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# An Information Behaviour Intervention Model to Support Companion Animal Welfare

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## Abstract

**Background:** studies of information behaviour related to companion animal health have been carried out in different contexts and there have been attempts to modify and idealize these information behaviours. **Objective:** The purpose of this study is to apply the Pet Health Information Behaviour Intervention (PHIBI) model in an empirical context and elaborate the theoretical contribution of the model to information behaviour research in the context of companion animal care and management. **Methods:** All the variables of the proposed model are quantified and tested through case study research involving twenty participants. Each case consisted of a guardian who participated in the information intervention program with their cat(s) and/or dog(s) in a small animal hospital, with a follow-up interview after two weeks. **Results:** Strong associative relationships are found between guardian singularities, guardian-professional interaction, and outcomes. **Conclusion:** The model will assist both information professionals and animal health providers to better design and evaluate information interventions that support companion animal welfare.

## Keywords

information behaviour, consumer health information, information skills, health literacy, information prescribing

## Key messages

- Despite the extensive availability of informational interventions on companion animal’s welfare and guardian’s behaviour, there is no depth to study to the outcomes of these interventions
- The PHIBI model could act as a practical guide for developing information interventions for guardians with different level of health information literacy and attachment to their companion animal.
- By adopting posthumanism in information behaviour studies we can connect human and animal in a shared information actions and spaces.

## Background

Companion animal guardians encounter many different types and forms of information throughout their real and virtual everyday lives (e.g., sensory, affective, and cognitive information). They read their companion animals' body language through visual, vocal, olfactory, or tactile information. Their companion animals facilitate social interactions (Wood et al, 2015), creating opportunities to meet others and providing information-sharing opportunities. Companion animal health information seeking and use is generally high, and it has been noted that guardians are increasingly turning to online information for various companion animal related topics (Gates et al, 2019; Prata, 2020; Kogan & Oxley, 2020; Kogan et al, 2021). Information research focused on companion animal care and management has been undertaken previously (for example, Lai et al., 2021; Kogan et al., 2010; Kogan et al., 2008). Many previous studies raise concerns about the accuracy, trustworthiness and readability of available information (Shaw & Hunter, 2017; Royal, Sheats & Kedrowicz, 2018; Philpotts, Dillon & Rooney, 2019; Baxter & Viera, 2020; Tater, 2020) and highlight issues around the guardians' information searching and appraisal skills (Mayer 2008; Kogan et al, 2012; Solhjoo, Naghshine, & Fahimnia, 2019).

There are many intervention strategies that focus on strengthening information skills with the aim of improving 'human health' and changing their health behaviours, from maintaining health, the prevention of conditions and diseases, to the management and treatment of illness and health disorders (Carey et al, 2018; Sheeran, Klein & Rothman, 2017; Chang et al, 2014). The most frequently used intervention strategies in previous studies of human health were instructional pamphlets (Chang et al, 2014). In these studies, researchers applied a range of different approaches, models, and methodologies that link the target community with innovation in the design and delivery of the intervention. The use of theory to inform the development of intervention strategies in the health context is often presented as a model or framework. Models differ from theories in that models focus on more specific problems. Both of them identify and describe relationships between concepts but models are linked more to the real world and present simplified versions of reality in a more concrete and visual manner (Case, 2012). The information-motivation-behavioural skills (IMB) model has received considerable attention because it not only provides a relatively simple explanation for health behaviours but also identifies constructs (including information, motivation, and behavioural skills) that are needed for successful self-management or adherence (Chang et al, 2014, 173). The IMB has also been used in designing and proposing the Pet Care Competency model which investigates guardian behaviour to improve the welfare of the companion animal (Glanville, Hemsworth and Coleman, 2020).

The effectiveness of companion animal health educational interventions in improving guardians' knowledge in different companion animal related contexts have been studied previously (Redding & Cole,

2019; Solhjoo, Naghshineh, & Fahimnia, 2019; Baker, Cormier & Vogtle, 2018; Royal, Sheats & Kedrowicz, 2018; Kogan et al, 2014), but none were guided by theory. Research in the veterinary context has often used an information prescription (IP) in the form of pamphlet and online material to change the health behaviour or health information behaviour of guardians (Kogan et al., 2014; Solhjoo, Naghshineh, & Fahimnia., 2019; Redding & Cole, 2019). With the global Coronavirus (COVID-19) pandemic, guardians are increasingly turning to online information and services. Indeed, there is evidence that COVID-19 led to a growth in video materials and pre-recorded webinars to enhance welfare of companion animals at homes (Mars companion animal care, 2020; Vet Professionals, 2020). Despite the extensive availability of evidence, some of which is based on research, some of which is not, studies of the impact of information interventions on companion animal's welfare and guardian's behaviour are rare and there is no depth of research relating to the outcomes of these interventions, and a framework exploring guardians' information behaviours to improve their information skills is lacking.

## Objective

Animal behaviour and welfare scientists believe that well designed interventions can play a part in improving companion animal health and welfare (Philpotts, Dillon & Roonet, 2019). Lund et al (2006) suggested that welfare scientists need to extend cross-disciplinary research and utilize examples of good practices in social science to achieve improvement in companion animal welfare. Scholars from information disciplines might be able to aid significantly in understanding the role of information in guardian behaviour, and assist with designing and implementing information-based solutions for improving animal welfare in practice.

Recently the Pet Health Information Behaviour Intervention (PHIBI) model was proposed based on a multidisciplinary systematic literature review (Solhjoo et al, 2018). In PHIBI, the 'model' is used as Wilson (1999) described: statements in the form of diagram that attempts to describe the relationship among elements of guardians' information behaviour, and outcomes or consequences of an information behaviour intervention. the PHIBI (see Figure 1) explores guardians' outcomes related to an information intervention by focusing on their previous information experiences, health literacy, human-companion animal bond, and interaction between the guardian and health provider. **The purpose of the study reported here is to test the PHIBI model in an empirical context and elaborate its theoretical contribution to information behaviour in the context of companion animal care and management.**

## Methods

The project was designed and operationalized in three stages. A detailed account of the first two stages was previously published (Solhjoo et al, 2018). First, concepts and constructs relevant for guardians'

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3 information behaviour in companion animal healthcare were identified through a systematic literature  
4 review. Concepts were then structured according to the IMCHB, which identified the background,  
5 dynamics, and contextual variables that explain health-related behaviours. For the final stage reported in this  
6 paper, based on the model devised, an information intervention was designed that consisted of a  
7 handout that included several tips to help clients with searching and evaluating online companion animal  
8 health information as well as a blank space for writing reliable and up-to-date veterinary medicine websites  
9 related to companion animal health and welfare. The information intervention was applied during each  
10 participant's appointment with the vet. The handout was a Persian translation of an IP created by Robin  
11 Downing, owner of the Downing Center for Animal Pain Management, published in the *dvm360 Magazine*  
12 (2014), and the trusted websites were identified and recommended by an information professional. All the  
13 variables of the proposed model were quantified and tested in this case study with the participation of twenty  
14 cases. Each case consisted of a follow up two weeks later with guardians who had participated in the  
15 information intervention program with their cat(s) and/or dog(s) in a small animal hospital (in Tehran, Iran).

### 24 ***Operationalization of the model***

25 The concepts within the PHIBI model were defined clearly in a previous article ([redaction of citations]).  
26 For the last stage of the research, the concepts were operationalized as variables that could be measured in  
27 the case study. Table 1 presents the conceptualization and operationalization of each element of the PHIBI  
28 model for this specific study. In this model, we have three main categories of a multi-dimensional construct  
29 called guardian singularities, guardian-professional interaction, and outcomes.  
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32 The guardian singularity (client singularity according to cox (2003)) is the background variables related to  
33 an individual, encompassing both intrapersonal and contextual elements. For this study, the intrapersonal  
34 elements of a guardian include demographic variables (e.g., age, sex, education, and health literacy level),  
35 and the contextual elements include information seeking and perceptions of the guardian-animal (human-  
36 animal) relationship. Standard scales have been used as measurable representations of these abstract  
37 constructs (see Table 1). For example, the guardian-animal relationship is measured as the Monash dog-  
38 owner relationship score (MDORS) or cat-owner relationship score (CORS) (Howell et al, 2017), which are  
39 scales generated from Social Exchange Theory, a well-established psychological theory specifying that  
40 relationships are maintained only when the perceived costs and benefits are either balanced or when the  
41 perceived benefits outweigh the perceived costs (Dwyer, Bennett & Coleman, 2006).  
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50 The second multi-dimensional construct of the model is guardian-professional interaction which is defined  
51 as the tangible content and process of relationship building and communication between a veterinarian, a  
52 guardian, and a patient (companion animal) (Solhjoo et al, 2018). Through this interaction, the professional  
53 (vet) could apply an information intervention and intervene in the guardian's information evaluation skills  
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3 to help improve their companion animal health information behaviour/skills. In this study, this was  
4 accomplished by indirect observation of veterinary-guardian-animal communications and the process of  
5 providing the IP which was captured by audio-video recording during appointments in the examination  
6 room). The interactions were then analysed with the Roter Interaction Analysis System (RIAS). RIAS is a  
7 framework used to study physician-patient interactions by dividing talk into discrete verbal and nonverbal  
8 communication variables (i.e., data gathering, education and counselling, relationship building, and  
9 activation and partnership) (Shaw et al, 2004) to calculate a relationship-centred score as a proportion of  
10 client-centred talk to veterinarian-centred talk, reflecting the balance of dialogue (Shaw et al, 2006).

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12 The final element of the PHIBI is the outcome. This is defined as the consequences that result from the  
13 guardian-professional interaction. Solhjoo et al (2018) identify possible primary and secondary outcomes  
14 of information interventions in the companion animal welfare context as instrumental, communication, and  
15 learning outcomes, and satisfaction (for more details see Table 1). These outcomes were operationalized  
16 through follow-up interviews with participants two weeks after visiting the hospital.

### 24 ***Participants***

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26 Convenience sampling was used to recruit guardians who meet the sampling criteria of the study: 1) adults  
27 aged between 18-55 years old, 2) patients (have a veterinary medical record at the small animal hospital),  
28 and 3) internet users. They were recruited in the hospital through advertisements in the waiting room  
29 between February to April 2020. Written, informed consent was obtained from all guardians who agreed to  
30 participate, including permission for the audio-video recording of their appointments with the vet, a short  
31 interview about the owner-companion animal relationship, completion of health literacy and online health  
32 information behaviour surveys, and a two-week follow-up telephone interview. Table 2 shows the study  
33 population of 20 guardians. There were 13 female participants and 7 male participants. Their mean age was  
34 35 years (range 20-50). In terms of education level, five participants had secondary education, 10 had an  
35 undergraduate education and 5 had graduate education. Half of the participants (n = 10) visited the hospital  
36 with dogs and the other half with cats. Only 4 cases referred to having more than one companion animal.  
37 Half of the appointments were for treatments, i.e. patients referred to a veterinarian due to a specific disease  
38 or problem (such as anemia, atopy, anorexia, ulcers, etc.), and the other half were preventive (for example,  
39 monthly check-ups, vaccines, antiparasitic, or annual blood test). Participants had lived with their  
40 companion animals between 6 months to 10 years.

### 50 ***Data analysis***

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52 The qualitative and quantitative analysis process began during data collection and continued as the results  
53 were gathered. The NVivo 10 qualitative data analysis software was used to manage and code recorded  
54 videos of appointments (using the RIAS framework) and telephone interviews (using a content analysis  
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3 technique based on the outcome categories). SPSS 21 was used for the descriptive analysis of guardian  
4 singularity (demographic variables, health literacy level, information-seeking behaviour, and guardian-  
5 animal relationship). In the statistical analysis, non-parametric tests (e.g. Mann-Whitney test, Kruskal-  
6 Wallis test, and Spearman's rank correlation coefficient) were performed to examine significant  
7 associations between the elements of the model. Nonparametric tests were used because there were  
8 qualitative data (nominal and ordinal scales), and small sample size. Analyses were considered statistically  
9 significant at the  $P < 0.05$  alpha level (two-tailed).  
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### 17 ***Limitations***

18 There were some limitations to the study. First, despite the non-demanding nature of participation, only a  
19 small number of participants from the animal hospital enrolled. It is likely that the small sample size limits  
20 the generalizability of the results of the study and might have introduced selection bias. Second, participants  
21 consisted of guardians who used veterinary services for the health and welfare of their companion animals.  
22 It is possible that the consequences and outcomes of the information intervention are different among  
23 guardians who do not seek out veterinary care as suggested by the Kogan, et al (2012) study on guardians'  
24 online information seeking behaviour. Third, the use of telephone interview to assess participant's  
25 knowledge and behaviour change related to companion animal health information intervention could result  
26 in artificially positive outcomes as it is based on their self-perception rather than actual behaviour and  
27 attitude. Finally, open-ended interview questions and coding is subjective to the interpretation of the  
28 researcher and may be interpreted differently by others. Also, there might be some limitations on the  
29 applicability of the PHIBI model which will be identified through testing in various settings.  
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### 39 **Results**

40 All constructs, variables, and relationships comprising the PHIBI model were used in the small animal  
41 hospital with 20 guardians (cat/dog guardian) who received an IP from the veterinarians during their  
42 appointments. This first application serves to demonstrate the testability of the PHIBI model and its  
43 potential to direct companion animal health-related information interventions. In what follows, the strong  
44 relationships that were found between guardian singularities, guardian-professional interaction, and  
45 outcomes are reported. These results support the elements of the PHIBI model as a framework for  
46 developing information behaviour intervention to support guardians' behavioural change programs and  
47 enhance companion animal welfare.  
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### ***Guardian singularities and outcomes***

In Table 3 the bivariate statistics of the relationship between guardian singularity and the application of and satisfaction with the IP is presented. Satisfaction with the IP was positively correlated with different groups of participants: 1) guardians who search the internet for a better understanding of the information provided by the vet during their appointments ( $p = 0.021$ , correlation coefficient= 0.692), and 2) guardians who search the internet as they disagreed with the vet's consultation ( $p = 0.0311$ , correlation coefficient= 0.545). Disruptions during veterinarian-client interactions, such as emotional reactions to hearing unwelcome news, the smell and noises of the environment, and anxious reactions of the companion animal during the examination, can prevent guardians receiving enough information related to their companion animal. However, according to the findings of the present study, the IP can be an appropriate tool to solve this problem, because guardians, regardless of their disagreement/ agreement with what the veterinarian told them, used the IP during their leisure time to search and find information related to their companion animals' issues. Various aspects of participants' information-seeking behaviour, including how to search, find, evaluate, and use companion animal health information on the Internet, were compared with the outcomes they reported in relation to their IP. Findings showed that guardians who search more for animal health on the internet in general ( $p = 0.00$ , correlation coefficient= 0.717), and those who prefer to use websites that they already know to find health information rather than using search engines (i.e., google) ( $p = 0.019$ , correlation coefficient= 0.560), were more satisfied with using recommended tips and sources given by the IP. Also, findings showed that guardians' negative emotional reactions to finding information on the Internet have a significant direct relationship with using the veterinarian's prescribed information. In other words, those who were more likely to be confused by the information they found on the internet, were more likely to browse the veterinarian-recommended website. Therefore, prescribing information can help guardians with low-level skills in information seeking.

In terms of health literacy levels, guardians with higher eHealth literacy scores reported more positive reactions related to recommended information evaluation tips and reliable sources on the IP. Among the eight items of eHealth literacy skills, the skills of "assessing health information" and "applying health information" are significantly related to the use of IP (see Table 3). In the Kruskal-Wallis test on three categorized of eHealth literacy level among participants: sufficient, problematic, and inadequate, there was a significant difference between eHealth literacy level and some reported outcomes. Learning outcomes reported from guardians with a sufficient level of health literacy (mean score= 15.11) was significantly higher ( $p = 0.01$ ) than participants with inadequate health literacy level (mean score = 4.23). These findings can be explained by the fact guardians with higher information appraisal skills would use multiple sources (e.g., Internet, library holdings, outside experts) to improve understanding about their companion animal's health, , as it enables them to compare and evaluate information and interpret it to understand their



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3 companion animal's condition. So, these guardians are more likely to use the veterinarian's prescribed  
4 information as an additional reliable source for their information needs in preventive companion animal  
5 healthcare and treatment.  
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9 There was a significant ( $P < 0.001$ ) positive correlation (correlation coefficient = 0.804) between the human-  
10 companion animal relationship and using the IP. The stronger the bond between owner and companion  
11 animal, the more often the owner used the tips to search for online information. However, there was no  
12 significant correlation between the human-companion animal bond and the companion animal owner's  
13 level of satisfaction with the IP. In terms of each variable within the owner-companion animal bond  
14 (companion animal-guardian interactions, perceived emotional closeness, and perceived costs), only  
15 emotional closeness was significantly related to the number of times participants reported using the IP. The  
16 human-companion animal relationship score was arranged from the lowest to the highest score and was  
17 divided into three categories with 33 and 66 percent as cut-off points. The relationship between the  
18 outcomes of the IP and the three levels of the human-companion animal bond was examined with the  
19 Kruskal-Wallis test. In terms of the outcomes, 50% of health outcomes were reported by those who had a  
20 strong relationship with their companion animal. These outcomes were changes in their companion animal  
21 healthcare behaviour (learning outcomes) and more willingness to discuss companion animal health  
22 information with the vet (communication outcomes).  
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### 31 ***Guardian-professional interaction and outcomes***

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33 The recorded interactions were broken down into individual utterances and were assigned to  
34 communication variables based on the RIAS framework (i.e., data gathering, education and counseling,  
35 relationship building, and activation and partnership). As noted in Table 4, relationship building ( $p = 0.014$ ,  
36 correlation coefficient = 0.614), and activation and partnership ( $p = 0.001$ , correlation coefficient = 0.701)  
37 were found to be significantly associated with a positive reaction to the IP. But it had no significant  
38 relationship with interactions such as "education and consultation" and "information gathering". It could be  
39 said that for successful information intervention during the veterinary appointment, creating a positive  
40 relationship with the client, paying attention to their expectations, and helping them to express their  
41 information needs are more essential than just education and consulting about information skills. To explore  
42 the guardian's perspective, veterinarians in this study used questions such as "what do you hope to find  
43 when you search on the internet about your companion animals' issue?" or "what concerns do you have  
44 regarding the online information you brought today?" There were also some guided internet searches along  
45 with IPs during the appointments.  
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54 By analyzing the videos recorded during guardian-professional interaction, I reached a measurable variable,  
55 a relationship-centered score. The correlation between this variable and the reactions to IPs were tested  
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(Table 4). There was a strong positive correlation ( $P < 0.001$ , correlation coefficient = 0.78) between the score of relationship-centred care and the level of satisfaction with the IP. In other words, among those appointments which recognize the nature and quality of relationships, and the mutual collaboration with the client to address the companion animal's needs, the clients' reaction and responses to the IP were more positive. The relationship-centred care scores were arranged from the lowest to the highest score and were classified into three categories of high, medium, and low with 33 and 66 percent as cut-off points. In the Kruskal-Wallis test, a significant relationship was found between relationship-centred care and reported instrumental outcomes ( $0.001 > p$ ). This means that when veterinarians gave more attention to the client's needs and partnership during the appointment with the information intervention process, the guardian felt more self-efficacy to search and evaluate online companion animal health information afterward.

## Discussion

Overall, a preliminary use of the PHIBI model has successfully been tested in a small animal hospital in Iran. The PHIBI model is a strong theoretical framework for developing information and educational interventions for guardians with different level of health information literacy and attachment to their companion animal. Findings provide evidence of 'what,' 'how,' 'why, and 'where and when' elements (Wetten, 1989) of the PHIBI model. It tested factors affecting the intervention to support information behaviours of guardians and significant relationships between these factors: from the individual character and background variables of the animal guardian, to dynamic variables of interactive and collective contributions between guardian and health providers to improve companion animal health information behaviours. It also provides some underlying psychological and social explanations to justify these factors and their relationships. It is a standardized assessment model to design and evaluate any information intervention within companion animal care and management context and It is a practical framework to have an impact on companion animal welfare in an interdisciplinary work and research. Plans are underway to introduce the model to a wider audience.

### *Potential contribution to information behaviour studies*

In the developmental review article, Solhjoo et al (2018) identified critical knowledge gaps in interventions to assist companion animal owners in online health information-seeking behaviour and their review was accomplished by proposing a conceptual model of PHIBI. The above empirical research was conducted for examination of relationships represents in the PHIBI model which is a crucial part of the theory-development process (Webster & Watson, 2002). In what follows the significant contributions of this model to information behaviour studies are elaborated.

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3 **Domain aspect:** models are often said to precede the development of formal theory (Wilson, 1999). The  
4 PHIBI model could be considered an extension of a current theory in health behaviour (i.e., IMCHB), or  
5 the development of a new theory in information behaviour related to companion animal welfare. It is at  
6 the intersection of information science and anthrozoology. Information science is distinguished from  
7 other fields (e.g., information technology, and computer science) by its focus on the human  
8 component of information (Cibangu, 2015). Therefore, this field can apply a post-humanist perspective  
9 that has been seen across varied disciplines including social, health, and technology studies. This  
10 phenomenon is of interest to the PHIBI model. By adopting this approach, humans are becoming the  
11 broader more-than-human world and boundaries between humans, animals and technologies are  
12 becoming blurred (Bolton, 2014). The human-animal relationship within the PHIBI model connects  
13 human and nonhuman in information actions and experiences. According to Fox (2006, p. 534) “living  
14 together with another species daily necessitates a certain intimacy and recognition of individuality and  
15 personality in non-humans”. This is also of relevance to the human information world, as this case study  
16 showed the emotional closeness to the companion animal relates to positive reactions to IP. This model  
17 would serve as a small step to understand information practice among guardians.  
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27 **Ontological aspect:** what type of knowledge can be expected to result from the PHIBI model? In general,  
28 theories aim to describe, explain, and enhance understanding of the world and, in some cases, to provide  
29 predictions of what will happen in the future or to give a basis for intervention and action (Gregor, 2006).  
30 Here according to Weber (2012, p. 4) by theory, I mean a particular kind of model that is intended to  
31 account for some subset of phenomena in the real world and how it should be explained and tested.  
32 Gregor (2006) defines the component common in all theories as a means of representation,  
33 construct, statements of relationship, and scope. This model is considered as statements of  
34 relationships among constructs of information behaviour intervention in companion animal welfare that  
35 can be tested. Here, constructs are physically represented in a graphical model (Figure 1). It represents  
36 the associative and compositional relationships among the constructs in such a form that they can be  
37 tested empirically. The scope is related to the aim of this model which is to tackle the problems of  
38 information behaviour among interspecies families (i.e., humans who share their homes with  
39 companion animals and think of them as friends or children (Fox, 2006; Blouin, 2012)) by assisting  
40 both information professionals and animal health providers to better design and evaluate information  
41 intervention which supports companion animal welfare. This theoretical model in information  
42 behaviour answer three key issue as stated by Johnson (1997, cited in Case et al., 2016): 1) it could  
43 provide a theoretical basis for predicting changes in information behaviours; 2) it could provide guidance  
44 for designing intervention strategies for enhancing information behaviour among guardians; 3) it  
45 conceptualizes and describes elements related to guardians’ information behaviour; 4) it  
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3 could identify some underlying forces that impel particular changes in the health information behaviour of  
4 guardians.  
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7 **Epistemological aspect:** the PHIBI model can be referred to as both inductive and deductive. The  
8 primary concern was with the development of concepts (related to companion animal welfare information  
9 practices) and then the development of a theory that integrates those concepts. Therefore, first the abstract  
10 concepts related to this model were derived from an interpretive literature review, and then they were  
11 integrated into a model based on the existing theory of IMCHB (Solhjo et al. 2018).  
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16 The research approach for applying this model could vary. The presented case study showed how the  
17 model can be tested and what research methods can be used. Here I used integrating approaches and  
18 mixed methods (e.g., indirect observation of vet-client interactions with a camera recorder, a survey  
19 about information-seeking behaviour and health literacy, telephone interview about the outcome  
20 of the intervention). However, more empirical study with different quantitative and qualitative methods  
21 is needed to provide evidence of the practical relevance of the model in companion animal welfare  
22 information practices.  
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27 **Socio-political aspect:** this model is based on a collaboration between information science scholars and  
28 veterinarians' practitioners. It is expected to be relevant and useful in practical projects to improve  
29 companion animal health information behaviour. It can provide benefits to individuals, organizations, and  
30 societies: for companion animal healthcare providers; agencies with an interest in enhancing companion  
31 animal welfare; social and educational campaigns for interspecies families that seek behaviour change  
32 programs; veterinary librarians and public librarians that provide information resources and services for  
33 guardian communities; information professionals and scholars with interest in human-animal-information  
34 interactions; and system developers to better design platforms and devices to connect with and provide  
35 information to guardians.  
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## 42 **Conclusions**

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44 Over many years, studies of information behaviour have been carried out in many different contexts  
45 related to both human and animal health. Theoretical frameworks of information behaviour and  
46 information literacy related to human health have been developed. The PHIBI model is in line with  
47 theoretical bases in the field but going further by including unique characteristics of information  
48 behaviours and practices in companion animal healthcare. It gives an insight into the information  
49 behaviour interventions among guardians, the outcomes related to them, and the importance of the  
50 guardian-professional interaction and guardian-animal relationship in information practices. The model  
51 was used in a small-scale context to intervene and investigate information behaviour associated with  
52 the provision of companion animal  
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3 healthcare. It could enable interdisciplinary works to design information interventions that include  
4 components more likely to be effective and better explain intervention outcomes to change guardian's  
5 health information behaviour and ultimately their health behaviours towards their companion animals. It is  
6 hoped that this model played a part in improving the welfare of companion animals and further studies will  
7 provide evidence of the practical relevance of the model and highlight any modifications that may need to  
8 be made.  
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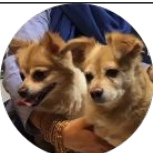

TABLE 1. Conceptualization and operationalization of elements of the PHIBI model






<b>Model Concept</b>	<b>Model Conceptualization</b>	<b>Study Operationalization</b>	<b>Study Measures</b>
<b>Guardian Singularity</b>	<b>Unique intrapersonal &amp; contextual configuration of an individual</b>		
Demographic Characteristics	Guardian characteristics	Age, Sex, Education, Type of companion animal, Duration of companion animal ownership	Demographic Questionnaire
Demographic Characteristics	Guardian characteristics	eHealth literacy	eHealth Literacy Scale
Environmental Resources	Availability of information	Health information-seeking behaviours	Information Seeking Behaviour Questionnaire
Social Influence	Advantages and disadvantages of caring for a companion animal	Guardian-animal relationship: includes guardian perception of emotional closeness, interactions, and costs	Monash Dog- Owner Relationship Scale, Cat-Owner Relationship Scale
<b>Guardian-professional Interaction</b>	<b>The extent to which companion animal health provider attends to individualistic guardian/patient needs</b>		
Communication and professional abilities	guardian-patient-professional interaction	Data gathering, education, and counselling, relationship building, activation, and partnership, relationship-centred score	Indirect observation and analysis with the Roter interaction analysis system framework
Provision of Health Information	Process of providing information intervention	Information Prescription	Indirect observation
<b>Outcome</b>	<b>Outcomes that are related to information intervention</b>		

Instrumental Outcome	The extent that the guardian utilizes information intervention	Companion animal health information evaluation skill, Self-efficacy for online companion animal health information seeking	Follow up interview
Communication Outcome	The extent that the guardian discusses companion animal health information with a companion animal health provider	Vet–client communication enhancement, Family/friend involvement	Follow up interview
Learning Outcome	The extend of the guardian’s knowledge and skills acquisition	Understanding companion animal health status, Changes in health behaviour, enhancement of companion animal’s lifestyle	Follow up interview
Satisfaction	The extent of guardian satisfaction with the information intervention	Satisfaction with information prescription	Follow up interview

TABLE 2. Cases and demographic information

#Case	Companion animal	Guardian	Type of appointment
C1 	cat female Less than 1 year	woman 30-39 years old Bachelor's degree	prevention (vaccination)
C2 	3 cats female/male less than 1 year	woman 40-49 years old master's degree	treatment (anemia)
C3 	cat female 4 years old	woman 30-39 years old bachelor's degree	treatment (allergic disease)
C4 	cat female 2 years old	woman more than 50 years old master's degree	prevention (checkup)
C5 	2 cats Male 5 and 3 years old	man 30-39 years old master's degree	prevention (checkup)
C6 	Cat Male 2 years old	Man 30-39 years old high school diploma	prevention (checkup)
C7 	cat female 1 year old	woman 20-29 years old bachelor's degree	treatment (liver problem)

1 2 3 4 5 6 7 8 9	 C8	cat female 6 years old	man 40-49 years old master's degree	treatment (dental issue)
10 11 12 13 14 15	 C9	cat male 2 years old	man 20-29 years old bachelor's degree	prevention (checkup)
16 17 18 19 20 21 22	 C10	cat female Less than 1 year	man 20-29 years old high school diploma	prevention (parasite prevention)
23 24 25 26 27 28 29	 D1	dog female Less than 1 year	man 40-49 years old Bachelor's degree	prevention (vaccination)
30 31 32 33 34 35	 D2	dog female 3 years old	woman 20-29 years old bachelor's degree	prevention (checkup)
36 37 38 39 40 41 42	 D3	dog female 6 years old	woman more than 50 years old bachelor's degree	treatment (anorexia)
43 44 45 46 47 48 49	 D4	2 dogs females 6 and 2 years old	woman 30-39 years old high school diploma	prevention (vaccination)
50 51 52 53 54 55 56 57 58 59 60	 D5	dog female 10 years old	man 30-39 years old master's degree	treatment (dental issue)

 <p><b>D6</b></p>	<p>2 dogs male/female 3 years old</p>	<p>man 30-39 years old bachelor's degree</p>	<p>treatment (respiratory disease)</p>
 <p><b>D7</b></p>	<p>dog male Less than 1 year</p>	<p>woman 40-49 years old bachelor's degree</p>	<p>treatment (parvovirus)</p>
 <p><b>D8</b></p>	<p>dog female 7 years old</p>	<p>woman 40-49 years old high school diploma</p>	<p>treatment (respiratory disease)</p>
 <p><b>D9</b></p>	<p>dog male Less than 1 year</p>	<p>man 30-39 years old bachelor's degree</p>	<p>prevention (parasite prevention)</p>
 <p><b>D10</b></p>	<p>dog male 9 years old</p>	<p>woman 20-29 years old high school diploma</p>	<p>treatment (skin infection)</p>

Guardian singularity	Application of information prescription		Satisfaction with information prescription	
	r <sub>s</sub>	p-value	r <sub>s</sub>	p-value
<b>Information seeking behaviour</b>				
Frequency of searching for online companion animal health information	0.717	0.00*	0.525	0.021*
Perceived difficulty of searching online companion animal health information	-0.237	0.394	0.236	0.361
Frequency of using search engines to find online companion animal health information	0.109	0.601	0.306	0.133
Frequency of using pre-known websites to find online companion animal health information	0.560	0.019*	0.552	0.021
Search online companion animal health information because of personal curiosity	0.241	0.200	0.284	0.325
Search online companion animal health information to better understand the information provided by the veterinarian	0.692	0.021*	0.760	0.001>*
Search online companion animal health information due to disagreement with the information provided by the veterinarian	0.435	0.055	0.545	0.0311*
<b>Affective aspects of information-seeking behaviour</b>				
Feeling disappointed and frustrated by not finding useful information on the internet	0.832	0.028*	0.715	0.041 *
Feeling confused and misunderstood by the information found online	0.069	0.773	0.046	0.842
Feeling worried and scared by the information found online	-0.113	0.352	0.013	0.792
Feeling confused and desperate because of the vast amount of information found the Internet	0.612	0.05*	0.598	0.05 *
Feeling comforted and relieved by the information I have found	0.072	0.602	0.190	0.460

<b>eHealth literacy Skills</b>				
To know what resources about companion animal health are available on the internet	0.224	0.309	-0.384	0.211
To know where to find help online companion animal health information	0.374	0.102	0.491	0.364
To know how to find helpful online companion animal health information	-0.372	0.384	0.683	0.281
To know how to use online companion animal health information to answer my questions	0.263	0.223	0.222	0.258
To know how to use online companion animal health information to help my companion animal	0.549	0.161	0.533	0.411
To know how to evaluate online companion animal health information	0.699	0.001>*	0.482	0.274
The ability to distinguished between the high and low quality of online companion animal health information	0.752	0.012*	0.619	0.032*
The ability to confidently use online companion animal health information	0.734	0.035*	0.590	0.001>*
Total score of eHealth literacy level	0.766	0.001>*	0.716	0.015*
<b>Human- companion animal relationship</b>				
Companion animal–guardian interaction	0.249	0.017	0.692	0.702
Perceived emotional closeness with the companion animal	0.828	0.001>*	-0.356	0.123
Perceived Costs of caring companion animal	0.393	0.140	0.510	0.244
Total score of human- companion animal bond	0.755	0.017*	0.521	0.337



TABLE 4. Spearman correlation coefficient results between guardian-professional interaction and reactions to information prescription

Guardian-professional interaction	Application of information prescription		Satisfaction with information prescription	
	$r_s$	p-value	$r_s$	p-value
Data gathering	0.717	0.00*	0.525	0.021*
Education and counseling	-0.237	0.394	0.236	0.361
Relationship building	0.109	0.601	0.306	0.133
Activation and partnership	0.560	0.019*	0.552	0.021
Relationship-centered score	0.241	0.200	0.284	0.325

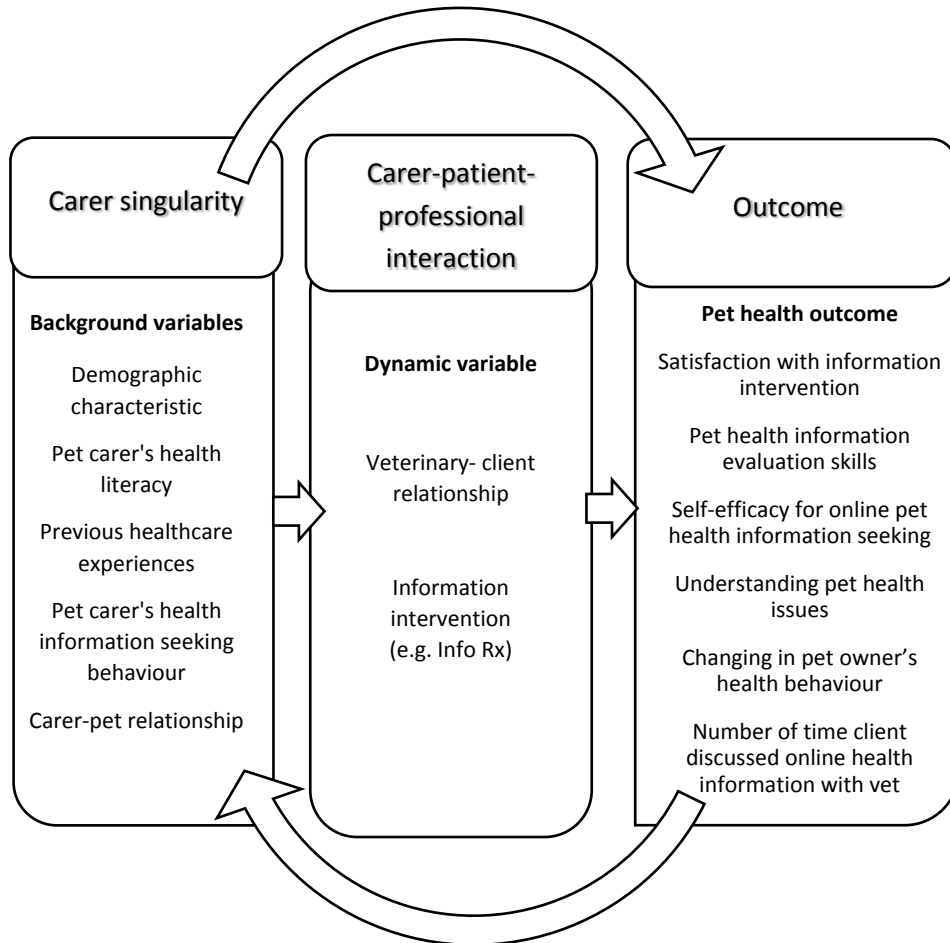


FIGURE 1. Pet Health Information Behavior Intervention Model (Solhjoo et al. 2018a)