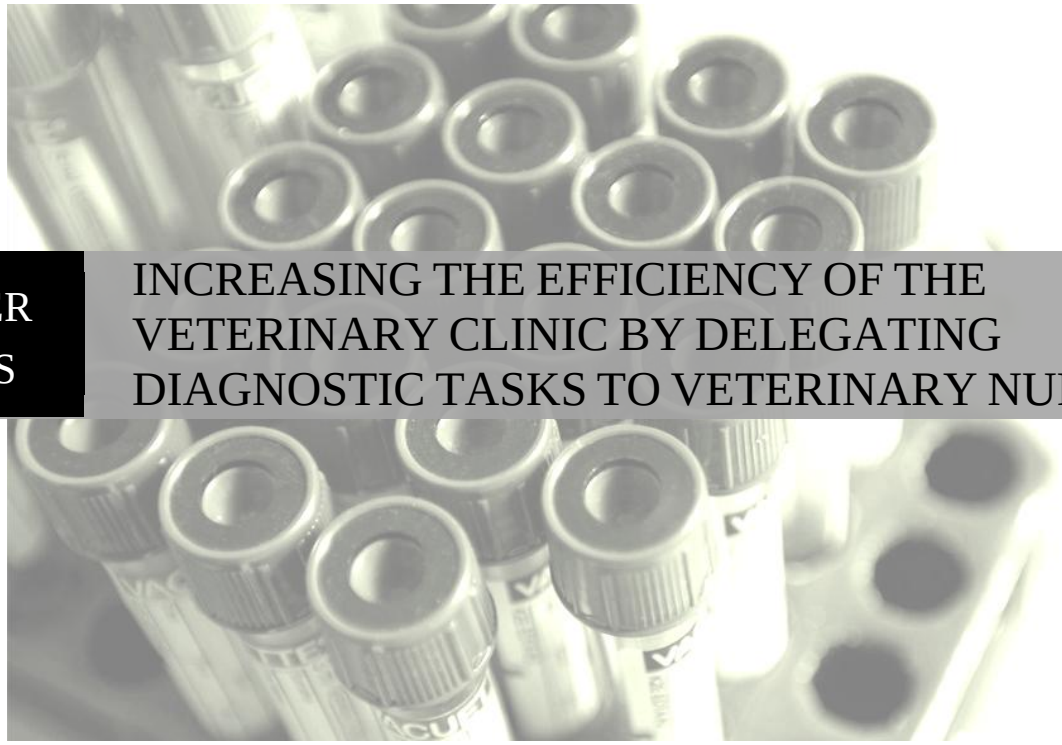
MASTER THESIS

INCREASING THE EFFICIENCY OF THE VETERINARY CLINIC BY DELEGATING DIAGNOSTIC TASKS TO VETERINARY NURSES



Date: April 3, 2019

Master medicine of companion animals | Cécile Vastenburg

Contents

Abstract

Introduction – It has been shown in human healthcare that delegating tasks to nursing staff increases the efficiency due to improving patient flow, patient care and the overall work environment. The objective of this study is to examine whether this method can improve the efficiency of a veterinary clinic by limiting waiting time for the pet owner and consult duration by delegating the additional diagnostics to the veterinary nurse.

Method and Materials – Six veterinary clinics in the Netherlands from AniCura were visited during four weeks. For each consult with additional diagnostics, several variables were recorded: gender and work experience of the veterinarian, work experience of the veterinary nurse, consult duration, waiting time for the pet owner, who handled the additional diagnostics, the type of diagnostics, the moment the results were communicated and general information from each clinic (ex. clinic size and years in business). The results were analyzed in SPSS.

Results – The consult duration was not significantly shorter when the veterinary nurse handled the diagnostics. A regression analysis of all the measured variables during consults showed that the gender of the veterinarian ($p=0,035$) and the clinic size ($p=0,043$) were significant predictors of the consult duration. The waiting time was significantly shorter when the veterinary nurse handled the diagnostics ($p=0,002$). A regression analysis of all the measured variables during consults showed that the handler of the additional diagnostics ($p=0,019$), the type of diagnostics ($p=0,017$) and the location ($p=0,023$) were significant predictors of the waiting time.

Conclusion – This study has shown that delegating the additional diagnostics to the veterinary nurses during consults, significantly decreases the waiting time for the pet owner. However, there are still factors that are unclear and need to be further researched.

1 – Introduction

There have been a lot of changes in veterinary medicine in recent years. Animals have become an important part of our lives and their owners have become very interested in their health, especially when it comes to prevention (Evers et al., 2018). Some clinics have joined forces to form a group of clinics in order to work more efficiently and share knowledge between these clinics (Evers et al., 2018; Marktplan.nl, 2015; Rabobank, 2017). It is expected that veterinary clinics will gain less revenue from sales, due to online competition, and will have to rely more on consults and surgeries for their income (Charles-Jones et al., 2003; Evers et al., 2018; Marktplan.nl, 2015; Rabobank, 2017). It is also expected that the total revenue for companion animals will increase slightly over the next few years (Rabobank, 2017). Therefore, it has become increasingly important to use the clinic's business hours as productively as possible.

Increasing efficiency and process optimization has been a hot topic in human healthcare in recent years. Since hospitals have started to optimize their processes, more hospital work is being delegated to the general practitioners, who are, as a result, searching for ways to handle the extra work load as efficient as possible (Charles-Jones et al., 2003). In the '90s general practitioners started delegating work to their nurses. While this began with management of chronic diseases and prevention, recent developments have caused doctors to delegate acute medical work (Charles-Jones et al., 2003). This has caused a change in their professional relationship and hierarchy. Charles-Jones et al (2003) investigated this phenomenon in the United Kingdom. They found that clinics divided patients into classes of medical importance. These classes determine which path the patient takes through the clinic. Easy medical cases are delegated to the nurses, so the doctors remain available for the serious cases. This has caused new levels of doctors and nurses to arise within their own groups. The practice as a whole becomes more flexible this way and there are more people available to deal with the different classes of patients (Charles-Jones et al., 2003). The staff members, who are less experienced, are also the least expensive. Directing simple medical cases to these staff members will not only save a lot of time, it will also be a lot more cost effective (Charles-Jones et al., 2003; Fanning & Shepherd, 2010; Kinnison et al., 2014).

The delegation of healthcare to other professions and/or staff members is also a hot topic in de human dental health care. Evans et al (2007) followed seventeen dental clinics and 850 patients. They found that on average 35.3% of patient visits and 43% of clinical time were devoted to tasks, which could have been performed by other professionals, like dental hygienists and therapists. If these professions were to be awarded with further diagnostic rights, this could increase to up to 69.5% of the patient visits and 58.4% of clinical time.

It's possible that delegating easier cases to less knowledgeable staff members can also be the answer for the veterinary practice as Kinnison et al (2014) mentioned. They found that this method of patient care results in a veterinarian who can focus more on diagnostics, instead of caring tasks. This benefits the veterinarian and it recognizes other employees, such as nurses, as experts in their fields. It is suggested that by working together, the practice will be better than the sum of its parts, while bringing together everyone's knowledge (Kinnison et al., 2014). Other contributing factors to a better and more efficient practice comprise of working towards a common goal, a noticeable team effort in regards to patient care, encouraging professional development, social events for the staff, an open discussion of conflicts, rewarding successes and recognizing every individual for their contribution (Moore et al., 2014; Kinnison et al., 2015; Savino & Sierra, 2018).

However, efficiency isn't the only thing to gain. Research in human healthcare has shown that patients, who were collaboratively treated, rated their care higher than patients who weren't (Patterson & McMurray, 2003). Patterson and McMurray (2003) also found other benefits, such as a higher satisfaction rate, less broken appointments, enhanced patience compliance, a decline in hospitalization and ultimately fewer visits to physicians. The patients aren't the only ones who experience the benefits. Research has shown that nurses who participated in a collaborative practice experienced a significantly higher job satisfaction (Moore et al., 2014; Patterson & McMurray, 2003).

There are some promising results in the United Kingdom in a few veterinary clinics, where veterinary nurses booked their own consults (Kinnison et al., 2014). During these consults they provided information about health and prevention to owners. This also allowed them to sell prevention items such as flea and worm treatments. This not only improved the morale of the nurses, it also allowed for longer appointments, giving the owners more opportunities to discuss concerns and the health of their pet. Kinnison et al (2014) also experienced that owners felt more comfortable discussing their concerns and questions with the nurses, instead of the veterinarians. These consults increased income, client retention, recommendations and the number of patients. The promising results are also briefly mentioned in an article by Lambert (2012), but without any details.

Despite a lot of research in human healthcare and brief mentions about research in veterinary clinics, there hasn't been much research done in regards to a (new) distribution of tasks in veterinary medicine. It is unclear whether veterinary clinics in the Netherlands are currently delegating extra tasks and/or consults to their veterinary nurses and if this could possibly be more efficient.

1.1 Overall objective

The overall objective of this study is to discover if veterinary nurses are currently being used to their full potential and whether clinics can increase their efficiency by delegating certain tasks to the veterinary nurses.

1.2 Research questions

- Can the average waiting time for owners and patients be reduced by delegating the additional diagnostics during the consults to the veterinary nurses?
- Can the average consult duration be reduced if veterinarians delegate the additional diagnostics to their veterinary nurses?
- Do veterinarians with more work experience, delegate additional diagnostics during consults more often to their nurses, than veterinarians with less experience?
- Do nurses, who have more work experience, get more additional diagnostics handed to them by veterinarians, compared to nurses with less work experience?
- Is there a difference between male and female veterinarians when it comes to delegating the additional diagnostics during consults?
- When are the results of the additional diagnostics communicated to the owner of the patient?

2 – Materials and Method

2.1 Materials

For this study six veterinary clinics of AniCura in the Netherlands were visited in January and February 2019 over the course of four weeks. AniCura, originally a Scandinavian company, is a group of veterinarian clinics who are now present in ten European countries and include 250 veterinary clinics (Anicura, 2019). During the study several veterinarians from each clinic were followed over the course of three days. The objective was to follow one veterinarian for each of the six clinics. Due to scheduling, multiple establishments per clinic and part time staff members, this aim was not achieved at any of the six clinics. The population consisted of patients from these six clinics who needed additional diagnostics.

2.2 Method

During these visits to the veterinary clinics, the student was present during appointments between the veterinarians with owners and their pets. Whenever a patient needed additional diagnostics, for example blood analysis, urine analysis or x-rays, several data was recorded. For each of these appointments the following data was collected: gender of the veterinarian (male/female), the work experience of the veterinarian (in years), the time the consult started, the time the consult finished, the total consult duration (in min:sec), the type of additional diagnostics, who handled the additional diagnostics (veterinarian/veterinary nurse), the work experience of the veterinary nurse involved with the additional diagnostics (in years), the waiting time (defined as the amount of time in minutes and seconds that the owners had to wait after the sample is collected, until the consult continued), the moment the results were communicated to the owner, the size of the clinic and the amount of years the clinic has been in business. When there were multiple diagnostics during one consult, the same data was recorded for each of the diagnostics. Time was measured with the standard clock and stopwatch app on a mobile phone.

The aim was to achieve a sample of 30 moments of additional diagnostics per clinic (180 in total). However, the desired amount of data was not achieved. A sample of 80 moments of additional diagnostics in total was recorded over all six clinics. This was mostly due to the inability to schedule consults with (sick) patients that need additional diagnostics ahead of time and the dependability on what type of patients and consults were presented to the veterinarians.

The data was collected on paper, transferred to Microsoft Office Excel and further analysed.

2.3 Statistical analysis

The collected data was transferred to SPSS (version 20) to be further analyzed. Descriptive statistics were determined for all independent variables, by using frequencies, median and mean for the categorical variables gender (male/female), handler of additional diagnostics (veterinarian/veterinary nurse), type of diagnostics (blood sample, x-ray, ultrasound, cytology, urine sample, feces sample, swab, blood pressure, microscopy), moment of communicating the results (directly during the consult, after a waiting period in the waiting room, later by phone), work experience of the veterinarian (<5 years or ≥ 5 years), work experience of the veterinary nurse (<5 years/≥ 5 years), location (clinic 1-6), clinic size (small (0-10 employees), medium (11-20 employees), large (21-30 employees)) and the years each clinic has been in business (new (0-10 years), medium (11-20 years), old (21-30 years)). The work experience of the veterinarian and the veterinary nurse was determined as less than five years or equal to or more than five years, based on the assumption that the first five years are generally known as the most difficult years, as these are the years where veterinarians and veterinary nurses have a lot to learn and get used to.

Consult duration (min:sec) and waiting time (min:sec) were further analyzed in combination with the variables mentioned above with independent sample t-tests. Box plots were made with SPSS (version 20) to visualize the results of the consult duration (min:sec) and waiting time (min:sec) in comparison with the measured variables.
There was a Chi-square test performed to determine if there is a significant difference between all six clinics compared with who handles the additional diagnostics. Because the data did not meet the assumption of required amount of data, the likelihood ratio was used to determine the significance (MgHugh, 2013). The likelihood ratio (LR) will be reported with the result, the degrees of freedom and the significant value (p).
Chi-square tests were also performed to determine if there was a significant difference between the gender of the veterinarian and who handles the additional diagnostics and to determine a significant difference between who handles the additional diagnostics and the work experience of the veterinarian (<5 years or ≥ 5 years). The data for both tests met the assumptions of the analysis.
The results of the Chi-square tests (χ^2) will be reported with the degrees of freedom, the result of the analysis and the significant value (p).

Because it was considered likely that multiple variables contributed to both the consult duration and the waiting time, several multiple linear regression analyses were performed.
The following multiple linear regression analyses were performed – with varying combinations of the measured data – to predict the average consult duration, based upon;

1. The gender of the veterinarian, the work experience of the veterinarian (< 5 years or ≥ 5 years), the person who handles the additional diagnostics (veterinarian/veterinary nurse), the moment the results were communicated to the owner (directly during the consult, after a waiting period in the waiting room, later by phone), the type of additional diagnostics (blood sample, x-ray, ultrasound, cytology, urine sample, feces sample, swab, blood pressure, microscopy), the clinic size (0-10, 11-20 or 21-30 employees), the years in business (0-10 years, 11-20 years, 21-30 years) and the different locations (clinics 1-6).
2. The gender of the veterinarian, the work experience of the veterinarian (< 5 years or ≥ 5 years), the person who handles the additional diagnostics (veterinarian/veterinary nurse), the moment the results were communicated to the owner (directly during the consult, after a waiting period in the waiting room, later by phone), the clinic size (0-10, 11-20 or 21-30 employees), the years in business (0-10 years, 11-20 years, 21-30 years) and the different locations (clinics 1-6), which were only measured during the consults with blood samples. This regression analysis was performed due to the fact that blood samples were by far the biggest group of diagnostic type (N=38).
3. The six separate locations.*****
4. The gender and work experience (< 5 years or ≥ 5 years) of the veterinarian
5. The type of diagnostics (blood sample, x-ray, ultrasound, cytology, urine sample, feces sample, swab, blood pressure, microscopy) and who handles the additional diagnostics (veterinarian/veterinary nurse).
6. The work experience of the veterinarian (< 5 years or ≥ 5 years) and the years that the clinics have been in business (0-10 years, 11-20 years, 21-30 years).*****

Preliminary analyses were performed to be certain that there were no violations of the assumptions of linearity, multicollinearity and normality. For analysis 3 and 6 (*), the assumptions initially weren't met, after which the data was transformed to logarithms.

The following multiple linear regression analysis were performed – with varying combinations of the measured data – to predict the average waiting time, based upon;

7. The gender of the veterinarian, the work experience of the veterinarian (< 5 years or ≥ 5 years), the person who handles the additional diagnostics (veterinarian/veterinary nurse), the moment the results were communicated to the owner (directly during the consult, after a waiting period in the waiting room, later by phone), the type of additional diagnostics (blood sample, x-ray, ultrasound, cytology, urine sample, feces sample, swab, blood pressure, microscopy), the clinic size (0-10, 11-20 or 21-30 employees), the years in business (0-10 years, 11-20 years, 21-30 years) and the different locations (clinics 1-6).*****
8. The gender of the veterinarian, the work experience of the veterinarian (< 5 years or ≥ 5 years), the person who handles the additional diagnostics (veterinarian/veterinary nurse), the moment the results were communicated to the owner (directly during the consult, after a waiting period in the waiting room, later by phone), the clinic size (0-10, 11-20 or 21-30 employees), the years in business (0-10 years, 11-20 years, 21-30 years) and the different locations (clinics 1-6), which were only measured during the consults with blood samples. This regression analysis was performed due to the fact that blood samples were by far the biggest group of diagnostic type (N=38).*****
9. The gender and work experience (< 5 years or ≥ 5 years) of the veterinarian.*****
10. The type of diagnostics (blood sample, x-ray, ultrasound, cytology, urine sample, feces sample, swab, blood pressure, microscopy) and who handles the additional diagnostics (veterinarian/veterinary nurse).*****
11. The work experience of the veterinarian (< 5 years or ≥ 5 years) and the years that the clinics have been in business (0-10 years, 11-20 years, 21-30 years). *****
12. The six separate locations. *****

Preliminary analyses were performed to be certain that there were no violations of the assumptions of linearity, multicollinearity and normality. For analyses 7-12 (*****) the assumptions initially weren't met, after which the data was transformed to logarithms.

The results of all multiple linear regression analyses will be reported with the F-value, the degrees of freedom, the significance value (p) and the R-squared (R^2). The beta coefficient (B) and the significance value (p) of the separate variable groups will also be reported, when necessary. The parameter estimates were analyzed for all of the multiple linear regression analyses, to determine any significant effects inside the different variable groups. The logarithms for the calculated beta coefficients (B) for the multiple linear regression analyses were calculated back to the geometrical mean.
G*Power (version 3.1.9.4) was used to perform a power analysis– using data from this study – to calculate the desired sample size is for regression analyses 1 and 7 for future research.
The level of statistical significant difference for all the analyses for this article is set at $p < 0,05$.

3 – Results

3.1 Study participants

Participating clinics (table 1) ranged from six to 26 employees (mean: 16,1 median: 15,5). These veterinary clinics were in business for seven to 22 years (mean: 14,7; median: 13). The number of veterinarians in each clinic ranged from three to fifteen (mean: 6,5; median: 5). The number of veterinary nurses ranged from three to fifteen (mean: 9,7; median: 10,5) per clinic. Two to five veterinarians were followed per clinic (mean: 3,2; median: 3), with 19 veterinarians in total over all six clinics. Their work experience ranged from 0,5 to 29 years (mean: 13,3; median: 17,0). Figure 1 shows the distribution of the work experience of the veterinarians in comparison to how long the clinics have been in business. Five (26,3%) of the veterinarians who were followed were male and 14 (73,7%) were female. The work experience of the veterinary nurses ranged from zero to nineteen years (mean: 7,8; median: 7). All veterinary nurses were female.

Table 1. General information of the six veterinary clinics in the Netherlands involved in this study

Clinic	Total employees	Veterinarians	Veterinary nurses	Years in business
1	6	3	3	7
2	15	5	10	14
3	10	4	6	22
4	16[1]	5	10	21
5	22	7	15	12
6	28	15[2]	13	12

[1] One employee is solely for administration work

[2] Nine veterinarians for companion animals and six veterinarians for farm animals and horses

3.2 Additional diagnostics

A total of 80 moments of additional diagnostics were recorded during consults over all six clinics. Figure 2 shows the distribution of the different variations of data of additional diagnostics that was collected during consults at the six veterinary clinics. 38 (47,5%) of the collected data was collected from consults where blood samples were taken from patients for further diagnostic testing and is therefore the biggest group of data. In comparison, there were relatively few consults where there were additional test necessary in the form of microscopy (n = 2) and measuring the blood pressure (n = 2), both 2,5% of the total amount of data.

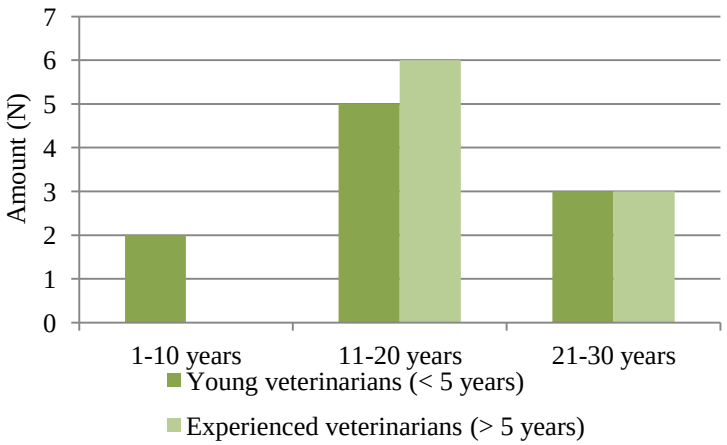


Figure 1. Distribution of the amount of veterinarians divided by work experience compared to the amount of years the veterinary clinics have been in business.

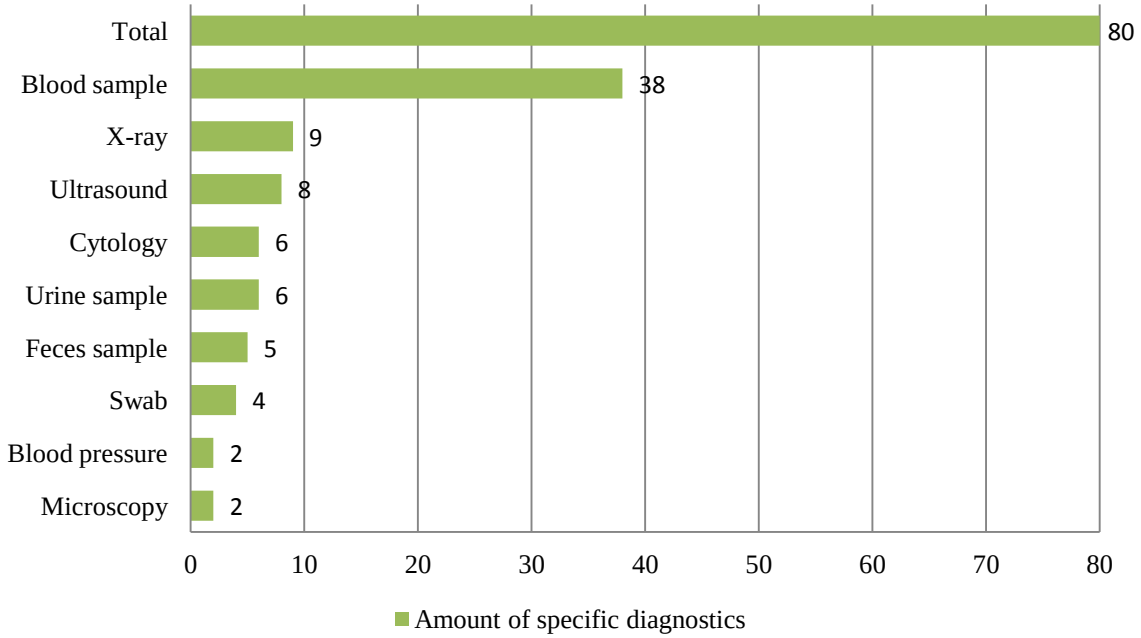


Figure 2. The distribution of the additional diagnostics – collected during consults – from all six clinics.

3.3 Division of tasks

Figure 3 shows the division of tasks between veterinarians and veterinary nurses in regards to additional diagnostics per clinic. Clinics one, two and five delegated the majority of the additional diagnostics during consults to the veterinary nurse. While the veterinarians at clinics three and six mostly handled the additional diagnostics themselves. Clinic four used both the veterinarian and the veterinary nurse an equal amount of times. The differences between the clinics were not significant (LR (5) =10,38, p=0,065).

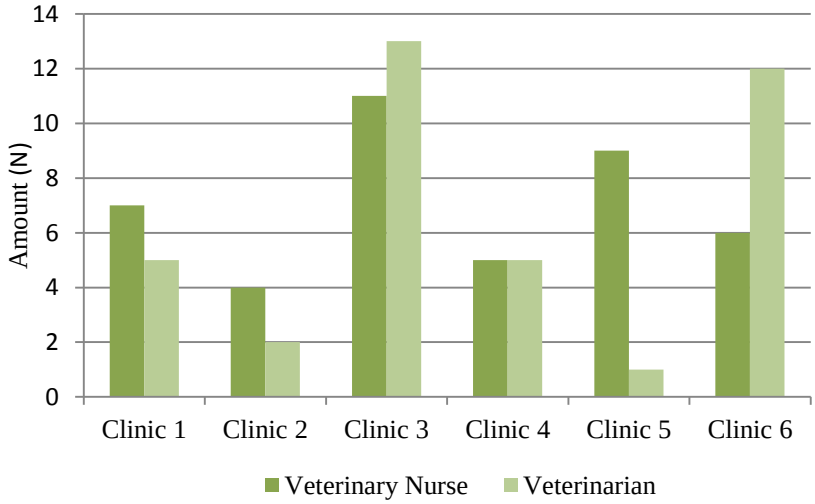


Figure 3. The division of who handled the additional diagnostics during consults at each of the visited clinics.

There were nineteen (23,8%) measurements done during consults with a male veterinarian and 61 (76,2%) during consults with a female veterinarian. In figure 4 it is shown that male veterinarians delegate 68% (13) of the additional diagnostics to veterinary nurses, while figure 5 shows that female veterinarians delegate 48% (29) of the additional diagnostics to their veterinary nurses. The difference between male and female veterinarians in regards to delegating tasks was not significant ($\chi^2(1) = 2,53$, p=0,112).

When it comes to work experience of the veterinarians, there wasn't a significant difference in regards to the delegation of additional diagnostics ($\chi^2(1) = 0,15$, p=0,696). The average work experience of veterinarians who delegate the additional diagnostics to the veterinary nurse was 13,4 years (median: 17). While the average work experience of veterinarians who handled this themselves was 13,3 years (median: 17).

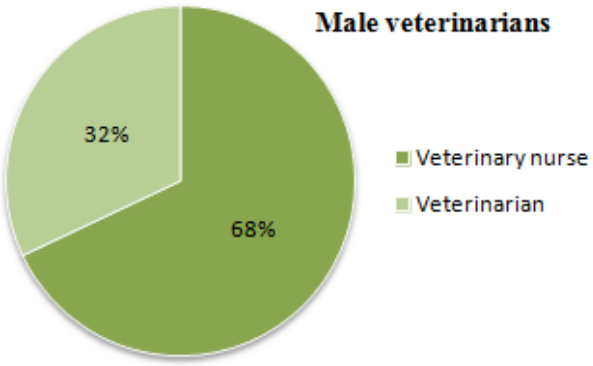


Figure 4. The distribution of the delegation of the additional diagnostics for male veterinarians

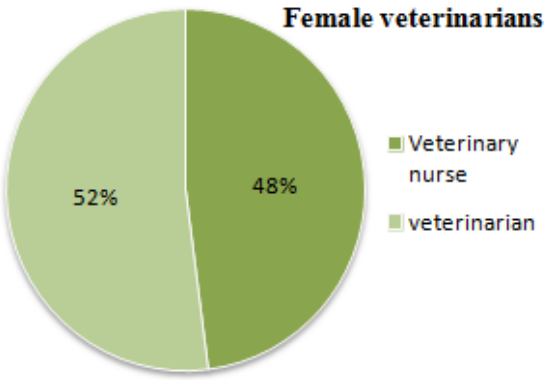


Figure 5. The distribution of the delegation of the additional diagnostics for female veterinarians

The work experience of the veterinary nurses involved was also taken into account. When the veterinary nurses are divided by work experience (figure 6), it shows that fourteen out of all 42 measurements (33%) with veterinary nurses were done with inexperienced veterinary nurses. 28 out of 42 measurements (67%) were done with experienced veterinary nurses with five years or more work experience.

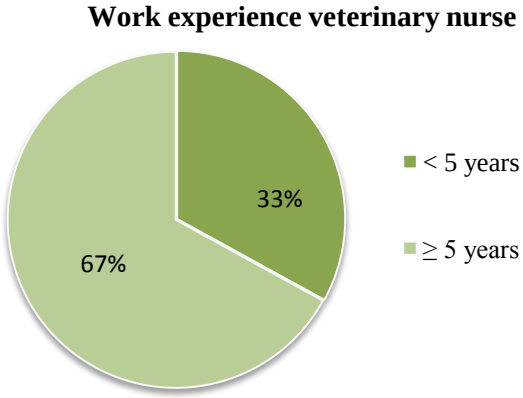


Figure 6. The work experience in years for the veterinary nurses who handled the additional diagnostics

3.4 Communication of results

For every consult with additional diagnostics, the moment that the veterinarian communicated the results of the tests to the pet owner was recorded. This moment varied from directly during the consult with none or minimal waiting time (n=33) to a little later during the consult after the owner went back to the waiting room to wait for the results (n=17) and to a phone call later during the day or after one or more days by the veterinarian (n=30).

3.5 Consult duration

The consult duration varied from two minutes to 52 minutes (mean: 21 minutes and 19 seconds; median: 20 minutes). Figure 7 shows the consult duration for each clinic, depending on which staff member (veterinarian or veterinary nurse) handled the additional diagnostics. As is shown, clinic 1 and 3 have the biggest variance in consult duration. Clinic 4 had the smallest variance, though there were two outliers – one relatively long consult (25 minutes) and one relatively short consult (9 minutes). There is no variance for the veterinarian for clinic 5, as there was only one data for this location. The location (regression analysis 3) was a significant predictor for the consult duration ($F(1,78) = 10{,}627$ $p=0{,}002$) with $R^2=0{,}120$. When looked at the parameter estimates clinics 1 ($B = 2{,}03$, $p = 0{,}003$) and 3 ($B = 1{,}66$, $p = 0{,}011$) had a significantly longer consult duration than clinic 6, the reference value. When all the data is combined (figure 8), it reveals that the consult duration shows less variance when the veterinary nurse handled the additional diagnostics. However, the consult duration was not significantly shorter ($p = 0{,}376$). The outlier point for the veterinary nurse is one consult that was relatively longer than the other (52 minutes).

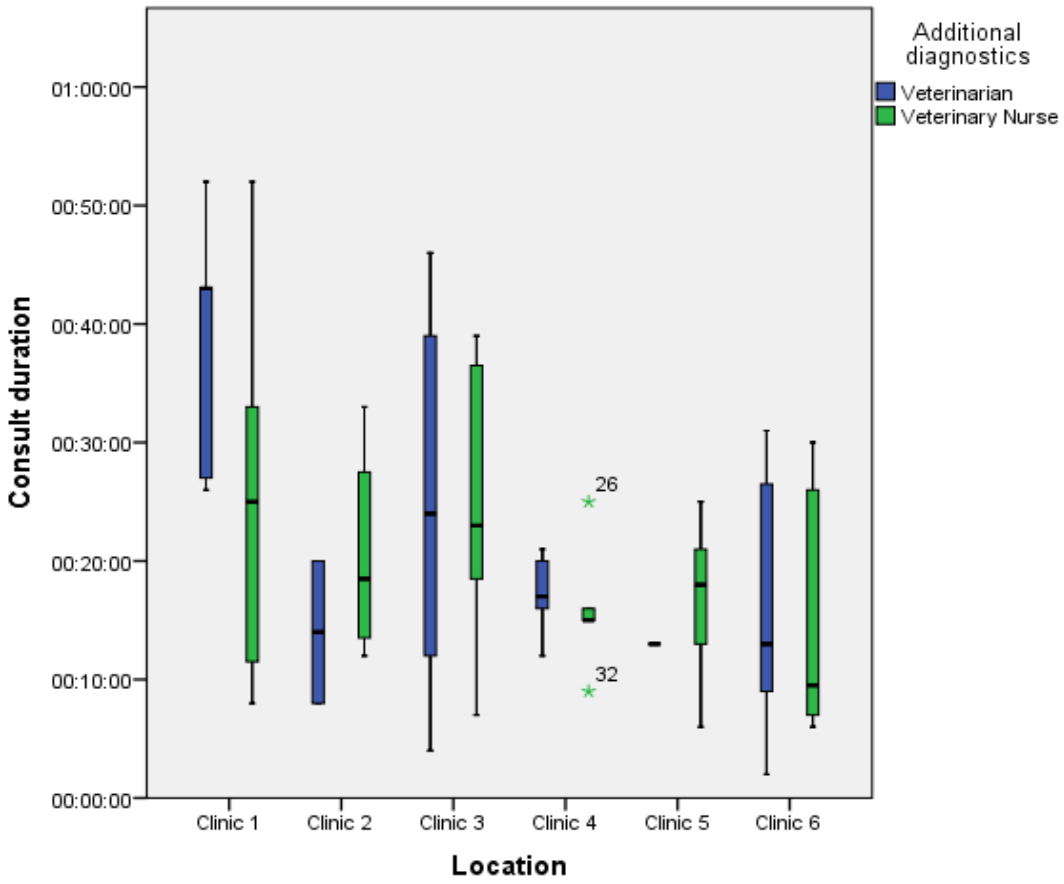


Figure 7. The consult duration (in h:mm:ss) for each of the six clinics depending on which staff member handled the additional diagnostics.

Figure 9 shows the consult duration depending on who handled the additional diagnostics compared to the amount of staff members for each clinic. The clinics were divided into three groups: between 0 and 10 (small), between 10 and 20 (medium) and between 20 and 30 employees (large). As is shown, medium and large clinics had relatively less variance than the small clinics. The outlier for the medium clinics was because of one relatively longer consult (33 minutes), where the veterinary nurse handled the additional diagnostics. The differences between the small and medium clinics ($p = 0{,}001$) and the small and the large clinics ($p < 0{,}001$) were significant. The difference in average consult time between the medium and large clinics was not significant ($p = 0{,}626$).

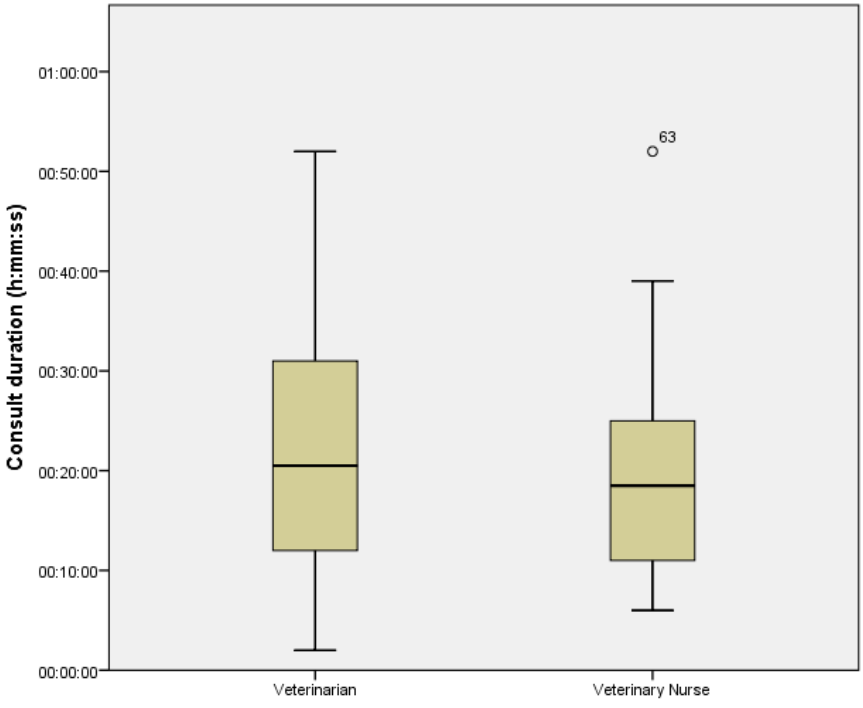


Figure 8. The consult duration (in h:mm:ss) of all the combined data, depending on who handled the additional diagnostics.

When the average consult duration is compared to the work experience of the veterinarian, the veterinarians with less than five years of work experience have an average consult time of 22 minutes and 54 seconds. The veterinarians with a work experience of five years or more have an average consult time of 20 minutes and 28 seconds. The difference between these two groups was not significant (p = 0,395). When looked at the work experience of veterinary nurses, defined as less than five years and equal to or more than five years, the difference in consult duration was not significant (p = 0,213).

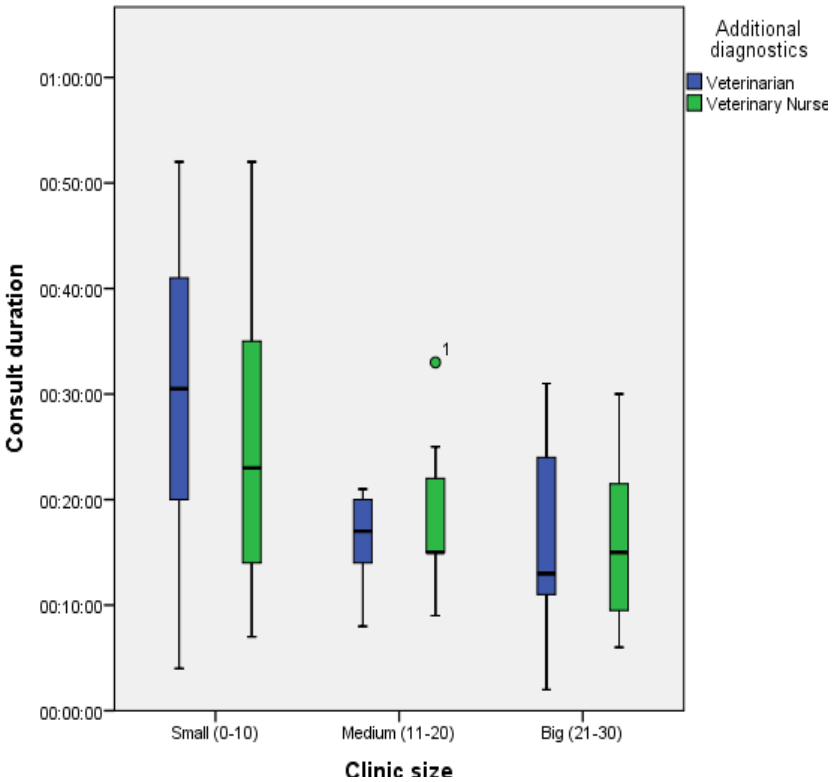


Figure 9. The consult duration (in hh:mm:ss) for small (0-10 employees), medium (11-20 employees) and big (21-30 employees) clinics, compared with who handled the additional diagnostics.

The male veterinarians have an average consult duration of 17 minutes and 3 seconds, while the female veterinarians have average consult duration of 22 minutes and 38 seconds. This difference was significant (p = 0,038). When the gender was paired with the work experience of the veterinarian (regression analysis 4), neither were significant predictors for the consult duration (F (2,77) = 1,590, p=0,211) with R^2=0,040.

Figure 10 shows the consult duration for each type of additional diagnostics and the staff member who handled them. It shows that the consult duration, divided by type of diagnostics, had a lot of variations between the separate groups. The outlier for veterinary nurses with blood samples was due to a consult that lasted relatively longer than the other consults (52 minutes). Consults with cytology and swabs had little variance in consult duration for the veterinary nurse, because there was only one data recorded. Consults with urine samples, where the veterinarian handled the diagnostics, have no variance because there was only one data recorded. No data was available for the veterinary nurse during consults with blood pressure and microscopy, causing them to be absent from the figure. Neither the type nor the handler of the diagnostics (regression analysis 5) were significant predictors for the consult duration (F (2, 77) = 0,438, p=0,647) with R^2=0,011.

Figure 11 shows the consult duration depending on the moment that the results were communicated to the pet owner. As shown, when the owner waited in the waiting room for the results or when the owner received the results by phone there is less variance in the consult duration and these consults appear to be relatively shorter. While consults where the owner receives the results directly during the consult without a separate waiting time show a lot of variance in the consult duration. The difference in consult duration between communicating the results directly and waiting (p = 0,441) and between communicating the results directly and by phone (p = 0,085) were not significant. The difference between communicating the results after a waiting period or at a later moment by phone was significant (p = 0,010).

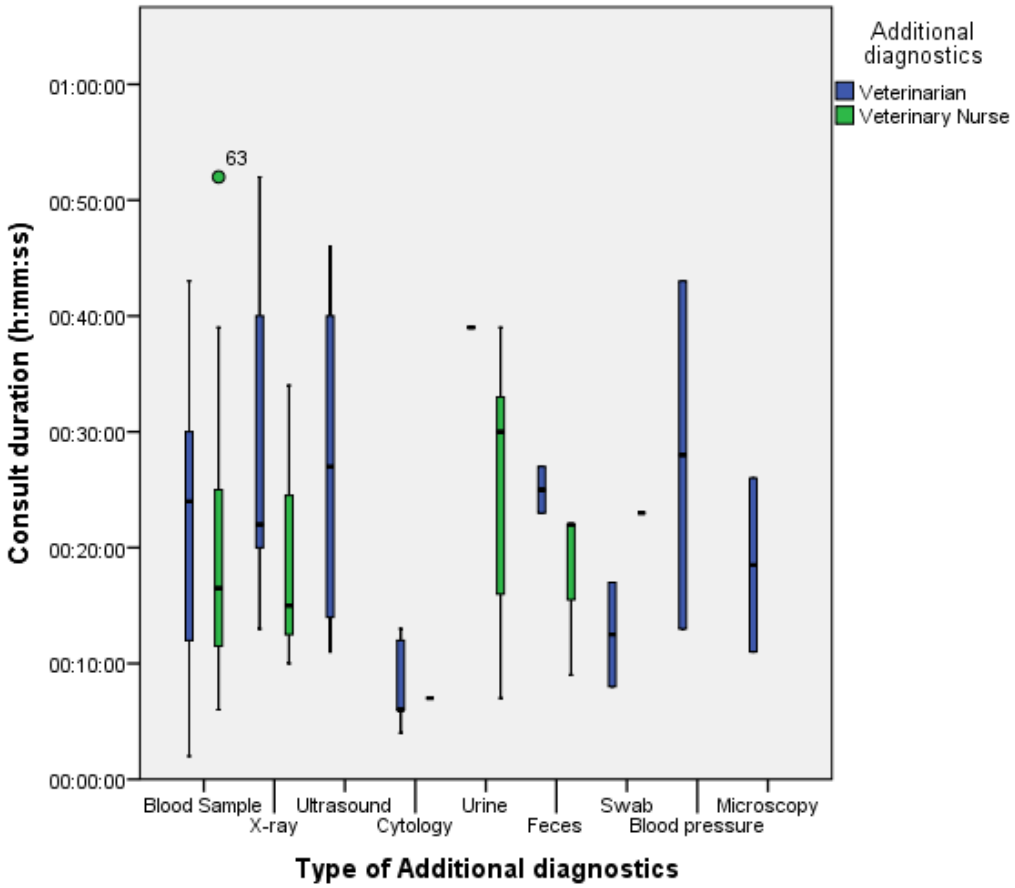


Figure 10. The consult duration (in hh:mm:ss) for each of the types of data that was collected during the study at all six clinics, divided by who handled the additional diagnostics.

When the consult duration is compared to the years that each clinic is in business (defined as new (0-10 years), medium (11-20 years) and old (21-30 years), it shows that new clinics have relatively longer consults with additional diagnostics compared to the older clinics (figure 12). Also clinics of medium age appear to have the shortest consult durations, compared to newer and older clinics. The difference in consult duration was significant between new and medium clinics (p = 0,010) and between medium and old clinics (p = 0,014). The difference between new and old clinics was not significant (p = 0,088).

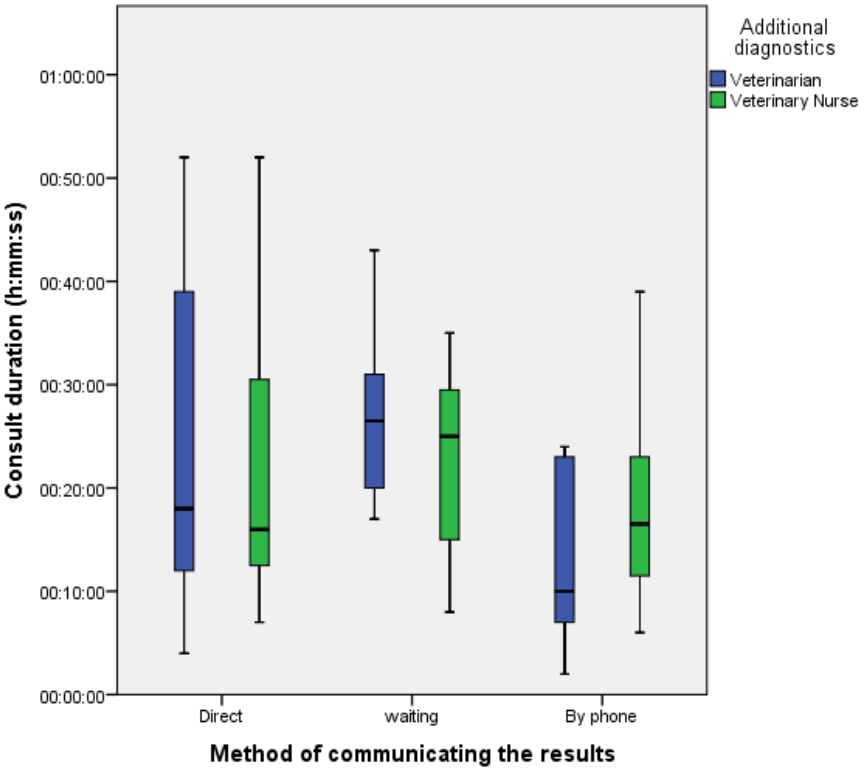


Figure 11. The consult duration (in hh:mm:ss) compared to the moment when the results of the additional diagnostics are communicated to the pet owner for all data combined, divided by who handled the additional diagnostics.

Figure 13 shows the consult duration compared to how long each clinic has been in business and the work experience of the veterinarians. During this study, no veterinarians with more than five years of work experience were followed at a clinic that was younger than ten years. It appears as if veterinarians with more than five years of work experience have relatively longer average consult durations than veterinarians with less than five years of work experience at the oldest clinics. However, neither the work experience of the veterinarians nor the age of the clinics (regression analysis 6) were significant predictors of the consult duration ($F(2, 77) = 0{,}465$, $p = 0{,}630$) with $R^2 = 0{,}012$.

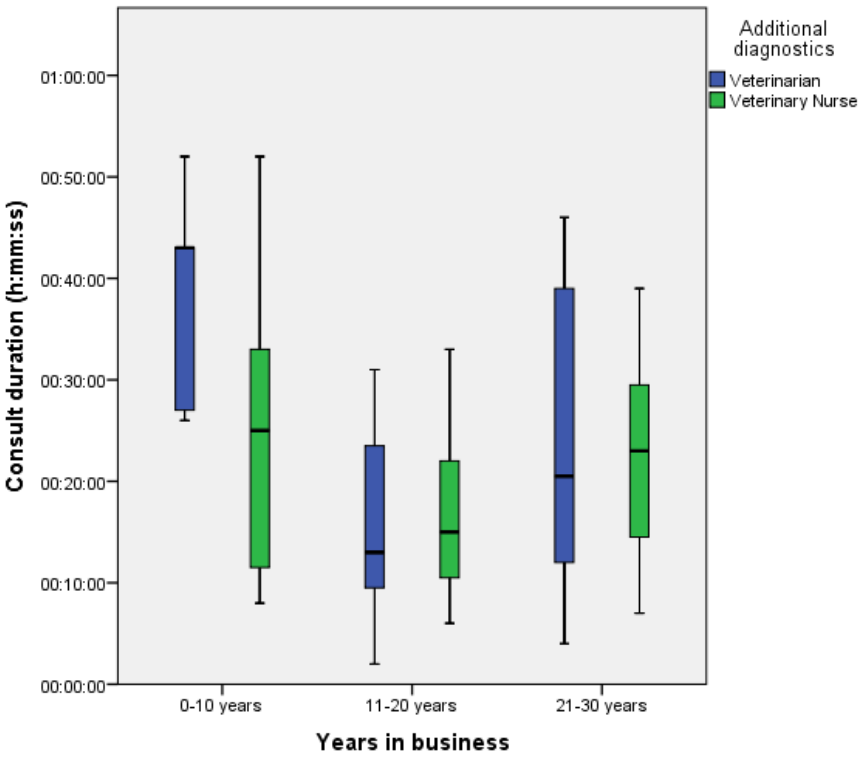


Figure 12. The consult duration (in hh:mm:ss) for all combined data when compared to the amount of years that the clinics are in business.

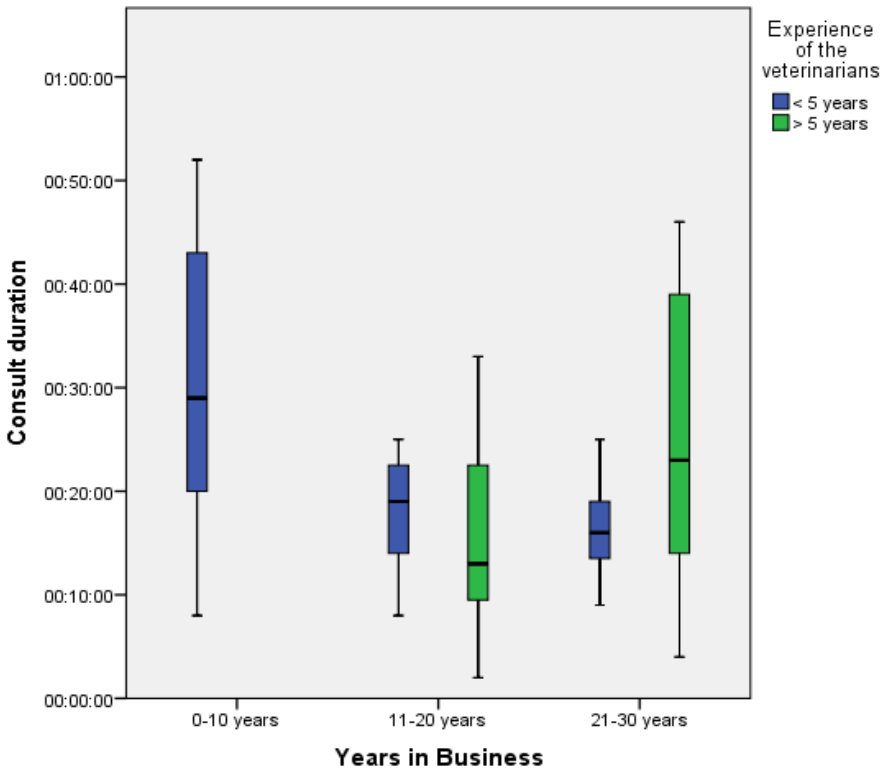


Figure 13. The consult duration (in hh:mm:ss) for the clinics, divided by the amount of years the clinics are in business and the work experience of the veterinarians.

When looked at all the measured data from the consults (regression analysis 1) as possible predictors for the consult duration (table 2), a significant regression equation was found (F (8,71) = 3,299, p=0,003) with R^2=0,271. The gender (B= -463,77, p=0,035) and the clinic size (B=-540,10, p=0,043) were found to be significant predictors. Work experience (B=139,18, p=0,476), who handles the additional diagnostics (B=-86,92, p=0,608) the type of additional diagnostics (B=-19,651, p=0,576), the moment of communicating the results (B=29,66, p=0,783), the years in business (B=-195,42, p=0,254) and the location (B=71,59, p=0,606) were not significant predictors.

Table 2. Results of regression analysis 1 to predict the average consult duration, based upon all combined measured data from all consults at all of the six clinics.

Model	Unstandardized Coefficients		Standardized Coefficients	t	P-value	95,0% Confidence Interval for B	
	B	Std. Error	Beta			Lower Bound	Upper Bound
(Constant)	2958,817	507,433		5,831	0,000	1947,024	3970,609
Gender	-463,766	215,308	-0,274	-2,154	0,035	-893,079	-34,453
Work experience of the veterinarian	139,178	194,323	0,091	0,716	0,476	-248,290	526,646
Handler of diagnostics	-86,921	168,763	-0,060	-0,515	0,608	423,425-	249,582
Type of diagnostics	-19,651	34,959	-0,062	-0,562	0,576	-89,357	50,055
Moment of results	29,663	107,501	0,036	0,276	0,783	-184,689	244,014
Clinic size	-540,096	262,414	-0,666	-2,058	0,043	-1063,334	-16,859
Years in business	-195,422	169,913	-0,191	-1,150	0,254	-534,219	143,374
Location	71,588	138,358	0,168	0,517	0,606	-204,289	347,465

Dependant variable: Consult duration

Table 3 shows the parameter estimates for regression analysis 1. It shows that female veterinarians have a statistically significant (B=727,444, p=0,019) longer average consult duration than male veterinarians, the reference value. There are no statistically significant differences inside any of the other variable groups.

When all the measured variables for only the consults with blood samples (n = 38) were analyzed (regression analysis 2), none of the variables were found to be significant predictors (F (7, 30) = 1,588, p=0,177) with R^2=0,270.

Table 3. The parameter estimates of regression analysis 1 to predict the average consult duration, based upon all combined measured data from all consults at all of the six clinics.

Parameter	B	Std. Error	t	Sig.	95% Confidence Interval	
					Lower Bound	Upper Bound
Intercept	212,020	639,831	0,331	0,742	-1067,400	1491,441
Gender						
Female	727,444	300,738	2,419	0,019	126,082	1328,806
Male	0[a]	.	.	.	.	.
Work experience veterinarian						
< 5 years	-377,900	345,707	-1,093	0,279	-1069,184	313,384
≥ 5 years	0[a]	.	.	.	.	.
Type of diagnostics						
Blood Sample	275,456	481,154	0,572	0,569	-686,671	1237,583
X-ray	586,878	487,755	1,203	0,234	-388,448	1562,203
Ultrasound	50,107	540,713	0,093	0,926	-1031,116	1131,331
Cytology	-359,884	510,082	-0,706	0,483	-1379,855	660,087
Urine	770,235	533,519	1,444	0,154	-296,603	1837,073
Feces	287,303	531,041	0,541	0,590	-774,580	1349,186
Swab	234,871	580,428	0,405	0,687	-925,767	1395,510
Blood Pressure	405,354	618,504	0,655	0,515	-831,420	1642,129
Microscopy	0[a]	.	.	.	.	.
Handler of add. diagnostics						
Veterinarian	287,772	192,155	1,498	0,139	-96,465	672,010
Veterinary Nurse	0[a]	.	.	.	.	.
Moment of Results						
Direct	-182,523	239,128	-0,763	0,448	-660,690	295,643
Waiting	205,763	218,278	0,943	0,350	-230,712	642,237
By Phone	0[a]	.	.	.	.	.
Clinic Size						
0-10 Employees	677,396	433,818	1,561	0,124	-190,076	1544,867
11-20 Employees	17,567	324,803	0,054	0,957	-631,916	667,051
21-30 Employees	0[a]	.	.	.	.	.
Years in Business						
0-10 Years	228,965	384,071	0,596	0,553	-539,033	996,962
11-20 Years	-397,886	419,172	-0,949	0,346	-1236,073	440,300
21-30 Years	0[a]	.	.	.	.	.
Locations						
Clinic 1	0[a]	.	.	.	.	.
Clinic 2	0[a]	.	.	.	.	.
Clinic 3	0[a]	.	.	.	.	.
Clinic 4	0[a]	.	.	.	.	.
Clinic 5	707,191	386,631	1,829	0,072	-65,924	1480,307
Clinic 6	0[a]	.	.	.	.	.

[a] this parameter is set to zero because it's redundant

3.6 Waiting time

The waiting time for all collected data ranged from 0 seconds to 25 minutes and 32 seconds. A waiting time of 0 seconds was achieved a total of five times during this study and in each case this was because the necessary additional diagnostics took place before the actual consult commenced. Therefore the pet owners received the results directly during the consults without having to wait at all.

Figure 14 shows the waiting time per clinic for the pet owner during consults with additional diagnostics. For five of the six clinics, there is a relative decrease in waiting time when the veterinary nurses handle the additional diagnostic, compared to when the veterinarians do it themselves. Only the second clinic was an exception to this. Clinics 1, 2, 3 and 6 show a lot of variance. There are several outlier points with waiting times that were decidedly lower or higher than the average waiting time for the veterinary nurses. Clinic 4 has less variance for the veterinary nurse, because the waiting time for this data was similar, with two outliers. Clinic 5 shows no variance for the veterinarian, because there was only one data collected during consults where the veterinarian handled the diagnostics. The location (regression analysis 12) was not found to be a significant predictor for the waiting time ($F(1,73) = 3{,}907$ $p=0{,}052$) with $R^2=0{,}051$.

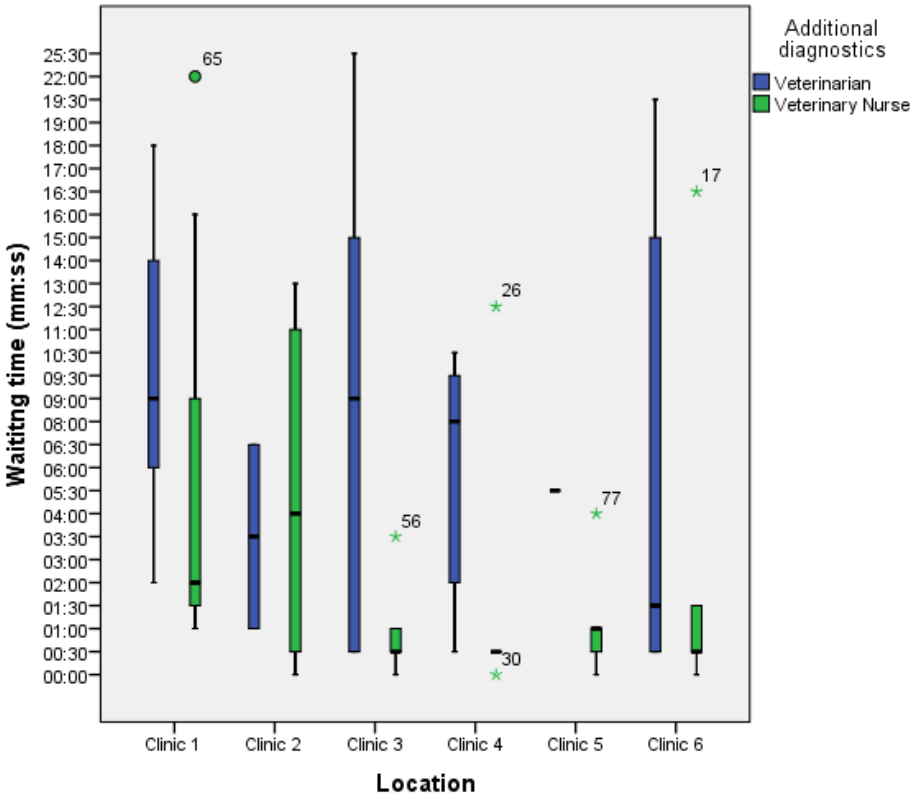


Figure 14. The waiting time (in min:sec) per clinic for the pet owner during consults with additional diagnostics, depending on who handled the diagnostics.

When all the data is combined (figure 15), it becomes clear that the waiting time for pet owners is significantly shorter when the additional diagnostics is handled by the veterinary nurse ($p = 0{,}002$). Figure 15 also shows that there is a lot of variance in the waiting time for the veterinarians. The veterinary nurse has a noticeably shorter average waiting time. But there are several outliers where the waiting time was decidedly longer than average.

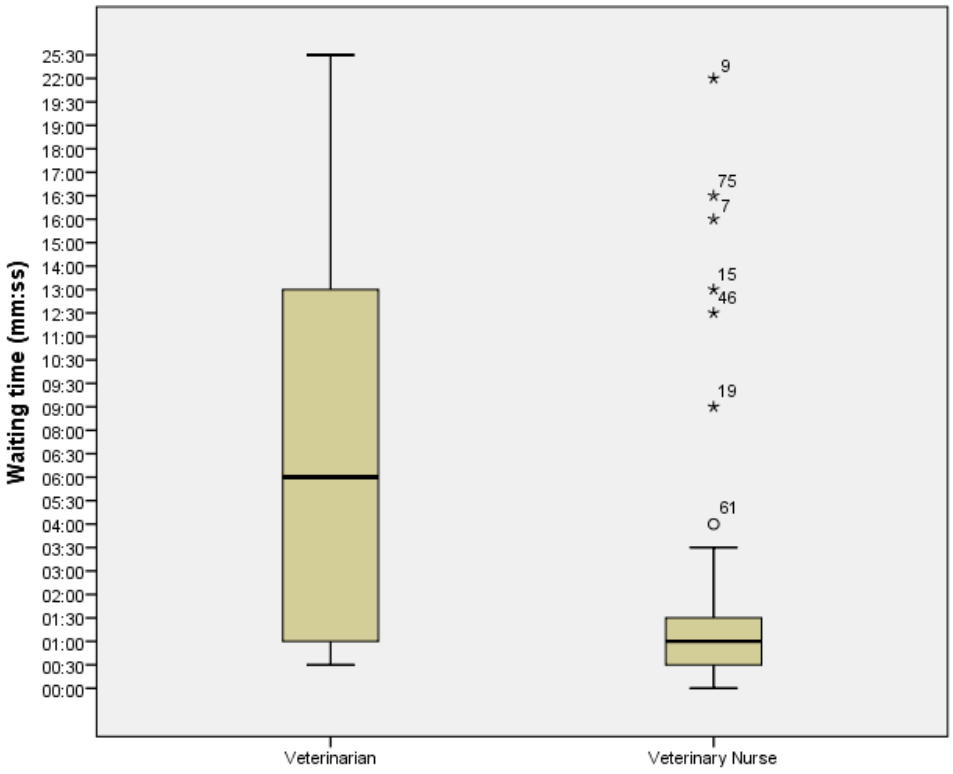


Figure 15. The waiting time (in h:mm:ss) for pet owners with the combined data from all clinics, when either a veterinary nurse or a veterinarian handled the additional diagnostics.

There is no significant difference in waiting time between female and male veterinarians (p = 0,137) or when looked at the experience of the veterinarian (<5 years or ≥ 5 years) (p = 0,689). When the gender was paired with the work experience of the veterinarian (regression analysis 9), it was found that these were significant predictors of the waiting time (F (2, 72) = 3,601, p=0,032) with R^2=0,091. When the parameter estimates from this analysis are taken into account, female veterinarians have a statistically longer waiting time than male veterinarians (B=2,784, p=0,039), while there is no statistically significant difference between the work experience groups. There is also no significant difference in waiting time when looked at the work experience of the veterinary nurses (<5 years or ≥ 5 years) (p = 0,245).

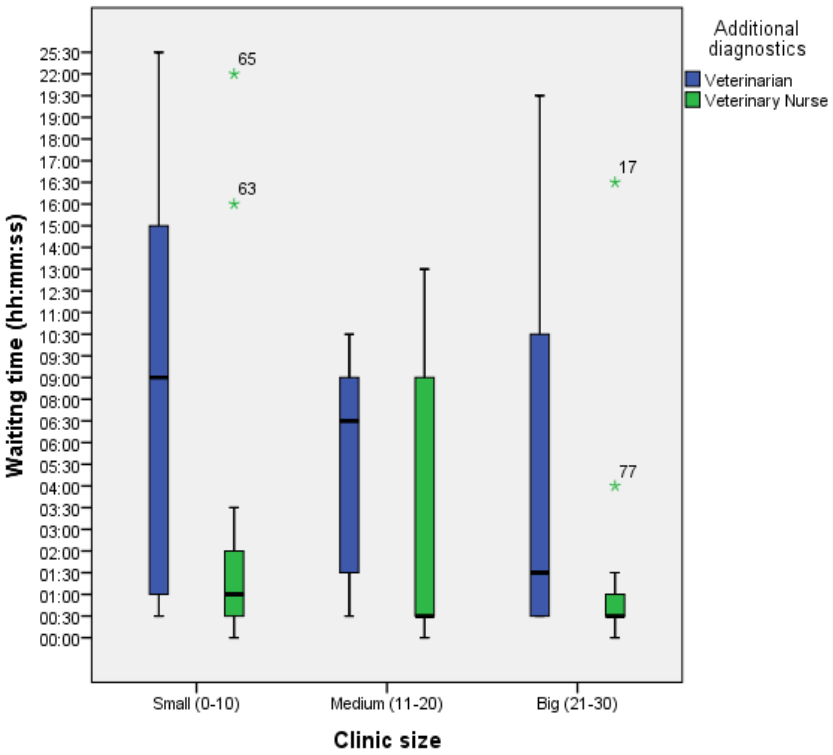


Figure 16. The waiting time (in min:sec) for small (0-10 employees), medium (11-20 employees) and big (21-30 employees) clinics, compared with who handles the additional diagnostics and the total average.

Figure 16 shows the waiting time for the clinics, divided by size into three groups: between 0 and 10 small), between 10 and 20 (medium) and between 20 and 30 employees (large). Small and big clinics show a lot of variance when the veterinarian handled the additional diagnostics, while there is little variance when the veterinary nurse handled the additional diagnostics. The waiting time is also relatively shorter when the veterinary nurse handled the additional diagnostics for both big and small clinics. For the medium sized clinics, the waiting times for the veterinarian and the veterinary nurse are relatively similar. The four outliers for the veterinary nurses from the small and big clinics were due to consults with a relatively longer waiting time than average. The differences between the small and medium clinics (p = 0,517), the small and the large clinics (p = 0,255) and the medium and large clinics (p = 0,710) were not significant.

Figure 17 shows the waiting time for each type of additional diagnostics and the staff members who handled the additional diagnostics. It shows that the waiting time varied much for each different type of diagnostics. Blood samples, x-rays and ultrasounds had a high variance, while cytology and urine samples have a low variance.

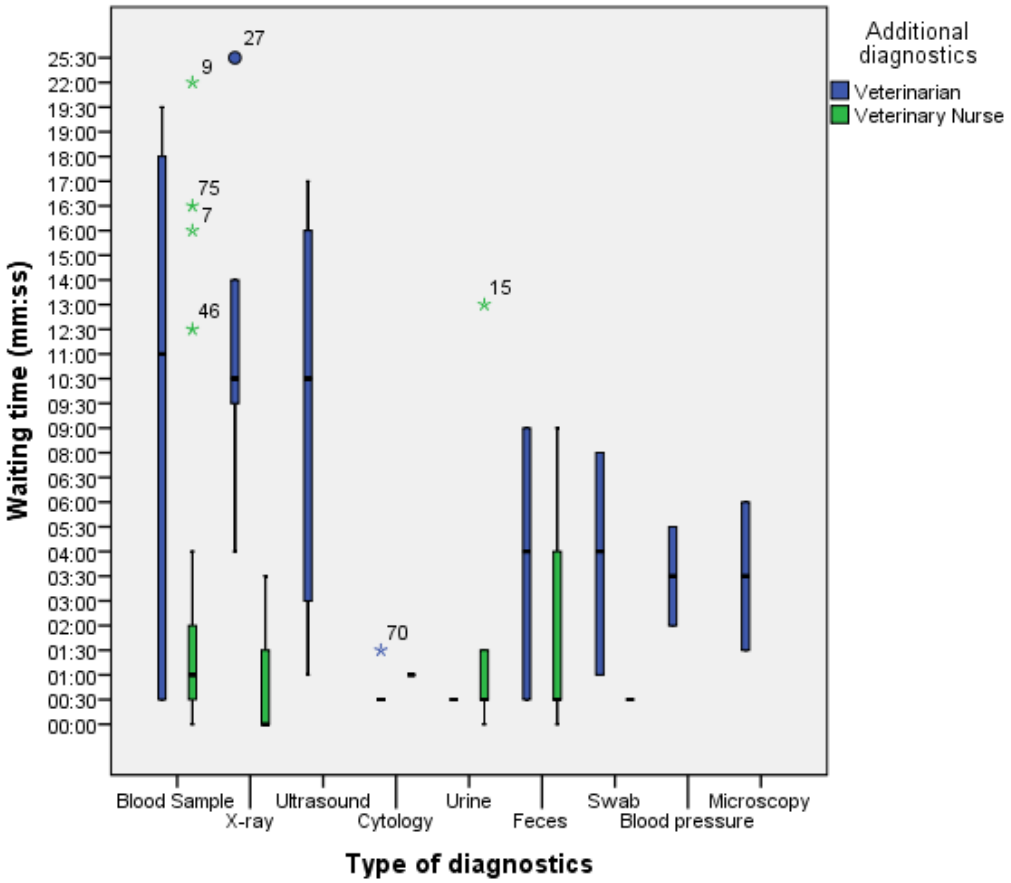


Figure 17. The waiting time (in min:sec) for each of the types of data that was collected during the study at all six clinics, divided by who handled the additional diagnostics.

Cytology and urine analysis had a relatively shorter waiting time, while blood samples, x-rays, ultrasounds and blood pressure and microscopy had a relatively longer waiting time. The several outliers in the figure are due to the data that had longer waiting times than average for the veterinarian or veterinary nurse, for the specific diagnostics. There was one data for the veterinary nurse during a consult with cytology, while the consults with veterinarians for cytology had a similar waiting time (with one outlier), resulting in no visible variance. There

was one data for a veterinarian during a consult with a urine sample. Because of this there is no variance visible. There were two data recorded for the veterinary nurse in regards to swabs, but the waiting time was similar, resulting in no variance. There was no veterinary nurse involved in any of the consults regarding blood pressure and microscopy, which is why there is no data visible in these categories. The type of diagnostics and the handler of the additional diagnostics (regression analysis 10) were not significant predictors for the waiting time ($F(2, 72) = 4{,}928$, $p=0{,}010$) with $R^2=0{,}120$. When looked at the effects between both groups – handler of diagnostics and type of diagnostics – the type of diagnostics had a significant effect on the waiting time ($p = 0{,}012$). It was also found that the average waiting time was significantly shorter ($p = 0{,}017$) in consults with blood samples, when the sample had to be sent out to an external lab, compared to when the analysis is done inside the clinic – regardless of the moment when the results were communicated to the owner.

When the waiting time is compared to the moment the results are being communicated to the pet owner (figure 18) it shows that getting the result directly during the consult, results in a significantly shorter waiting time for the pet owner than waiting for the results in the waiting room ($p < 0{,}001$). The waiting time is also significantly shorter when the owner gets the results later over the phone ($p < 0{,}001$) compared to directly during the consult.
The waiting time during consults is significantly shorter when the results are received by phone ($p < 0{,}001$), compared to when the owner waits in the waiting room. Receiving the results over the phone appears to result in the shortest average waiting time for owners during consults, regardless of who handled the additional diagnostics. Figure 18 also shows that there is more variance in the groups of owners that received the results directly during the consults and after a waiting period in the waiting room, compared to receiving the results by phone at a later moment.

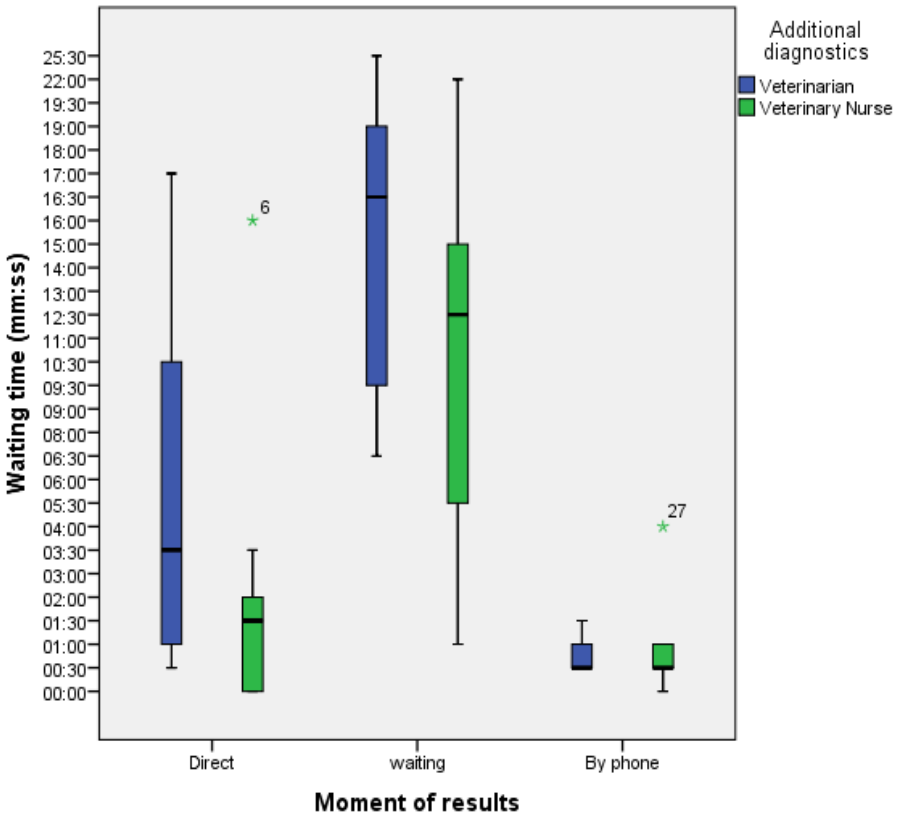


Figure 18. The waiting time (in min:sec) compared to the moment when the results of the additional diagnostics are communicated to the pet owner for all six clinics combined, divided by who handled the additional diagnostics.

When the waiting time for pet owners is compared to the years that each clinic is in business (defined as new (0-10 years), medium (11-20 years) and old (21-30 years)), it shows that there is a lot of variance for the veterinarians for all clinic ages (figure 19). For all clinics, consults had a relatively shorter average waiting time, when the veterinary nurses handled the diagnostics.

Some consults had a longer waiting time, resulting in the visible outliers. The average waiting time for veterinary nurses appears to be decidedly lower for the medium and old clinics, compared to the new clinics. The differences in waiting time were not significant between new and medium clinics (p = 0,094), between new and old clinics (p = 0,188) and between medium and old clinics (p = 0,672).

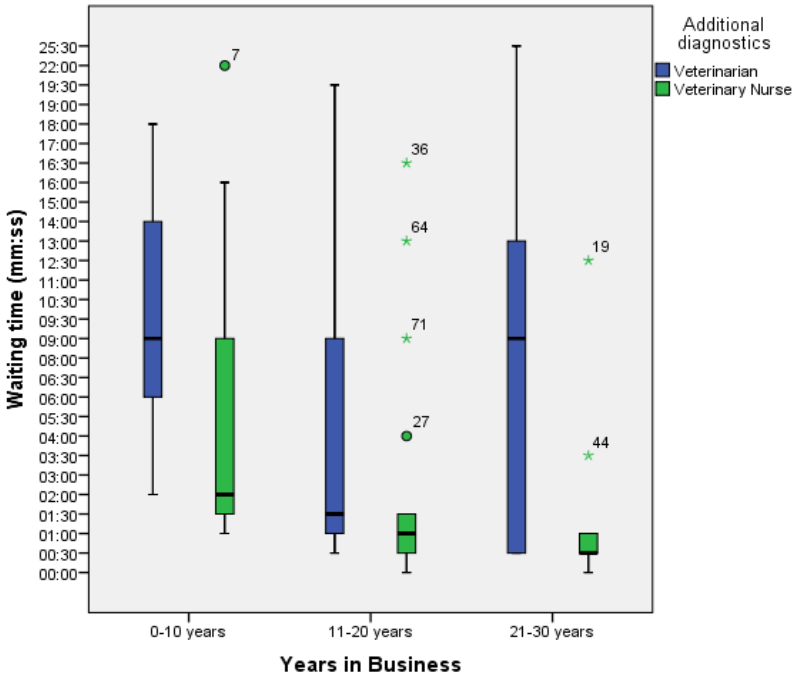


Figure 19. The waiting time (in min:sec) during consults with additional diagnostics, for all combined data when compared to the amount of years that the clinics are in business and who handled the additional diagnostics.

Figure 20 shows the waiting time compared to how long each clinic has been in business and the work experience of the veterinarians. During this study, no veterinarians with more than five years of work experience were followed at a clinic that was younger than ten years. It appears as if new veterinarians at new clinics have a longer average waiting time than the new veterinarians at older clinics. However, the work experience of the veterinarians and the age of the clinics (regression analysis 11) were not found to be significant predictors of the waiting time (F (2, 72) = 1,806, p=0,172) with R^2=0,048.

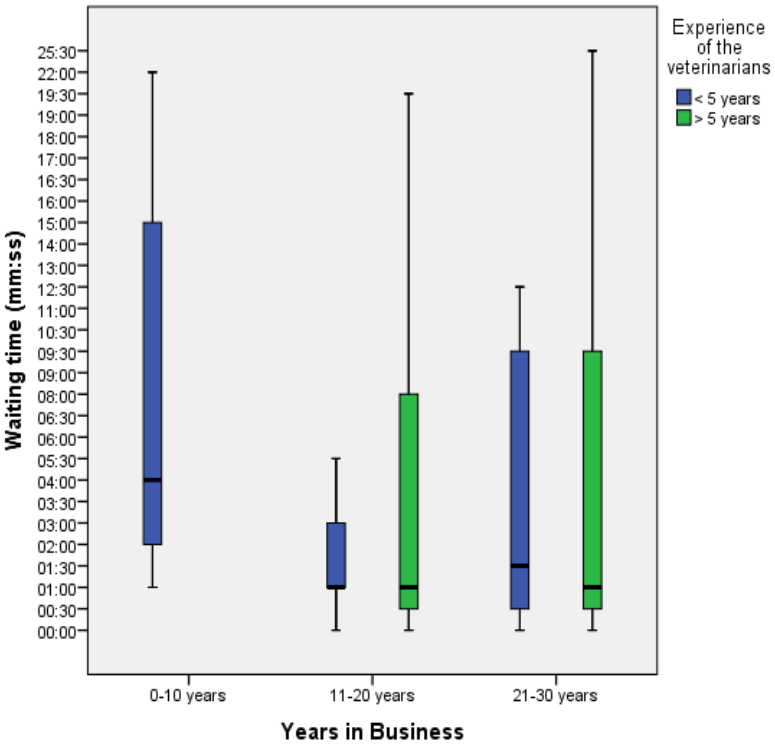


Figure 20. Average waiting time divided by the amount of years the clinics are in business compared to the work experience of the veterinarians.

When looked at all the measured data from the consults (regression analysis 7) as possible predictors for the waiting time (table 4), a significant regression equation was found (F (8,66) = 3,539, p=0,002) with R^2=0,300. Who handles the additional diagnostics (B= -0,355, p=0,019), the type of diagnostics (B=-0,816, p=0,017) and the location (B=-0,452, p=0,023) were found to be significant predictors. Gender (B=-0,612, p=0,347), Work experience (B=1,088, p=0,865), the moment of communicating the results (B=-3,083, p=0,085), the clinic size (B=0,649, p=0,386) and the years in business (B=1,441, p=0,386) were not significant predictors.

Table 4. Results of regression analysis 7 to predict the average consult duration, based upon all combined measured data from all consults at all of the six clinics.

Model	Unstandardized Coefficients		Standardized Coefficients	t	Sig.	95,0% Confidence Interval for B	
	B[b]	Std. Error	Beta			Lower Bound	Upper Bound
(Constant)	192.528,6	1,219		9,981	0,000	9,734	14,602
Gender	-0,612	0,519	-0,123	-0,946	0,347	-1,527	0,545
Work experience of the veterinarian	1,088	0,491	0,023	0,170	0,865	-0,898	1,065
Handler of diagnostics	-0,355	0,431	-0,305	-2,406	0,019	-1,897	-0,176
Type of diagnostics	-0,816	0,083	-0,275	-2,456	0,017	-0,367	-0,038
Moment of results	-3,083	0,643	0,592	1,750	0,085	-0,159	2,410
Clinic size	0,649	0,283	-0,224	-1,527	0,131	-0,999	0,133
Years in business	1,441	0,418	0,154	0,873	0,386	-0,470	1,199
Location	-0,452	0,341	-0,798	-2,324	0,023	-1,475	-0,112

Dependent Variable: Ln(waiting time)

b. B is the log value calculated back to the geometrical mean

Table 5 shows the parameter estimates for regression analysis 7. It shows that consults where urine analysis was the additional diagnostics, have a statistically significant (B=-0,112, p=0,032) shorter waiting time than microscopy, the reference value. When the pet owners have to wait in the waiting room for the results, the waiting time was statistically significantly higher (B=12,833, p< 0,001) than when the owner receives the results by phone, the reference value. There are no statistically significant differences inside any of the other variable groups.

When all the measured variables for only the consults with blood samples were analyzed (regression analysis 8), none of the variables were found to be significant predictors (F (6, 30) = 1,493, p=0,214) with R^2=0,230.

Table 5. The parameter estimates of regression analysis 7 to predict the average consult duration, based upon all combined measured data from all consults at all of the six clinics.

Parameter	B[b]	Std. Error	t	Sig.	95% Confidence Interval	
					Lower Bound	Upper Bound
Intercept	1242,648	1,226	5,811	0,000	4,669	9,581
Gender						
Female	1,733	0,577	0,953	0,345	-0,606	1,705
Male	0[a]	.	.	.	.	.
Work experience veterinarian						
< 5 years	1,354	0,677	0,448	0,656	-1,053	1,659
≥ 5 years	0[a]	.	.	.	.	.
Handler of add. diagnostics						
Veterinarian	1,035	0,389	0,088	0,930	-0,746	0,814
Veterinary nurse	0[a]	.	.	.	.	.
Type of diagnostics						
Blood Sample	-0,353	0,907	-1,147	0,256	-2,858	0,777
X-ray	1,702	0,935	0,569	0,572	-1,342	2,406
Ultrasound	2,347	1,020	0,837	0,406	-1,190	2,896
Cytology	-0,229	0,957	-1,542	0,129	-3,394	0,442
Urine	-0,112	1,026	-2,132	0,037	-4,245	-0,133
Feces	0,508	1,029	-0,658	0,513	-2,739	1,385
Swab	-0,188	1,091	-1,531	0,131	-3,857	0,516
Blood Pressure	0,674	1,165	-0,338	0,737	-2,727	1,939
Microscopy	0[a]	.	.	.	.	.
Moment of Results						
Direct	1,313	0,535	0,510	0,612	-0,799	1,344
Waiting	12,833	0,435	5,865	0,000	1,680	3,423
By Phone	0[a]	.	.	.	.	.
Clinic Size						
0-10 Employees	3,364	0,854	1,421	0,161	-0,497	2,923
11-20 Employees	1,665	0,650	0,786	0,435	-0,791	1,812
21-30 Employees	0[a]	.	.	.	.	.
Years in Business						
0-10 Years	1,242	0,797	0,272	0,787	-1,381	1,814
11-20 Years	2,740	0,824	1,223	0,226	-0,643	2,659
21-30 Years	0[a]	.	.	.	.	.
Locations						
Clinic 1	0[a]	.	.	.	.	.
Clinic 2	0[a]	.	.	.	.	.
Clinic 3	0[a]	.	.	.	.	.
Clinic 4	0[a]	.	.	.	.	.
Clinic 5	1,912	0,758	0,855	0,396	-0,870	2,166
Clinic 6	0[a]	.	.	.	.	.

a. This parameter is set to zero because it is redundant.

b. B is the log value calculated back to the geometrical mean

4 – Discussion

Due to – amongst other things - the declining revenue from sales, veterinary clinics need to increase their efficiency to keep their clinic in business. There have been great results in human and dental healthcare – both for patients and staff – due to delegating tasks to other staff members (ex. nurses), such as a more flexible and efficient clinic, a better work environment and happier patients (Charles-Jones et al, 2003; Evans et al, 2007). There were some promising results in veterinary clinics (Kinnison et al, 2014), but the current situation in regards to the division of tasks in veterinary clinics in the Netherlands was unclear. Identification of the current task division and a study of data of the current situation helps to gain insight into the task division that is currently in place in the veterinary clinics in the Netherlands and what the potential benefits could be, when certain tasks are delegated to the veterinary nurses.
The findings of this study suggest that there are multiple factors that influence the effectiveness – in terms of waiting time for the pet owner and consult duration – of veterinary clinics in the Netherlands.

4.1 Waiting time

The study suggests that the waiting time for pet owners during consults with additional diagnostics is significantly shorter when the veterinary nurse handles the diagnostics instead of the veterinarian. This result was not unexpected, because as Kinnison et al (2014) mentions, delegating tasks to the veterinary nurse, leaves the veterinarian free to do tasks that only they can do. They can continue the consult with the animal in question, while the diagnostics are being handled – therefore drastically shortening the waiting time for the pet owner. The veterinarian can also start a consult with a different patient, while the veterinary nurse is dealing with the diagnostics. This frequently happened over the course of this study. This ultimately results in a more flexible practice (Kinnison et al, 2014). Another interesting finding was that for some consults, the additional diagnostics were performed by the veterinary nurses before the consults took place, as soon the owner entered the clinic. This had the benefit of causing no waiting time during the actual consult and the veterinarian could immediately give the owner the result of the diagnostics. This resulted in a more efficient consult and it was appreciated by both the owner and the veterinarians. While this isn't always an option, it's certainly an interesting method to possibly increase the efficiency. When all the gathered information during consults is taken into consideration at the same time, who handles the diagnostics is still a significant factor in shortening the waiting time. However, it also shows that the type of diagnostics and the location play an important role in this equation. These results are also not unexpected. For this study all types of additional diagnostics were included. Because of this, there is a large range (N = 9) in type of diagnostics, resulting in a lot of variance in waiting time between the different diagnostics. As this study has shown, blood samples, x-rays and ultrasounds had a longer average waiting time, then for example microscopy. This was possibly due to the fact that these diagnostics tend to take longer. For example, blood sample analysis takes up to – on average – ten to fifteen minutes to complete. This generally takes up a lot more time than taking a quick look under the microscope. There were also moments when the owner left the practice immediately after the blood sample was taken and received the results over the phone, drastically reducing the waiting time during the consult.
The moment when the owner receives the result, has been shown to significantly affect the waiting time. However, when all the measured information from all the clinics is combined in the regression analysis, the moment of communicating the results is not significant. It is possible that there wasn't enough data in some of these groups to reach the level for statistical

significance. Another thing that needs to be taken into consideration, in regards to communicating the results, is the human factor. Often, the pet owner chose whether they would like to wait around for the results or if they preferred to receive the results over the phone. On top of that, because some diagnostics had to be sent to external laboratories, the results would automatically be shared by phone after a few days, keeping the waiting time during consults to a minimum.

Six locations were used for this study and all of these locations have their own method of dividing tasks, a differing staff-size and different set ups. During this study, there were some clinics where the veterinary nurse was waiting to immediately take the samples and handle the diagnostics and there were clinics where the veterinarian had to spend valuable time looking for a veterinary nurse to help with the diagnostics. All of these factors contribute to how efficiently the additional diagnostics were handled. It is therefore not unexpected that the location plays an important role in the waiting time for the owner.

Another factor that might contribute to the waiting time is the size of the clinic. Some clinics have a lot more veterinary nurses amongst their staff than others, which could potentially make it easier to find a veterinary nurse to handle the additional diagnostics. It's possible that this could decrease the average waiting time. However, this was not found to be a significant difference during this study. There is also the possibility that some clinics have more veterinary nurses than necessary, as this study does not indicate that there is a significant difference between clinics with a few or a lot of veterinary nurses compared to the amount of veterinarians.

4.2 Consult duration

Considering the result that the waiting time was significantly shorter when the veterinary nurse handled the additional diagnostics, it was an unexpected finding that the consult duration was not significantly shorter in the same situation. Possibly, a shorter waiting time simply doesn't result in shorter consults. However, it is also possible that there were too many other variables that influenced the consult duration. For example, during the study there were moments when owners brought multiple pets to the consults and one of them needed additional diagnostics. If the veterinary nurse handled the diagnostics, the waiting time could be significantly lower, but because there were more animals that needed to be examined at the same consult, the consult duration could possibly remain the same or even increase. There were also a few moments where multiple diagnostics were performed during one consult. It is possible that the waiting time for each of these diagnostics was reduced if they were delegated to the veterinary nurse, but because there were several diagnostics done during the same consult, the consult duration could still be the same or potentially longer.

The results of this study show that, when all the gathered information about the consults is taken into account, gender of the veterinarian and the size of the clinic are statistically significant predictors for the consult duration. It was not expected that the gender of the veterinarian played a significant role in the efficiency during the consults with additional diagnostics. A possible explanation for this could be that the male veterinarians had on average more work experience (19 years) than the female veterinarians (11 years), combined with the fact that there was three times as much data from female veterinarians than male veterinarians. However, when the gender and the work experience were combined for a regression analysis, neither were significant predictors. It is possible that this might be significant if there was more data and a more equal amount of data from both genders.

The finding that the clinic size is a significant predictor for the consult duration is not unexpected. It is likely that the amount of staff present plays a role in the efficiency. After all, if there are more veterinary nurses available to help with the additional diagnostics, it might make the handling of the additional diagnostics quicker, therefore reducing the overall consult duration.

4.3 Limitations of study

The results of this study indicate that (AniCura) clinics can start delegating the additional diagnostics to the veterinary nurse today, to significantly reduce the waiting time for the pet owners. However – due to the limited time to collect data – the desired sample size was not achieved. A power analysis based on the data from this study, indicates that for the overall regression analysis for the waiting time (regression analysis 7) the sample size should've consisted of 160 additional diagnostics during consults, for a power of 80%. A power analysis for the overall regression analysis for the consult duration (regression analysis 1) shows that the sample size should've at least consisted of 295 additional diagnostics, for a power of 80%. This means that there was not enough data collected and it's possible that possibly significant predictors were missed. Therefore, it's still an option that the consult duration might be reduced as well, when the diagnostics are delegated to the veterinary nurses.

Due to the limited time, the unpredictable nature of a veterinary clinic and the dependability on the type of patients that were presented, the types of data that were achieved, were very different amongst each other. It is possible that potential significant findings were missed, because there was not enough data in each separate variable group. Also, because six clinics were visited for this study, there is also an extra influence from every different location, the different staff members and the different clinic sizes. While this means that the results can be more easily mirrored to the entire veterinary clinic population, it does make it more difficult to determine what precisely causes the potential difference in waiting time and consult duration. It is possible that when these extra variables are eliminated, more significant predictors might appear. When all the regression analyses are taken into account, all of them have a low R^2 – ranging from 0,011 to 0,300. This means that only a small amount (1,1% to 30%) of the variance can be explained by the measured predictors. There could possibly be other factors that contribute to the efficiency of the clinics, which were missed in this study. For follow up research, it is recommended to focus on one type of diagnostics, one type of consult (ex. 1 patient and 1 additional diagnostic per consult), one clinic and one veterinarian per clinic to limit the variety. This would enable the researcher to determine more accurately, whether or not the waiting time and consult duration are significantly shorter if the veterinary nurse handles the additional diagnostics.

4.4 Future research directions

As Kinnison et al (2014) mentions, delegating more tasks to veterinary nurses allows them to feel appreciated and valuable. It creates a good work environment and therefore reduces stress. Studies in human health have shown that nurses who get more tasks delegated to them have a higher job satisfaction rate (Moore et al., 2014; Patterson & McMurray, 2003), which may increase a clinics ability to retain qualified staff members. These effects were not investigated during this study. They may be potentially great benefits and it is therefore an interesting angle to research in the future.

Another interesting topic is the possible benefits for the patient owners and patients, such as a higher satisfaction rate, less broken appointments, enhanced patience compliance, a decline in hospitalization and ultimately fewer visits to physicians (Patterson & McMurray, 2003). It's possible that delegating tasks to other staff members leads to the same effects in veterinary clinics. This was not researched during this study, but it could be a big motivator for veterinary clinics to change the task division.

Another potentially efficient method that has not been investigated during this study is the method of allowing veterinary nurses to book their own consults. Previous research by Kinnison et al (2014) has shown that this method has great potential, as it improved the morale of the veterinary nurses. Also, pet owners appreciated the longer consults and on top of that, these consults increased income, client retention, recommendations and the number of

patients. It is possible that this could be very beneficial for veterinary clinics to increase efficiency and improve the staff morale and therefore it warrants further research.

4.5 Conclusions

Efficiency has become a hot topic and a necessary one, due to the recent and coming changes in revenue for veterinary clinics. As this study has shown, delegating the additional diagnostics to the veterinary nurses could lead to a reduced waiting time for the pet owner during consults. Another possible way to increase efficiency and reduce the waiting time, is by allowing the veterinary nurses – when possible – to perform the additional diagnostics before the consult takes place. Even though this study didn't show a significant reduction in the consult duration when the veterinary nurse handles the diagnostics, due to the limited sample size, this can't be ruled out completely. However, there are still factors that are unclear and need to be further researched. There are also several other options that might proof fruitful in the future – ex. having nurses book their own consults with pet owners – which are worth further research.

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