: Veterinary Medicine, Health Science, One Health, Library and Information Science, Communication Studies, and Human Animal Studies. To identify the relevant literature, we performed three rounds of selection: (1) keyword search, (2) screening the titles and abstracts, and (3) screening full texts.

Furthermore, the search strategy included all possible combinations of keywords under 4 broad themes: (1) veterinary services OR veterinary medicine OR veterinary practice, (2) pet healthcare OR companion animal healthcare, (3) wellness information OR health information OR information prescription, (4) online OR Internet OR Web. We also conducted backward and forward searching with Google scholar, Web of Science and Scopus. These Processes resulted in 95 publications.

The titles and abstracts of the 95 publications were reviewed and screened based on the following inclusion criteria: (1) studies focusing on health information; (2) studies addressing health services through Internet for health related purposes; (3) studies targeting pet owners or the veterinary clinics; (4) studies with the full text written in English or Persian; and (5) original research studies. A total of 38 studies that did not meet all these five criteria were excluded. This process produced a final of 57 publications.

The themes addressed in the 57 publications fell into six categories: Pet owner's health behaviour, pet owner's HISB, evaluation of health literacy, interventions to improve health literacy, development of human- companion animal relationship and client- veterinarian communication.

Coding and analysis of the content

After data collection we moved to data analysis by reading and rereading our data sources, and by writing down our interpretations. A brief overview of our analysis method is presented in Fig 1. We illustrate systematic four phased process of our literature review method, and include input, processing, output and related tools for each phase.

Throughout the analytical process we used a combination of inductive and deductive coding approach. We started with a detailed analysis of sources to generate concepts and ideas as themes emerge. Then for deductive coding we continued with those specific set of themes and theoretical ideas in mind specially from health behaviour and information behaviour theories and explored whether and how these are mentioned in the sources.

Creating a primary coding Scheme and testing it with two or more coders are suggested for qualitative content analysis (Bandara, Miskon & Fielt, 2011; Beekhuyzen, 2007) hence, all authors engaged in reading and discussions of five randomly selected articles to develop a coding scheme. In doing so, the authors suggested and refined codes that pertained to (1) develop pet owners'

HISB and (2) its evaluation. Some coding categories were stemmed from the Interaction Model of Client Health Behaviour (IMCHB) (e.g., client singularity and health outcome). Once the preliminary scheme was developed, authors tested its feasibility by applying it to three articles which resulted in a slight correction of the coding scheme. We coded at least in two levels to make sure that things do not be omitted or miscoded. First, we captured all content that related to each main theme of the coding scheme within the assigned node. In the second level of analysis we derived deeper meaning and furthered coding to the content already captured in the main nodes. At Last, authors applied the final coding scheme to ten articles in order to check the coding for consistency (reliability). Fig 2 presents the parent and child nodes in *NVivo 10* based on our coding scheme.

We used NVivo's query function to help find patterns and to check our initial ideas. The function allowed us to save searches and to re-run them as required on different data, and to export the results. We ran text search queries for specific words or combinations of words on all or selected sets of selected sources such as pet and health information, as well as word frequency queries to generate lists of the most frequent words in articles.

Finally, we used NVivo model tools to visualize patterns and relations between nodes and sources and made an overview of what is involved in interventionist approach that changes online HISB of pet owners.

Results

From early 1990s researchers started to discuss relevant advances of technology and how they can best be utilized to provide new and better access to the literature relating to animal health (Wiley & Powell, 1992). Although the veterinarian continues to be the primary source of health information for pet owners, research on those seeking information relating to pet health indicates consumers seek health care information from a variety of online sources, including the Web, email discussion lists or social media (Westermann-Cicio, 2002; Murphy, 2006; Mayer, 2008; Fleishman-Hillard, 2008; Kogan & et al., 2010; Volk & et al., 2011; Chen, Hung & Peng, 2012; Choi, 2015).

Since, pet owners are active participants in their pet's medical treatment, they need credible information to make informed decisions, but they often lack quantifiable awareness of their pets' health. Therefore, veterinary practices should provide clients with education materials. Veterinarians are in a position to educate their clients as well as correct erroneous information they may receive from other online sources (Trevejo, 2009; Kogan & et al., 2014a). Murphy (2006) examined veterinary consumer health information (both print and online) by evaluating the literature for authority, comprehensiveness of coverage, significance, validity, and ease of use, and concluded a limited quantity of quality, in-depth resources that address specific diseases and disorders written at an appropriate reading level for consumers is available in English. So, we need a relation between veterinarians and librarians to provide services and materials that could identify credible and reliable online sources for pet health information to improve pet owner's online HISB (Pelzer & Wiese, 2005; Kogan & et al., 2010; Dinkelman, Viera & Bickett-Weddle, 2011). On the

other hand, by knowing the HISB of pet owners, one can identify the triggers leading and encouraging them to seek related and reliable information. Drawing on this qualitative content analysis, we built a model (Fig 4) to assess veterinarians-prescribed information prescription in improving pet owners' online HISB and pet health outcomes.

PET HEALTH INFORMATION SEEKING BEHAVIOUR

HISB is defined as the ways in which individuals go about obtaining information, including information about their health, health promotion activities, risks to one's health, and illness (Lambert & Loiselle, 2007). In addition, it is more likely that people will seek health information not only for themselves but also for family members when there is a supportive social context (Yang, Chen & Wendorf Muhamad, 2017; Choi, 2015). Given the fact that humans appear to share a very close relationship with their pets, most pet owners think of their pets as family members (Serpell , 1996; Ross & Baron-Sorensen, 1998; Dwyer, Bennett & Coleman, 2006), and consider their pets' wellbeing as other family members or themselves (Kogan & et al. 2010; Choi, 2015). So, we can define pet health information seeking behaviour (PHISB) as active efforts of a caregiver to obtain specific information in response to their pet health issue. Different groups have different goals for their search for health information. If information seeking is done by pet owners and in order to improve their pet's health, it'll be used as a factor in the decision making process for making health related decisions and can be considered a health decision making process (Lambert & Loiselle, 2007). In the following lines we are going to discuss concepts related to PHISB (Fig 4).

Human-pet relationship

The term "human-animal bond" was coined in 1977 which was almost immediately changed to the more specific "human-companion animal bond," but both terms persist in the literature (Anderson,2004; Hosey & Melfi, 2014). The American Veterinary Medical Association defines the human-animal bond as a mutually beneficial and dynamic relationship between people and animals that is influenced by behaviours that are essential to the health and well-being of both. This includes, emotional, psychological, and physical interactions of people, pets, and the environment. The scope of human-pet studies includes academic areas, such as biology, psychology, sociology, anthropology, economics and medicine. In the literature the greatest emphasis has been on Animal-assisted Intervention, and the benefits of pets for people and their interaction with them (Hosey & Melfi, 2014).

The benefits that pets yield to humans are unquestionable. The bond between humans and their pet may be as deep as the bonds individuals form with friends, siblings, and even spouses. They can be our best friends, our children, physical extensions of ourselves (for disabled people), and someone to share our lives with (Ross & Baron-Sorensen, 1998). While a pet is a highly esteemed member of the family, consumption of health care services for a pet is significantly different from a regular family member. The quality of the pet–owner relationship may influence the practice of health care. For example, owners who have strong bonds with their pets seek higher levels of veterinary care, compared with owners who exhibit weaker bonds (Lue, Pantenburg & Crawford,

2008; Brockman, Taylor & Brockman, 2008). A strong bond is defined by specific behaviours of owners related to their feelings about their pets, including a number of costs and benefits associated with human–pet relationships: 1. engage in shared activities, 2. the perceived emotional closeness of the relationship, and 3. the perceived costs of the relationship for the pet owners (Dwyer, Bennett & Coleman, 2006; Podberscek & Gosling, 2005; Howell & et al., 2017). Rohlf et al. (2012) suggests that there may be a strong relationship between frequency of pet–owner interactions and a variety of responsible pet ownership behaviours. Hence, owners who engage with their pets in a variety of shared activities are more likely to engage in health-promoting behaviours such as HISB.

Among the research that studied pet owners based on their behaviours, human pet relationships were considered by researchers as a crucial factor (Hosey & Melfi, 2014; Chen, Hung & Peng, 2012). They described health perceptions and levels of companion animal attachment in pet owners (Lue, Pantenburg & Crawford, 2008; Rohlf & et al., 2012; Stephens & et al., 2012). Recently, there has been a surge of scientific interest in the types of relationships formed between humans and pets. This has resulted in a substantial increase in our understanding of the nature of human-pet relationships and, importantly, the social and psychological consequences of such relationships for both animals and humans (Dwyer, Bennett & Coleman, 2006). Chen, Hung & Peng (2012) had segmented three dimensions of pet ownership: attachment, interaction and the role of the pet as a human substitute. Also, they suggested that a pet owners' information search behaviour will be affected by their relationships with pets. Consumers who are more attached with their pets are more likely to use communication channels that are categorized as informational or need to be actively searched, such as the Internet. Therefore, the human – pet relationship affects the owner's information search behaviour.

There is a need to explore how pet owner's HISB are influenced by their relationships with their pets. Investigation of the HISB can specify the importance of owner-pet bond and its effect on the pet health and helps in creating minor and major strategies for promoting health and wellness. Also, there may be significant differences in the way dog and cat owners behave in seeking online health information. Thus, pet owner's choice of pet species is a factor that should be considered.

Veterinarian-client relationship

The effect of doctor-patient communication on HISB of patients has been characterized in many researches (Murray & et al. 2003; Iverson, Howard & Penney, 2008; Zare-Farashbandi & et al., 2017). It is recommended physician provides information to the patient that requires identifying the information needs of patients and considering their HISB (Zare-Farashbandi & et al., 2017). On the other hand, in reviewing veterinary-client communication, the following topics are addressed: analysis of veterinary-client communication (Shaw & et al. 2004; Shaw & et al. 2006; McArthur & Fitzgerald, 2013); and the influence of communicative behaviours on pet health outcomes (Lue, Pantenburg & Crawford, 2008; Coe, Adams & Bonnett, 2008; Kanji & et al., 2012). While Mayer (2008) recommends that there are differences in the doctor-patient and veterinarian-pet owner relationships, they are similar enough that studies from human medicine can be used to understand the information-seeking behaviour of veterinary clients.

Communication with the veterinarian plays a significant role in the strengthening of the bond between the veterinarian and pet owner. The strength of this bond, has a direct impact on the loyalty of a pet owner to a veterinarian and the care pets receive. This bond is defined as a tangible relationship between a pet owner and veterinarian. Through this relation, the pet owner can improve his or her PHISB and be a better online consumer. Clients who feel they receive enough pet-care information are more likely to have a strong bond with their veterinarian (Coe, Adams & Bonnett, 2008; Lue, Pantenburg & Crawford, 2008). However, the time of sharing information is also significantly important which consumers are sometimes not ready to receive the information offered by a health professional (Murphy, 2006).

Although veterinarians may provide written educational materials to their clients, consumers seek health information from a variety of online sources. Internet use for pet health information is not intended to undermine the veterinarian-client relationship. On the contrary, online health information seeking can change the role of the client to a more active one. In other words, the ability to bring information found on the internet to their veterinary can increase clients' confidence in their ability to manage their pet illness and make them more willing to ask questions. It can also lead to greater sense of responsibility and self-efficacy (Kogan & et al., 2010; Lo & Parham, 2010). Veterinarians should be prepared to discuss online information clients give in their appointments, creating an opportunity to educate clients (Hofmeister & et al., 2008; Trevejo, 2009, Kogan & et al., 2010). Therefore, we can assume veterinarians-client communication has an important role in online HISB of pet owners.

Health literacy of pet owners

Studies that have investigated websites related to specific veterinary topics have raised concerns about the accuracy, trustworthiness and usability of available information (Murphy, 2006; Hofmeister & et al, 2008; Mayer, 2008). Moreover, they have pointed out signs of low health literacy among pet owners (Mayer, 2008; Shaw & Hunter, 2017). It has been suggested to include information about the provision of consumer pet health information to clients in veterinary medical education (Dinkelman, Viera & Bickett-Weddle, 2011). In a research veterinarians expressed concern over their clients' ability to understand the pet health information they find online, and when clients were asked how they check the accuracy of these information, most reported they discuss with their veterinarian (Kogan & et al., 2010). In order for pet owners to effectively participate in shared decision making and pet health management, they need to be able to obtain, understand, communicate about and apply pet health information. Additionally, the ability to seek and access the health information is needed. These skills are collectively defined as health literacy (Berkman, Davis & McCormack, 2010). It is very important for veterinarians to understand clients' health literacy before delivering interventions or education.

Investigating the role of health literacy within human health care participation, including the information seeking process is increased. Prior studies have shown positive associations between individuals' health literacy and self-efficacy for health behaviours and between individuals' health literacy and online health information seeking (Ghaddar & et al., 2012). The health literacy studies

also include outcome measures such as health information evaluation skills, use of the Internet, and information seeking support (Barry, D'Eath & Sixsmith, 2013).

Similarly, pet owners have an active role and want to participate in their pet's health care decisions. And all of these targets can be reached by having high level of health literacy (Aydın, Kaya & Turan, 2015). Shaw & Hunter (2017) proposed a health literacy model of veterinary clients. It showed the components of an effective communication strategy that promotes the formation of a positive partnership between veterinary team members and clients. The end result is improved health for the pet (i.e., pet health) and enhanced client satisfaction and compliance, team satisfaction, and practice performance. In this respect, health literacy is one of the important factors that affect online HISB of pet owners.

INFORMATION PRESCRIPTION IN VETERINARY APPOINTMENTS

Investigating the PHISB and identifying pet owner's information seeking patterns can provide us with useful strategies for effective transfer of information to the clients. Veterinarians should focus on the importance of providing health information for pet owners because they obviously use the internet to gather details to learn more about the care of their pets.

The Information Prescription or Info Rx project has been of interest to health care professionals and librarians for almost a decade (Timm & Jones, 2011). Information Prescriptions are designed to guide pet owners to trusted sources of pet health information on the Internet, promote their health literacy, support the veterinarian-client relationship and client education (Burke & et al., 2010), and allow them to be better able to manage their pet condition and maintain their independence (Brewster & Sen, 2011). Factors such as Internet availability, frequency of Internet use to find health information, and client preference for information received from health providers increase the likelihood that clients would follow an information prescription with a recommended website both in human (Burke & et al., 2010), and veterinary medicine (Kogan et al., 2014a; Kogan et al., 2014b).

The practice of guiding clients to Internet sites is still relatively rare in veterinary medicine. Kogan et al. (2010) reported that nearly half (47.0%) of veterinarians either rarely or never suggest specific websites. However, in their later researches they clearly illustrate the positive reactions reported by pet owners when given an information prescription and they would like to receive guidance in their online searches for pet health information websites (Kogan et al., 2014a; Kogan et al., 2014b). Two types of information prescriptions can be recommended for veterinary practices indirect (generic) info RX and direct (topic-specific) Info RX. The impact of the first one, indirect prescription, had been examined on animal health, client relations and clinic success in previous researches, but there is no literature about information prescriptions based on specific veterinary topics. As a result, we should focus on the importance of putting information at the center of pet healthcare and pet owners need the power to act themselves so that pet health information can be used in health related decision making.

PET HEALTH OUTCOMES

HISB sometimes acts as a predecessor for other health related behaviour such as the use of health services (Lalazaryan & Zare-Farashbandi, 2014). Measuring the impact of health information on

health behaviours and outcomes is desirable but challenging. According to Lambert and Loiselle (2007), outputs of health information seeking are: 1. cognitive outputs such as informed decision-making; 2. behavioural outputs such as discussing the gathered information with health experts; 3. health outputs such as increased the commitment to treatment and changes to health behaviour; 4. physical outputs, and 5. effective results. Moreover, interventions for enhancing consumers' online health information affects many health outcomes including self-efficacy for health information seeking, health information evaluation skills, number of times patient discussed online health information with a health provider and consumer health status (Car & et al., 2011; Aydın, Kaya & Turan, 2015).

Similar to human health information interventions, we can measure pet health outcomes by assessing pet owners from different options obtained from earlier studies. We adapted the following health outcomes through our study in veterinary clinic: self-efficacy for pet health information seeking, pet health information evaluation skill, number of times client discussed online health information with vet, and pet health status.

Discussion

Information interventions that influence health behaviour both for humans and their pets are a mainstay of public health practice and an area of potential interest and investigation for library and information science researchers. Online PHISB interventions generally aim to make pet owners aware of reliable pet health information and equip them with information seeking skills. It is reasonable to expect that greater awareness and skills will lead to more instances of online pet health information seeking, thus contributing to health knowledge.

Researchers have begun to investigate the relationships between information practices and health behaviours using and expanding models that contain clearly articulated information constructs. It is recommended to information scientists to draw on multidisciplinary frameworks when working with and beyond health information issues that can capture the complexity of online HISB, especially health behaviour models (Marton & Wei Choo, 2012; Greyson & Johnson, 2016). Therefore, for our interventionist approach that affects issues ranging from online PHISB to pet health outcomes we explored health behaviour models to identify and adapt a theory that is most applicable to these research findings for the group of pet owners in the context of veterinary medicine.

The IMCHB is the model that we chose to guide our initial model, since the model has the ability to encompass all of the concepts of interest for this study. The IMCHB model was created in order to describe the relationship between client needs and nursing interventions. While the model is used most in nursing settings, it can be applied in any type of healthcare atmosphere (Mathews, Secrest & Muirhead, 2008). The object of the model is to identify explanatory relationships between the three major conceptual elements: client singularity, client-provider relationship, and health outcome (Cox & Roghmann, 1984) see Fig 5.

The IMCHB was selected as a health behaviour model to adapt in our study for several reasons. The object of the model aligns with the purpose of the study, which is to investigate the association

of individual characteristics of pet owners such as PHISB, health literacy and pet-owner relationship to the veterinarian information prescription to reliable online pet health sources. The individual client characteristics, the client education process, which is an interface between pet owner and veterinarian, as well as the health outcome of information prescription, are all captured within the IMCHB. The model is also applicable in any health care setting and to any health care provider (Cox & Roghmann, 1984). Fig 6 illustrates the adaptation of the IMCHB to our initial model.

The following is a description of the conceptualization of three major elements of the IMCHB for investigating pet owner's online HISB interventions: Client singularity is the unique configuration of an individual, encompassing both intrapersonal elements (in this study: pet owner's age, sex, education, socioeconomic status and health literacy) and contextual elements (in this study: previous pet healthcare experiences, human-pet relationship, and PHISB). Client-professional interaction/intervention is described as both the content and process of a therapeutic interface between the patient and the health care provider (Cox, 2003). Client-professional interaction can be captured in the veterinary medical centers through the measurement of provision of pet health information (study of veterinarians- client interactions, and type of information prescription including generic or topic-specific). Health outcome is defined as the behaviour or behaviour related consequences that result from the patient-provider interaction (Cox, 2003). We included possible pet health outcomes which was identified through our literature review and content analysis in the previous section: measuring satisfaction with information prescription, pet owner's health information evaluation skills, pet health status, self-efficacy for pet health information seeking, and number of times client discussed online health information with veterinarian. By the adaption of IMCHB we can describe pet owner's HISB through the uniqueness of the client, interaction between pet owner and veterinarian, and the healthcare outcomes because of information intervention.

Conclusion

Due to a growing number of person who go online to find health information about their pets and a large preference among pet health providers to share information about animals and interact with their clients on the internet, and lack of research on improving PHISB with considering their characteristics, the need of creating comprehensive framework and model to intervene and evaluate pet owner's online HISB is necessary. By doing a combination of inductive and deductive coding with *NVivo* software through a multidisciplinary literature review we indicate the most influencing factors on online HISB of pet owners, including human-pet relationship, veterinary-client interactions, and pet owner's health literacy. Also, our initial model provides useful framework for evaluating outcomes of transferring information to the pet owners using information prescription. We attempt to strengthen our findings further by learning from health behaviour models which lead to a better pet health promotion. Therefore, based on adaption of the IMCHB, we developed our initial model by conceptualizing major elements of the IMCHB for investigating pet owner's online HISB interventions. We hope that our model serves as an initial

step to engage information scientists and veterinarians for planning on pet health information outreach. However, future research needs to test the proposed model in various case studies and populations for validation.

Abbreviations

HISB Health Information Seeking Behaviour

PHISB Pet Health Information Seeking Behaviour

IMCHB Interaction Model of Client Health Behaviour

References

Alishahi-Tabriz, A., Sohrabi, M. R., Kiapour, N., & Faramarzi, N. (2013). Addressing the changing sources of health information in Iran. *International journal of preventive medicine*, 4(1), 33.

Anderson DC. (2004). The human-companion animal bond. *The Reference Librarian*;41(86):7-23. doi: 10.1300/J120v41n86_02

Aydın GÖ, Kaya N, Turan N. (2015). The role of health literacy in access to online health information. *Procedia-Social and Behavioural Sciences*; 195:1683-7. doi: 10.1016/j.sbspro.2015.06.252

Bandara, W., Miskon, S., & Fielt, E. (2011). A systematic, tool-supported method for conducting literature reviews in information systems. In *Proceedings of the19th European Conference on Information Systems (ECIS 2011)*.

Barry, M. M., D'Eath, M., & Sixsmith, J. (2013). Interventions for improving population health literacy: insights from a rapid review of the evidence. *Journal of health communication*, *18*(12), 1507-1522. doi.org/10.1080/10810730.2013.840699

Beekhuyzen, J. (2007, November). Putting the pieces of the puzzle together: Using Nvivo for a literature review. In *Proceedings for the 4th QUALIT Conference Qualitative Research in IT & IT in Qualitative Research. Wellington, New Zealand, Victoria University of Wellington* (pp. 19-20).

Berkman ND, Davis TC, McCormack L (2010). Health literacy: what is it? *Journal of Health Communication*; 15(S2):9-19.

Brewster, L., & Sen, B. (2011). 'Quality signposting': the role of online information prescription in providing patient information. *Health Information & Libraries Journal*, *28*(1), 59-67. doi: 10.1111/j.1471-1842.2010.00912.x

Brockman, B. K., Taylor, V. A., & Brockman, C. M. (2008). The price of unconditional love: consumer decision making for high-dollar veterinary care. *Journal of Business Research*, 61(5), 397-405. doi: 10.1016/j.jbusres.2006.09.033

Burke, M., Carey, P., Haines, L., Lampson, A. P., & Pond, F. (2010). Implementing the information prescription protocol in a family medicine practice: a case study. *Journal of the Medical Library Association: JMLA*, *98*(3), 228. doi: 10.3163/1536-5050.98.3.011

Car, J., Lang, B., Colledge, A., Ung, C., & Majeed, A. (2011). Interventions for enhancing consumers' online health literacy. *The Cochrane Library*, 15;(6):CD007092. doi: 10.1002/14651858.CD007092.pub2

Chen, A., Hung, K. P., & Peng, N. (2012). A cluster analysis examination of pet owners' consumption values and behaviour–segmenting owners strategically. *Journal of Targeting, Measurement and Analysis for Marketing*, *20*(2), 117-132.. doi: https://doi.org/10.1057/jt.2012.10

Choi, W. (2015). *New Framework of Web Credibility Assessment and an Exploratory Study of Older Adults' Information Behaviour on the Web* (Doctoral dissertation, Florida State University).

Chretien KC, Kind T. (2013). Social media and clinical care. *Circulation*, 127(13):1413-21. doi.org/10.1161/CIRCULATIONAHA.112.128017

Coe JB, Adams CL, Bonnett BN. Coe, J. B., Adams, C. L., & Bonnett, B. N. (2008). A focus group study of veterinarians' and pet owners' perceptions of veterinarian-client communication in companion animal practice. *Journal of the American Veterinary Medical Association*, *233*(7), 1072-1080. doi.org/10.2460/javma.233.7.1072

Cotten, S. R., & Gupta, S. S. (2004). Characteristics of online and offline health information seekers and factors that discriminate between them. *Social science & medicine*, 59(9), 1795-1806. doi.org/10.1016/j.socscimed.2004.02.020

Cox, C. L. (2003). Online exclusive: a model of health behaviour to guide studies of childhood cancer survivors. In *Oncology nursing forum* (Vol. 30, No. 5, pp. E92-9).

Cox, C. L., & Roghmann, K. J. (1984). Empirical test of the interaction model of client health behaviour. *Research in nursing & health*, *7*(4), 275-285. doi: 10.1002/nur.4770070406

Dinkelman, A. L., Viera, A. R., & Bickett-Weddle, D. A. (2011). The role of veterinary medical librarians in teaching information literacy. *Journal of veterinary medical education*, *38*(2), 141-149. doi: 10.3138/jvme.38.2.141

Dwyer F, Bennett PC, Coleman GJ. (2006). Development of the Monash dog owner relationship scale (MDORS). *Anthrozoös*; 19(3):243-56.

Fleishman-Hillard. (18 Feb 2008). *Veterinary Clinics Embrace Digital Technology, but Give Mixed Reviews to Online Marketing, Consumer-Focused Sites*. Retrieved from http://fleishmanhillard.com/2008/02/news-and-opinions/veterinary-clinics-embrace-digital-technology-but-give-mixed-reviews-to-online-marketing-consumer-focused-sites/

Ghaddar, S. F., Valerio, M. A., Garcia, C. M., & Hansen, L. (2012). Adolescent health literacy: the importance of credible sources for online health information. *Journal of school health*, *82*(1), 28-36. doi: 10.1111/j.1746-1561.2011.00664.x

Golbeck, J. (2011). The more I people I meet, the more I like my dog: a study of pet-oriented social networks on the web. *First Monday*, 16 (2). doi: http://dx.doi.org/10.5210/fm.v16i2.2859

Greyson, D. L., & Johnson, J. L. (2016). The role of information in health behaviour: A scoping study and discussion of major public health models. *Journal of the Association for Information Science and Technology*, 67(12), 2831-2841. doi: 10.1002/asi.23392

Hashemzadeh, M. (February 7, 2017). ME largest veterinary hospital opens in Tehran. In Persian. *Farsnews Agency*. Retrieved from http://www.farsnews.com/printable.php?nn=13951119000116

Hofmeister, E. H., Watson, V., Snyder, L. B., & Love, E. J. (2008). Validity and client use of information from the World Wide Web regarding veterinary anesthesia in dogs. *Journal of*

the American Veterinary Medical Association, *233*(12), 1860-1864. doi.org/10.2460/javma.233.12.1860

Hosey G, Melfi V. (2014). Human-animal interactions, relationships and bonds: a review and analysis of the literature. *International Journal of Comparative Psychology*; 27(1).

Howell, T. J., Bowen, J., Fatjó, J., Calvo, P., Holloway, A., & Bennett, P. C. (2017). Development of the cat-owner relationship scale (CORS). *Behavioural Processes*; 141(Pt 3):305-315. doi.org/10.1016/j.beproc.2017.02.024

Hsieh, H. F., & Shannon, S. E. (2005). Three approaches to qualitative content analysis. *Qualitative health research*, *15*(9), 1277-1288. doi: 10.1177/1049732305276687

Iran Veterinary Organization (2017). *List of Veterinary Medicine Centers in Tehran Province*. In Persian. Retrieved from http://tehran.ivo.ir/portal/File/ShowFile.aspx?ID=0e72a59a-3ae5-4c75-a219-affb135c2721

Iverson, S. A., Howard, K. B., & Penney, B. K. (2008). Impact of internet use on health-related behaviours and the patient-physician relationship: a survey-based study and review. *Journal of the American Osteopathic Association*, *108*(12), 699.

Kanji, N., Coe, J. B., Adams, C. L., & Shaw, J. R. (2012). Effect of veterinarian-client-patient interactions on client adherence to dentistry and surgery recommendations in companion-animal practice. *Journal of the American Veterinary Medical Association*, *240*(4), 427-436. doi.org/10.2460/javma.240.4.427

Kogan, L. R., Schoenfeld-Tacher, R., Simon, A. A., & Viera, A. R. (2010). The Internet and pet health information: perceptions and behaviours of pet owners and veterinarians. *Internet J. Vet. Med*, 8(1).

Kogan, L. R., Schoenfeld-Tacher, R., & Viera, A. R. (2012). The Internet and health information: differences in pet owners based on age, gender, and education. *Journal of the Medical Library Association: JMLA*, 100(3), 197. doi: 10.3163/1536-5050.100.3.010

Kogan, L. R., Schoenfeld-Tacher, R., Gould, L., Viera, A. R., & Hellyer, P. W. (2014a). Providing an information prescription in veterinary medical clinics: a pilot study. *Journal of the Medical Library Association: JMLA*, 102(1), 41. doi: 10.3163/1536-5050.102.1.008

Kogan, L. R., Schoenfeld-Tacher, R., Gould, L., Hellyer, P. W., & Dowers, K. (2014b). Information prescriptions: A tool for veterinary practices. *Open veterinary journal*, *4*(2), 90-95.

Lalazaryan, A., & Zare-Farashbandi, F. (2014). A review of models and theories of health information seeking behaviour. *International Journal of Health System and Disaster Management*, *2*(4), 193. doi: 10.4103/2347-9019.144371

Lambert, S. D., & Loiselle, C. G. (2007). Health information—seeking behaviour. *Qualitative health research*, *17*(8), 1006-1019.

Leech, N. L., & Onwuegbuzie, A. J. (2007). An array of qualitative data analysis tools: A call for data analysis triangulation. *School psychology quarterly*, *22*(4), 557. doi: 10.1037/1045-3830.22.4.557

Lo, B., & Parham, L. (2010). The impact of web 2.0 on the doctor-patient relationship. *The Journal of Law, Medicine & Ethics*, *38*(1), 17-26.

Lue, T. W., Pantenburg, D. P., & Crawford, P. M. (2008). Impact of the owner-pet and client-veterinarian bond on the care that pets receive. *Journal of the American Veterinary Medical Association*, *232*(4), 531-540. doi.org/10.2460/javma.232.4.531

Mahdavi A, Valizade S, Seyedpoor L, & Aftebi, S. (2016). The use of social networking in the field of health. *Proceedings of the 7th Annual Congress of Ardabil University of Medical Sciences*. Ardabil, Iran.

Marton, C., & Wei Choo, C. (2012). A review of theoretical models of health information seeking on the web. *Journal of Documentation*, *68*(3), 330-352. doi: 10.1108/00220411211225575

Mathews SK, Secrest J, Muirhead L. (2008). The interaction model of client health behaviour: A model for advanced practice nurses. *Journal of the American Association of Nurse Practitioners*, 20(8):415-22. doi: 10.1111/j.1745-7599.2008.00343.x

Mayer, S. H. (2008). A librarian's guide to providing resources for pet owners. *Journal of the American Veterinary Medical Association*, *232*(10), 1464-1467. doi.org/10.2460/javma.232.10.1464

McArthur ML, Fitzgerald JR. (2013). Companion animal veterinarians' use of clinical communication skills. *Australian veterinary journal*; 91(9):374-80. doi: 10.1111/avj.12083

Mousavian M. (15 July, 2016). 53% of Iranians Use Social Media. In Persian. *Shargh Daily*. 13(2638):17

Murphy, S. A. (2006). Consumer health information for pet owners. *Journal of the Medical Library Association*, *94*(2), 152.

Murray, E., Lo, B., Pollack, L., Donelan, K., Catania, J., White, M., ... & Turner, R. (2003). The impact of health information on the internet on the physician-patient relationship: patient perceptions. *Archives of internal medicine*, *163*(14), 1727-1734. doi:10.1001/archinte.163.14.1727

Wiley, D., L, Powell, A. (1992). The role of information technology in providing animal health information-a publisher's point of view. Proceedings of the 1st International Conference of Animal Health Information Specialists; 1992 July 16 - 19; Reading University, Reading, UK.

Pelzer, N. L., & Wiese, W. H. (2005). Online tools for accessing veterinary information: electronic continuing resources. *Journal of electronic resources in medical libraries*, *2*(4), 53-79. doi: 10.1300/J383v02n04_04

Podberscek AL, Gosling SD. Personality research on pets and their owners: Conceptual issues and review. In: Podberscek A, Paul E, Serpell J. (Ed). *Companion animals and us: Exploring the relationships between people and pets*. UK: Cambridge University Press; 2005. P. 143-67.

Rohlf, V. I., Bennett, P. C., Toukhsati, S., & Coleman, G. (2012). Beliefs underlying dog owners' health care behaviours: results from a large, self-selected, internet sample. *Anthrozoös*, *25*(2), 171-185.

Ross CB, Baron-Sorensen J. (1998) *Pet loss and human emotion: Guiding clients through grief.* Taylor & Francis.

Serpell J. (1996). *In the company of animals: A study of human-animal relationships*. Cambridge University Press.

Shaw J. R., Hunter, L. (2017). Promote Mutual Understanding, Improve Client Compliance. *Veterinary Team Brief*. 37-40.

Shaw, J. R., Adams, C. L., Bonnett, B. N., Larson, S., & Roter, D. L. (2004). Use of the Roter interaction analysis system to analyze veterinarian-client-patient communication in companion animal practice. *Journal of the American Veterinary Medical Association*, 225(2), 222-229. doi.org/10.2460/javma.2004.225.222

Shaw, J. R., Bonnett, B. N., Adams, C. L., & Roter, D. L. (2006). Veterinarian-client-patient communication patterns used during clinical appointments in companion animal practice. *Journal of the American Veterinary Medical Association*, *228*(5), 714-721. doi.org/10.2460/javma.228.5.714

Statistical Center of Iran (2016). *The results of survey on ICT usage in households*. In Persian. Retrieved from www.amar.org.ir/Portals/0/Files/fulltext/1394/n_tabkhveaafeve_94.pdf

Stephens, M. B., Wilson, C. C., Goodie, J. L., Netting, F. E., Olsen, C. H., & Byers, C. G. (2012). Health perceptions and levels of attachment: owners and pets exercising together. *The Journal of the American Board of Family Medicine*, *25*(6), 923-926. doi: 10.3122/jabfm.2012.06.110325

Timm DF, Jones D. (2011). The Information Prescription: Just What the Doctor Ordered! *Journal of Hospital Librarianship*; 11(4):358-65. doi: 10.1080/15323269.2011.611110

Trevejo, R. T. (2009). Public health for the twenty-first century: what role do veterinarians in clinical practice play?. *Veterinary Clinics of North America: Small Animal Practice*, *39*(2), 215-224. doi.org/10.1016/j.cvsm.2008.10.008

Volk, J. O., Felsted, K. E., Thomas, J. G., & Siren, C. W. (2011). Executive summary of the Bayer veterinary care usage study. *Journal of the American Veterinary Medical Association*, *238*(10), 1275-1282. doi.org/10.2460/javma.238.10.1275

Westermann-Cicio, M. L. (2002). Healthy pets: web sites to help you make wise health care decisions for your pet. *Health care on the internet*, *6*(3), 33-43. doi: 10.1300/J138v06n03_04

White, J. I. (2015). *Information management and animal welfare in crisis: The role of collaborative technologies and cooperative work in emergency response* (Doctoral dissertation, University of Colorado at Boulder)

Wiley, D. L., & Powell, A. (2008, December). The role of information technology in providing animal health information-a publisher's point of view. International Conference of Animal Health Information Specialists.

Yang, Q., Chen, Y., & Wendorf Muhamad, J. (2017). Social Support, Trust in Health Information, and Health Information-Seeking Behaviours (HISBs): A Study Using the 2012 Annenberg National Health Communication Survey (ANHCS). *Health communication*, 32(9), 1142-1150. doi.org/10.1080/10410236.2016.1214220

Zare-Farashbandi, F., Lalazaryan, A., Rahimi, A., & Hassanzadeh, A. (2017). The Effect of Patient-Physician Relationship on Health Information Seeking Behaviour of Diabetic Patients. *Medical Ethics Journal*, *10*(38), 37-50. doi: 10.21859/mej-103837

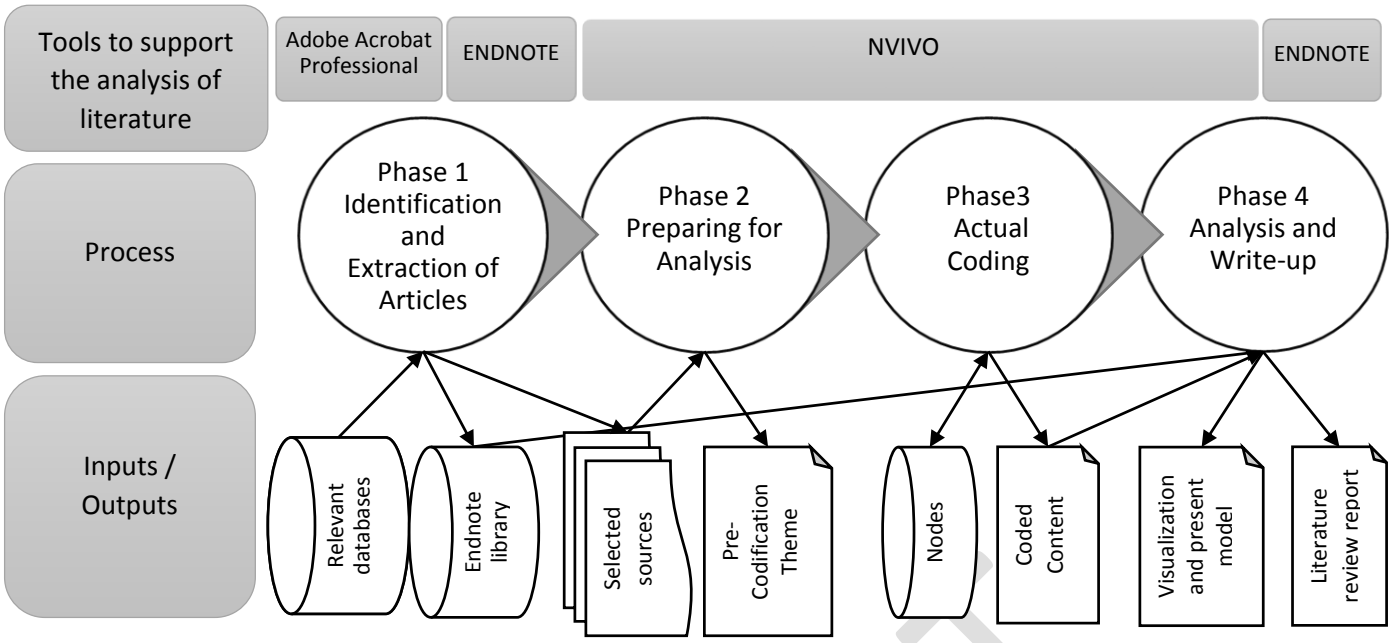
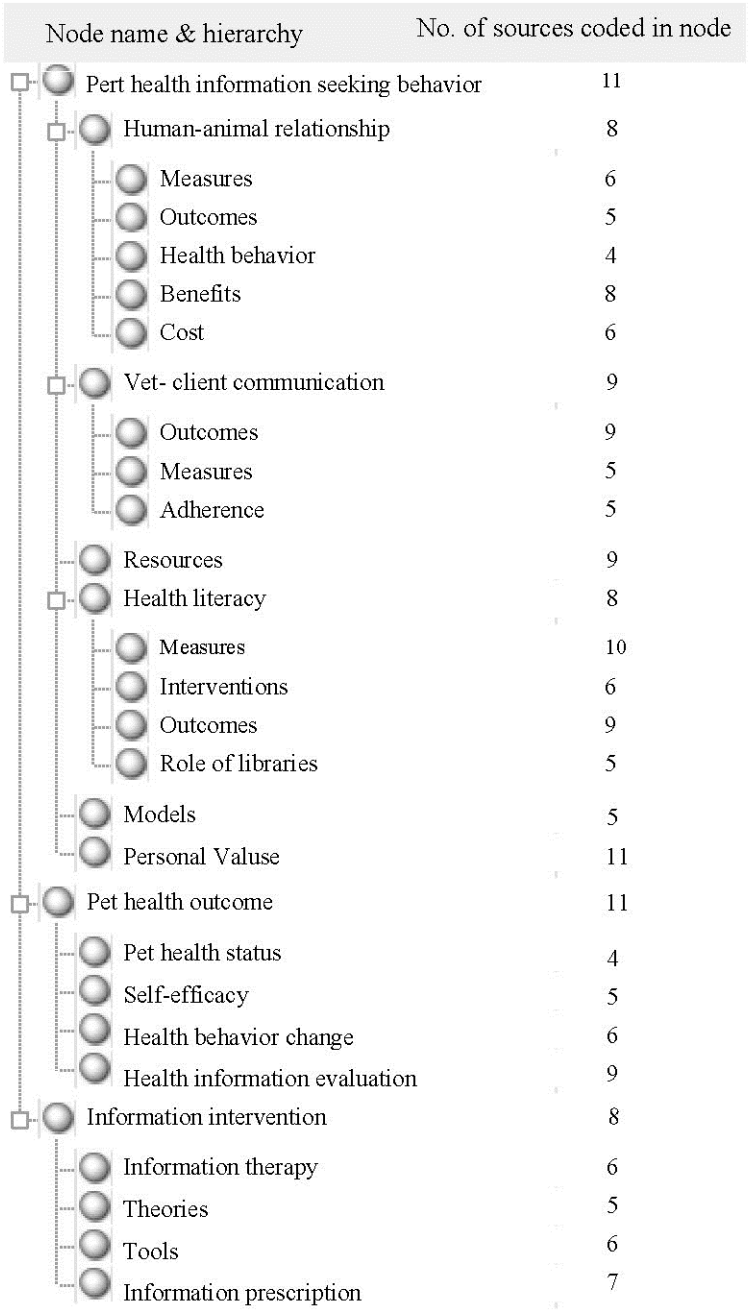


Fig 1. Summary overview of literature review phases. Adapted with permission from Bandara W, Miskon S, Fielt E. A systematic, tool-supported method for conducting literature reviews in information systems. InProceedings of the19th European Conference on Information Systems ©2011.

Fig 3. Most fifty frequent words in research selected articles

Coding Scheme



Node name & hierarchy	No. of sources coded in node
Pert health information seeking behavior	11
Human-animal relationship	8
Measures	6
Outcomes	5
Health behavior	4
Benefits	8
Cost	6
Vet- client communication	9
Outcomes	9
Measures	5
Adherence	5
Resources	9
Health literacy	8
Measures	10
Interventions	6
Outcomes	9
Role of libraries	5
Models	5
Personal Valuse	11
Pet health outcome	11
Pet health status	4
Self-efficacy	5
Health behavior change	6
Health information evaluation	9
Information intervention	8
Information therapy	6
Theories	5
Tools	6
Information prescription	7

Fig 3. The coding scheme developed for the review of literature from NVivo 10

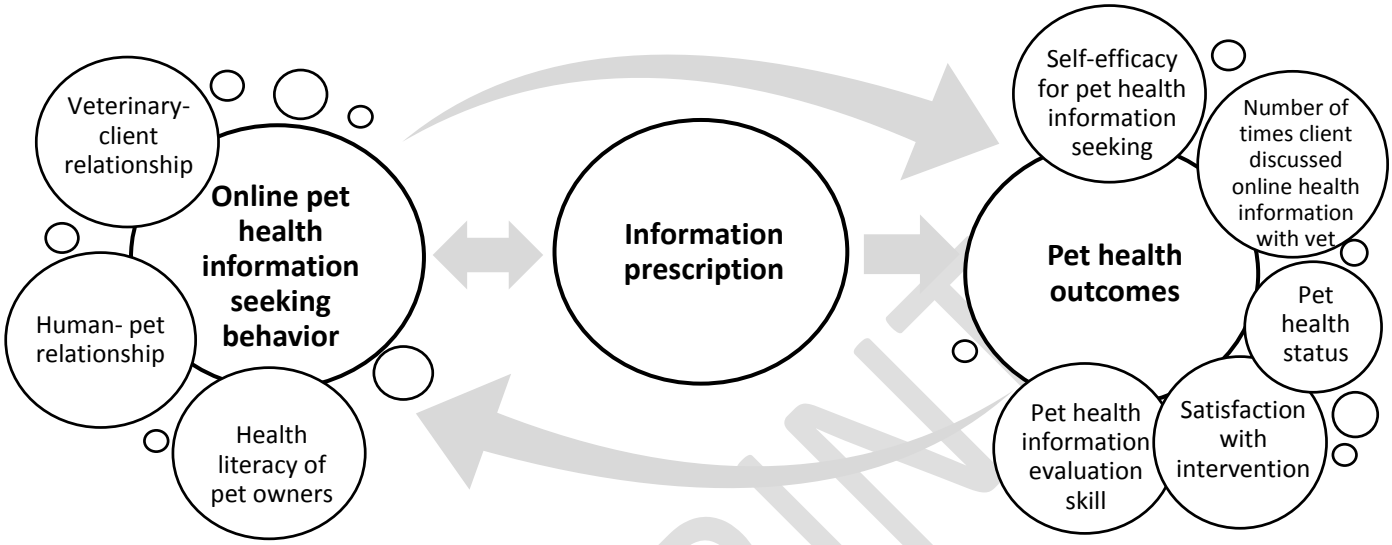


Fig 4. Initial model designed for investigating pet owner's online health Information behavior interventions

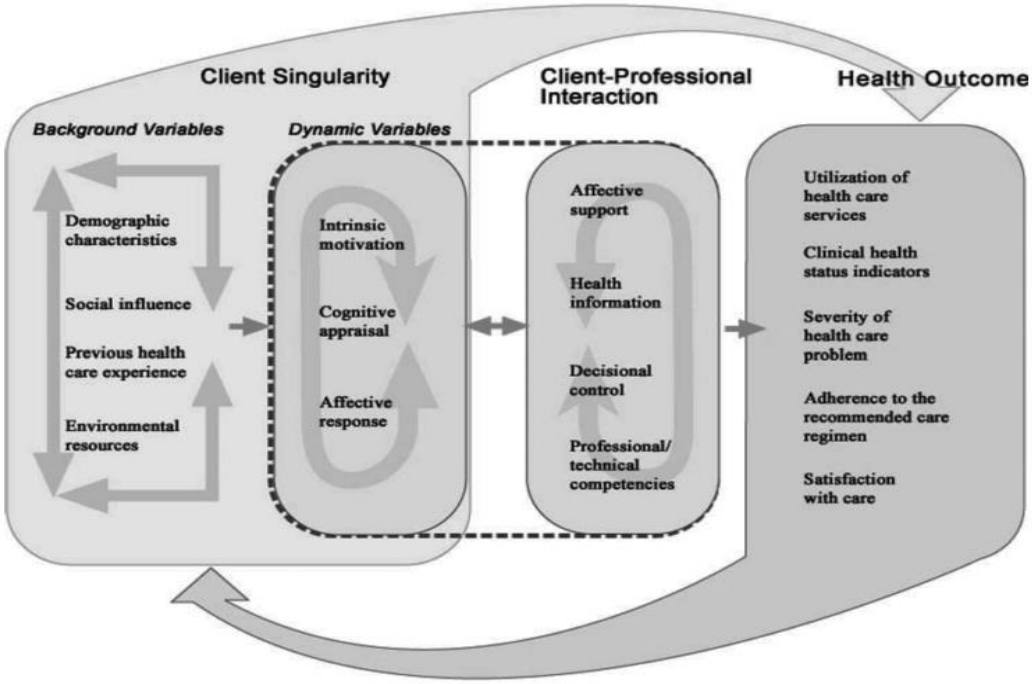


Fig 5. "Interaction model of client health behavior" by C. L. Cox, 2003, ONCOLOGY NURSING FORUM, 30,p. E93.

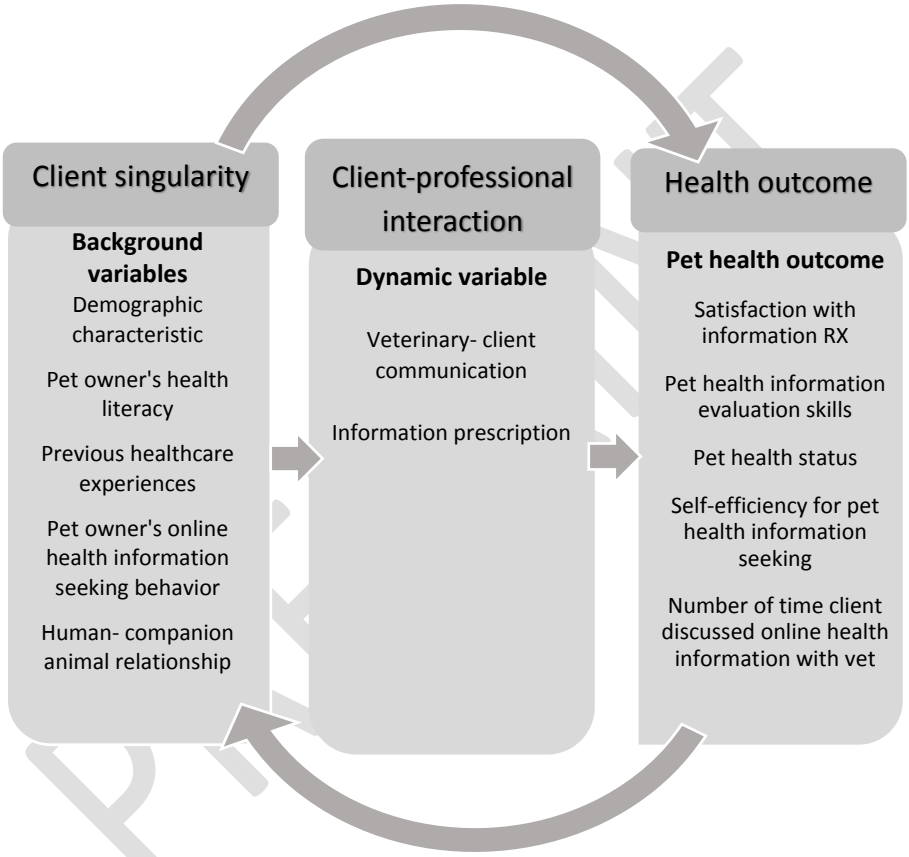


Fig 6. Adaptation of IMCHB for investigating pet owner's health Information behavior interventions