

# Impact of Fluorescent Light Energy on the Quality of Life of Dogs with Dermatologic Disease and Their Owners

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## Abstract

**Background:** Quality of life (QoL) is a term used to evaluate general well-being, and it is defined as 'the degree to which an individual enjoys his or her life. Within the realm of medicine, the evaluation of QoL frequently involves examining how disease exerts a detrimental impact, diminishing the enjoyment and fulfilment experienced by the individual. Dermatological diseases have been found to exert a substantial negative influence on the QoL of dogs and their owners due to nuisance and stress related to the disease but also due to the caregiver burden. In the management of bacterial skin infections, topical therapy is commonly administered alongside systemic antibiotics. Nonetheless, the protracted duration of treatment and difficulties in ensuring owner compliance can introduce a significant caregiver burden, potentially exacerbating the challenges associated with these conditions. **Purpose:** This study aimed to evaluate the impact on the quality of life (QoL) of dogs with dermatologic diseases after fluorescent light energy (FLE) treatment. **Methods:** The study was an open, prospective, multicentric clinical trial that included dogs with various dermatological conditions. The dogs received FLE treatment once weekly until the clinical resolution was achieved. Owners completed a validated questionnaire to assess the QoL of their dogs before and after therapy. **Results:** Thirty-five dogs with deep pyoderma, interdigital furunculosis, pyotraumatic dermatitis, wounds and perianal fistulas were included. All dogs received two sessions of fluorescent light energy once a week. Median treatment duration was 9 weeks for perianal fistula, 7 weeks for interdigital furunculosis, 5 weeks for deep pyoderma, 3 weeks for wounds and 1.5 weeks for pyotraumatic dermatitis. Complete remission was noted in 86% of dogs, and

14% showed an improvement but partial remission. The majority of owners reported a positive impact on their dogs' QoL after therapy, and 74% of the dogs showed at least a 50% reduction in QoL scores. **Conclusion:** Fluorescent light energy has been shown to exert beneficial effects on the healing of dermatological diseases and the quality of life (QoL) in dogs and their owners, whether used as a standalone treatment or in combination with standard care therapies. Additionally, it was well-tolerated by the dogs. This study emphasizes the significance of considering both the owner's and dog's QoL when evaluating the therapeutic efficacy of dermatological treatments.

## Keywords

Fluorescent Light Energy, Quality of Life, Dog, Dermatology

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## 1. Introduction

Quality of life (QoL) is a term used to evaluate general well-being, and it is defined as "the degree to which an individual enjoys his or her life." In medicine, QoL is often assessed in terms of how it is negatively affected by the disease [1].

Several studies confirmed that dermatological diseases could negatively influence the QoL in dogs and their owners due to nuisance and stress related to the disease [2]. Moreover, time-consuming, tiresome or difficult treatments can also negatively affect the QoL of owners and their pets. A validated questionnaire was established for pets and is frequently used in research to evaluate QoL degradation due to disease or improvement after treatment [2].

Bacterial skin infections are one of the most common canine dermatological problems [3], requiring different therapeutical options but frequently resulting in antimicrobial prescriptions [4]. Although topical therapy can be used successfully as monotherapy in cases of surface and superficial pyoderma [5], a combination with systemic antibiotic therapy in cases of deep infection is often necessary. Current recommendations suggest cases of canine deep pyoderma should be treated with systemic antibiotics at the upper end of their dose rate for a minimum of 4 - 6 weeks, together with topical antiseptic therapy [4]. Treatment should be continued until the infection has resolved visually and cytologically [4] [6]. Antibiotic courses in practice are often much shorter than 4 - 6 weeks due to a lack of owner compliance and financial constraints, especially where large dogs are treated [5].

Treatment compliance is very important for successful therapy and limiting antimicrobial resistance. However, administering oral medication and performing shampoo is not always easy in refractory patients. This may lead to stress for the owner and dog, with subsequent degradation of their relationship, and ultimately to treatment failure [7].

This observation suggests that dermatologists should consider the owner's physical and psychological distress and the social dimension of their dog's con-

dition, as well as the clinical lesions in studies investigating therapeutic efficacy.

Low-energy light therapy, also known as photobiomodulation (PBM), has been shown to have beneficial effects on several animal skin conditions and anti-inflammatory properties [8]. A Fluorescent Light Energy (FLE) system that consists of a blue light-emitting diode (LED) device and a topical photoconverter gel, which, when illuminated by the LED device, emits low-energy light in the form of fluorescence, has shown beneficial effects in the management of dermatological conditions and chronic wounds in humans [5] [9] as well as in the management of different conditions including, interdigital pyoderma, deep pyoderma, wounds, and canine perianal fistulae [10] [11] [12] [13] [14].

The aim of this open, prospective, multicentric clinical study was to evaluate the effect of fluorescent light energy treatment on the quality of life (QoL) of dogs with dermatologic disease.

## 2. Materials and Methods

### *Design of the study*

This study was designed as an open, prospective, multicentric non-controlled and non-randomized study. The dogs enrolled in the study were all client-owned pets. This study was conducted in accordance with local legislation on the use of patients for clinical trials. The owner's written consent was obtained for each case prior to participation.

### *Study sample*

There were no restrictions on age, breed, body weight, or sex for the animals recruited. To be enrolled, dogs had to present deep pyoderma, interdigital furunculosis, pyotraumatic dermatitis, perianal fistula, or wounds. These inclusion criteria had to be validated through clinical examination and complementary exam results. Impression smears and tape stripping had to be performed to confirm the presence of neutrophils, bacteria, and phagocytosis for pyoderma and interdigital furunculosis on typical lesions such as pustules and furuncles. Pyotraumatic dermatitis should have been diagnosed based on anamnestic information, specifically the acute onset of self-induced lesions localized on the head or dorsum. Perianal fistulas and wounds were diagnosed based on anamnestic elements and clinical examination, following the exclusion of differential diagnoses such as sacculitis and neoplasias. There were no restrictions on age, breed, body weight, or sex for the animals recruited. Before enrollment, practitioners were asked to perform skin scrapings and cytology (impression smears and tape stripping) on all dogs to exclude ectoparasites and fungal infections. Dogs were not included if they presented signs of systemic ill health. After enrollment, dogs could be excluded due to poor compliance with the study protocol instructions regarding visits and medication, adverse effects, and the development of any further comorbidities.

### *Questionnaire*

A previously validated questionnaire (**Appendix**) was used. This was com-

posed of 15 questions, each with four possible answers: not at all (score 0), a little (score 1), quite a bit (score 2) and very much (score 3). The 15 questions were subdivided as follows: one question on the general severity of the disease (S, range 0 - 3), seven questions on the quality of life of the dog (QoL1, total score range 0 - 21) and seven questions on the quality of life of the owner (QoL2, total score range 0 - 21).

The quality-of-life questionnaire was given to owners of dogs with dermatological diseases before and after therapeutic intervention.

### ***Therapy***

The therapy consisted in applying the fluorescent light energy once weekly until the clinical resolution was determined. As previously described [5], the FLE procedure consisted of applying an approximate 2 mm layer of the gel on the lesions and illuminating with the blue light-emitting diode (LED) device that delivers noncoherent blue light with a peak wavelength between 440 and 460 nm and a power density between 55 and 129 mW/cm<sup>2</sup>, for 2 minutes, at approximately 5 cm distance. After illumination, the gel was gently removed using sterile gauze dipped in a sterile saline solution. Dogs were kept by their owner during Fluorescent Light Energy application, and no sedation or excessive contention was needed. Two successive illuminations were realized once a week. Concurrent medications as necessary to control symptoms and secondary infections were allowed.

### ***Evaluation of responsiveness to therapy***

Each dog was examined weekly until clinical resolution. At each visit, the dog received a general and a dermatological examination. The primary outcome measure was the improvement in QoL after therapeutic intervention, as evaluated by the owner. The secondary outcome was to assess if Fluorescent Light Energy alone allows dogs to achieve clinical resolution.

### ***Statistics***

The evolution of the total score and the score for each question were analyzed using linear mixed models with time (as a categorical variable) as a fixed effect and the dog as a random effect (to take into account the repeated measurements on each animal).

## **3. Results**

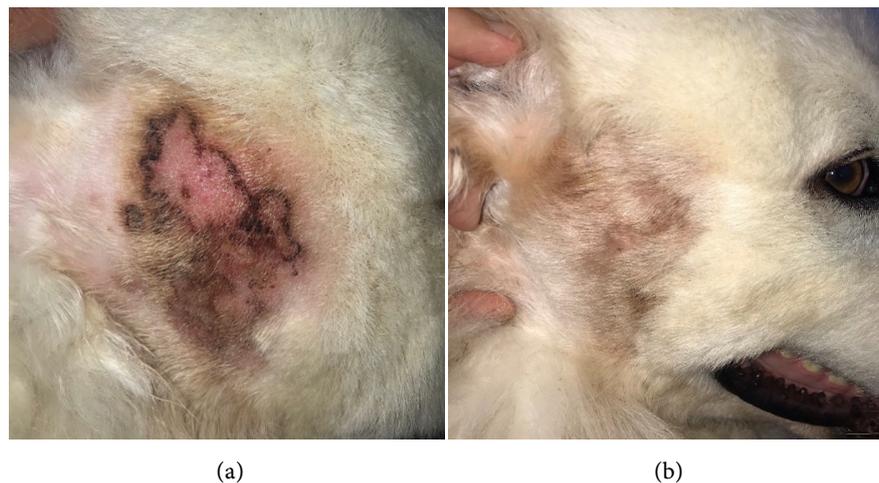
### ***Animals***

Thirty-five dogs were enrolled in the study comprising 25 males (20 castrated) and 10 females (9 spayed). The mean age and weight of the animals were 5 years and 7 months (range 2.4 - 10 years) and 20.2 kg (range 12.18 - 21.30 kg), respectively. French and English Bulldog (12 of 35), Mixed breed dogs (8 of 35), Labrador and golden retrievers (5 of 35 each), West Highland white terriers (4 of 35), German shepherd dogs (3 of 35), Belgian sheepdog (3 of 35) were the most commonly represented breeds. Details of included dogs are presented in **Table 1**.

Thirteen dogs had interdigital furunculosis, 10 had deep pyoderma, 6 had wounds, 4 had pyotraumatic dermatitis, and 2 had perianal fistula on presentation. Eight of 35 dogs were new cases, whereas the remaining 27 were undergoing recrudescence of a prior episode.

Thirty dogs (86%) achieved a clinical resolution: 18 with the Fluorescent Light Energy alone (7 interdigital furunculosis, 4 pyotraumatic dermatitis, 6 deep pyoderma, 4 wounds) (**Figures 1-3**), 12 with the concomitant use of FLE and topical antiseptic shampoo (3 interdigital furunculosis, 4 deep pyoderma, 2 wounds). Five dogs (14%) (3 interdigital furunculosis, 2 perianal fistula) had a partial response and needed other therapies (**Figure 4, Table 1**).

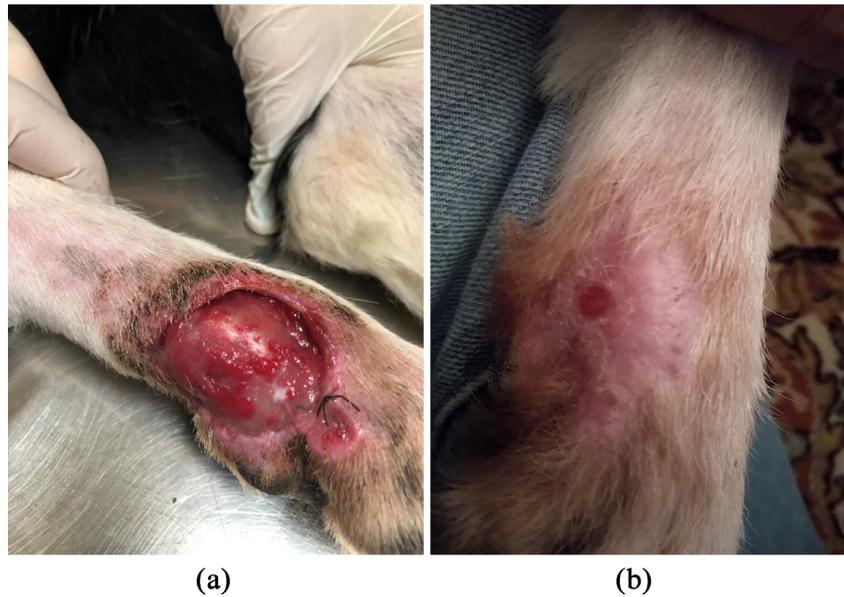
No adverse effect was noticed during the all-time of treatment with FLE.



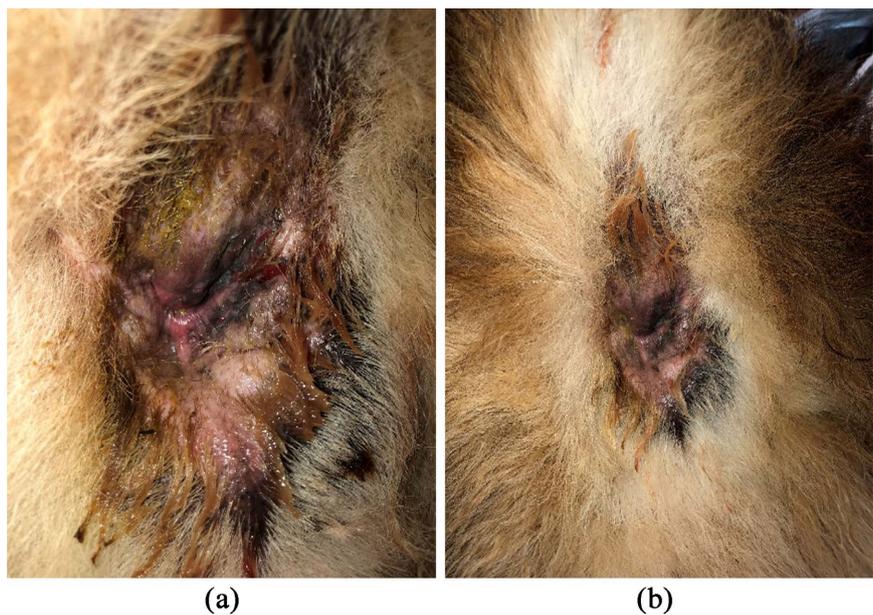
**Figure 1.** Mixed Maremma Shepherd dog with acute pyotraumatic dermatitis treated with fluorescent light energy. (a) Enrolment visit; (b) Week 1.5.



**Figure 2.** Mixed Boxer dog with chronic interdigital furunculosis treated with fluorescent light energy. (a) Enrolment visit; (b) Week 6.



**Figure 3.** Border Collie dog with surgical excision wound treated with fluorescent light energy. (a) Enrolment visit; (b) Week 4.



**Figure 4.** German Shepherd dog with chronic perianal fistula treated with fluorescent light energy. (a) Enrolment visit; (b) Week 4.

### *Quality of Life*

There was a significant improvement in total QoL scores after the therapeutic intervention compared to Day 0 ( $p < 0.0001$ ) with a mean (SD) QoL score before and after therapy of 18.34 and 9.89, respectively (**Table 1**). The QoL was reduced by at least 50% for 74% of the dogs.

When the answers to the individual questions were compared before and after treatment, all questions showed a decrease in scores except for three. The scores for questions 6 (What was the impact of your dog's disease on its relationship

with you, the other family members or other dogs—social relationship in **Table 1**), 13 (How much effect did your dog's disease have on causing emotional distress?—emotional suffering in **Table 1**) and 15 (How much impact did your dog's disease have on the relationship between family members?—family relationship in **Table 1**) were not significantly different ( $p = 0.17$ ,  $p = 0.20$  and  $p = 0.10$ , respectively) but improved (by 46%, 19% and 49% respectively).

Fluorescent light energy (FLE) treatment significantly positively affected the QoL of owners and dogs affected with deep pyoderma, interdigital furunculosis, pyotraumatic dermatitis, perianal fistula or wounds.

92% of the owners observed a positive impact on the QoL of their animals compared to the moment before therapy. Percentage improvement of total QoL scores after the therapeutic intervention compared to before therapy was of 54%.

Considering each disease separately, the diagnoses with higher total scores (*i.e.* worse QoL), in decreasing order, were as follows at D0: perianal fistula (20.95), interdigital furunculosis (19.7), deep pyoderma (17.74), wounds (17.42) and pyotraumatic dermatitis (15.89) (**Table 2**). After the therapeutic intervention, the mean total quality of life (QoL) scores decreased for each disease as follows: perianal fistula (14.05), interdigital furunculosis (10.7), deep pyoderma

**Table 1.** QoL's mean scores for each question before and after therapeutic interventions.

Question	D0	End	p-value*
	Mean	Mean	
Disease severity	2.26	1.11	<0.0001
Behavior/Mood	1.58	0.61	<0.0001
Sleep	0.84	0.32	0.0068
Meals	0.42	0.16	0.0439
Playing/working	1.29	0.50	0.0002
Social relationship	0.61	0.39	0.1724
Changes in habits	0.95	0.53	0.0277
Therapies	1.61	0.76	0.0003
Lost time	2.00	1.08	<0.0001
Physical exhaustion	1.11	0.61	0.0081
Usual activities	1.11	0.66	0.0286
Expenditure	2.13	1.53	0.0044
Emotional suffering	1.39	1.13	0.2011
Physical restlessness	0.58	0.29	0.0441
Family relationship	0.47	0.24	0.1040
Total	18.34	9.89	<0.0001

\*p-value from mixed model with time as fixed effect and dog as random effect.

**Table 2.** QoL's total mean score for each skin disease before (D0) and after therapeutic intervention (End).

Diagnosis	D0 Mean Total QoL	End Mean Total QoL
Perianal fistula	20.95	14.05
Interdigital furunculosis	19.7	10.7
Deep pyoderma	17.74	9.49
Wounds	17.42	8.74
Pyotraumatic dermatitis	15.89	6.47

(9.49), wounds (8.74), and pyotraumatic dermatitis (6.47) (**Table 2**). The results demonstrated that the most significant improvements in QoL after treatment with FLE were observed for pyotraumatic dermatitis (59%), wounds (51%), deep pyoderma, and interdigital furunculosis (46% each), followed by perianal fistula (33%). Furthermore, QoL scores were reduced by at least 50% with FLE for pyotraumatic dermatitis and wounds and by at least 30% for perianal fistula, deep pyoderma, and interdigital furunculosis.

The time between the completion of the pretreatment and the post-treatment questionnaire it depended on the time needed to achieve a clinical resolution. It ranged from 1.5 to 9 weeks, with a median of 4.3 weeks.

#### 4. Discussion

Several studies have evaluated the effectiveness of fluorescent light energy on common dermatoses in dogs. Once or twice weekly application of FLE exerted a beneficial effect on interdigital furunculosis [10] [15], perianal fistula [14], wounds [13] and deep pyoderma [16] healing. Similarly, this study reported successful healing of 86% of dogs with FLE once a week and 14% of improvement with partial remission. Furthermore, 100% of the 4 dogs affected with pyotraumatic dermatitis had a complete remission after 1.5 weeks of FLE. These results confirmed the importance of FLE as a therapeutic option in cases of some bacterial diseases (sometimes alone) and should be emphasized regarding the increasing identification of multidrug resistance skin infections. The median length of treatment (4 weeks) is similar to previous results. It could have been interesting to realize samples for culture and susceptibility testing in cases of interdigital furunculosis, deep pyoderma and wounds to confirm previous results of complete clinical resolution of multidrug resistance skin dermatoses [17].

The study clearly showed that the disease profoundly and negatively affects the QoL of dogs with dermatological diseases and their owners. These results have been previously demonstrated with several diseases: sarcoptic mange, pododermatitis, atopic dermatitis, pemphigus foliaceus, endocrine alopecia (hyperadrenocorticism, hypothyroidism or testicular tumour), otitis, flea allergic dermatitis, demodicosis, pyoderma and cutaneous adverse food reactions [18] [19]. To

the author's knowledge, this is the first time that the evaluation of impact of deep pyoderma, wounds, perianal fistula and pyotraumatic dermatitis on the QoL of dogs and their owners has been assessed. These various dermatoses had a detrimental effect based on the average score of 18.34, highlighting the significance of assessing both QoL1 and QoL2 not only during clinical trials but also in everyday medical practice.

As in previous studies, the evaluation of QoL can be interesting when studying therapeutic options [20] [21] [22]. Although patient care remains of primary focus, considering the client's experience may be helpful, as many companion animal skin diseases require long-term client management. The additional care and resources required to manage skin disease in a companion animal could lead to "caregiver burden", a term referring to the problems encountered while providing informal care for a loved one with an illness [7]. When prescribing therapies, veterinarians not only have to consider the effectiveness of the prescribed drugs but also the owner's compliance. Conditions like deep pyoderma, interdigital furunculosis and perianal fistula often require a multitherapeutic approach composed of prolonged courses of antibiotics, and topical antiseptics, eventually associated with topical or systemic anti-inflammatory drugs. Manipulation of the lesions can cause aggressive behaviour and stress in dogs, especially if the procedure is painful.

Furthermore, owners may also experience stress due to physical difficulties in treating large or refractory dogs. People also fail to administer drugs to their pets due to omission or difficult schedule with their fixed daily routines. All these factors influence the success of a course of treatment and the therapeutic outcome. By being performed once a week by the veterinarian, the FLE system represents an effective and owner-compliant alternative to conventional therapy. Previous studies have shown that, depending on the condition, FLE may be an effective sole treatment eliminating the need for, or decreasing the length of administering systemic antibiotics and it has the potential to accelerate time to clinical resolution. This present study confirmed the hypothesis that treatment with fluorescent light energy system significantly improved the QoL of dogs and their owners. Using the individual mean score of the questions (range 0 - 3), the highest scoring items in QoL1 before therapeutic interventions were: disturbances caused by therapies, followed by disturbances in the animal's sleep and behavior/mood. At the end of the study disturbances caused by therapies improved by 53% compared to the beginning of the study. Fluorescent Light Energy supports owners as much as possible to promote effective compliance and relieve them of administration of home therapies.

In this study, the highest scores in QoL2 before therapeutic interventions were related to concerns about expenses, lost time, and emotional distress. Such results are consistent with other studies [2] [18] [23].

By the end of the study, there was a significant 46% improvement in the time devoted to managing the dog's disease, including therapy administration and

related activities, compared to the beginning of the study.

The present study is limited by the number of enrolled dogs. It would have been informative to include a lesional score to enhance the precision in assessing treatment effectiveness. However, each disease had varying lesional scores that were not yet validated, and the study's primary focus was measuring the impact on QoL. Conducting further studies with a control group receiving disease treatment without FLE would be valuable in confirming our findings.

In conclusion, we have demonstrated that fluorescent light energy exerts beneficial effect healing of dermatological diseases as well as QoL in dogs and their owners whenever it is used as the sole treatment or associated with standard-of-care therapies.

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### Conflicts of Interest

Oscar Fantini is a Vetoquinol employee, and the authors declare no conflicts of interest regarding the publication of this paper.

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## Appendix: Questionnaire on the Quality of Life of Dogs with Skin Disease and Their Owners

Please read the questionnaire carefully and tick one answer only

1. How severe and disturbing has your dog's disease been?  
 not at all       a little     quite a bit     very much
2. What was the impact of your dog's disease on its behaviour and/or mood? (More lazy, more nervous, more aggressive, etc.)  
 not at all       a little     quite a bit     very much
3. How much was your dog's sleep disturbed by the disease?  
 not at all       a little     quite a bit     very much
4. How much were your dog's meals disturbed by the disease? (It has no appetite, it scratches during meals, it does not like special food, etc.)  
 not at all       a little     quite a bit     very much
5. How much were your dog's playing or working activities disturbed by the disease? (It is more lazy, nervous, itchy, etc.)  
 not at all       a little     quite a bit     very much
6. What was the impact of your dog's disease on its relationship with you, the other family members or other dogs? (Due to mood changes, presence of skin lesions, etc.)  
 not at all       a little     quite a bit     very much
7. How much has your dog's disease changed its usual habits? (Change in place where he is allowed to sleep, live, eat, way it which it is walked, etc.)  
 not at all       a little     quite a bit     very much
8. How much was the dog disturbed by the administration of therapies (Shampoos, sprays, tablets, injections, ear cleaning and drops, etc.)  
 not at all       a little     quite a bit     very much
9. How much time did you lose for your dog's disease? (Administration of therapies, shampooing, home cleaning, cooking, veterinary consultations, etc.)  
 not at all       a little     quite a bit     very much
10. How much effect had your dog's disease on your tiredness? (Extra cleaning, cooking, shampooing, etc.)  
 not at all       a little     quite a bit     very much
11. How much were your usual activities and/or those of your family disturbed by your dog's disease? (Leisure, vacation, walks, work, hunting, etc.)  
 not at all       a little     quite a bit     very much

12. How much impact did your dog's disease have on your expenditure? (Cost of treatment, veterinarian, etc.)
- not at all       a little     quite a bit     very much
13. How much effect did your dog's disease have on causing emotional distress (Feeling of guilt, powerlessness, sorrow, regret, anxiety, nuisance, disgust, anger, frustration, etc.)
- not at all       a little     quite a bit     very much
14. How much physical uneasiness/discomfort did your experience due to your dog's disease? (Offending odour, feeling of dirtiness at home, aesthetic nuisance, etc.)
- not at all       a little     quite a bit     very much
15. How much impact did your dog's disease have on the relationship between family members? (Between spouses, between parents and sons, with relatives and friends, etc.)
- not at all       a little     quite a bit     very much