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Kinnison, T., S. A. May and D. Guile (2015). "Veterinary team interactions, part 2: the personal effect." *Veterinary Record* 177(16): 419.

Which has been published in final form at <http://dx.doi.org/10.1136/vr.103313>. The final article is © 2015, BMJ Publishing Group.

The full details of the published version of the article are as follows:

TITLE: Veterinary team interactions, part 2: the personal effect

AUTHORS: T. Kinnison, S. A. May, D. Guile

JOURNAL TITLE: *Veterinary Record*

VOLUME/EDITION:

PUBLISHER: BMJ Publishing Group

PUBLICATION DATE: 21 October 2015 (online)

DOI: 10.1136/vr.103313

## Veterinary Team Interactions Part Two: The Personal Effect

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### **Abstract 199/200**

Modern veterinary practices consist of multiple professions/occupations, often spread over multiple branches. Within these teams are identifiable 'key people' who are central to information and resource flow. Key people are frequently the appointed leaders, such as practice managers, but also include emergent leaders. Veterinary surgeons are commonly involved in the flow of higher order interactions such as problem solving, while administrators are often involved in information interactions. These key people are repeatedly boundary spanners, sharing resources across physical boundaries such as branches. Their marginal status (belonging to multiple groups) also allows them to interact across professional boundaries. Lower order interactions including asking for information and advice are often interprofessional; however, higher order interactions tend to be intraprofessional. Analysis of interaction reciprocity between professions demonstrated the prevalence of a profession based hierarchy, with veterinary surgeons at the top. Being social outside of work with a colleague is also linked to work based interactions. The results of this paper demonstrate the need for practices to consider key people and support them appropriately. Further to this, they suggest that, to promote an effective team, interactions should be based on experience as much as professional status, and that social interactions should be encouraged.

## Introduction

Modern day veterinary teams are complex entities. In order to offer the services required by the public and to run a successful business, a practice will now be composed of members of different professions and occupations providing complementary roles. Solo practitioners are almost a thing of the past and practices are growing in size, especially with the rise of corporate structures. The practice team may subsequently work across multiple branch sites. Each factor affecting the practice community may have an influence on the interactions which occur within the team. The teams are not stable with individuals joining and leaving, practices growing, and the roles and duties of each profession or occupation in flux. An example of this is the professionalisation of veterinary nurses. This affords veterinary nurses greater accountability for their own actions and may lead to changes in the traditional relationships within the practice. It is important to understand where we are now, in order to assess where we are going in the future. However, veterinary team interactions in practice are an under-researched phenomenon. Exploration could assist with considering the changes in relationships as well as providing guidance for creating effective and efficient interprofessional teams. This may come at the level of undergraduate education or continuing professional development, or both, and therefore is relevant to current and future members of the veterinary team.

It is no longer the case that patient or practice outcomes of a veterinary practice rely solely on the veterinary surgeon. Therefore a shift towards focussing on veterinary team competence rather than an individual's competence is suggested, as has been explored in human healthcare (Lingard 2009). This must involve an exploration of communication within teams. Various interactions between individuals enable information and knowledge to flow through a group to create mutual understanding (shared mental models), which can lead to change (Jeffery and others 2005) and new decisions (Patel and others 2009). A lack of communication can lead to mistakes, and interprofessional communication has often been identified as a source of error in healthcare (e.g. Alvarez and Coiera 2006) and now in veterinary practices (Kinnison and others, submitted for publication). This paper is the second in a series aiming to document the interactions within modern day veterinary practices in England, with the ultimate ambition of providing guidance to enhance interprofessional working.

Both papers use Social Network Analysis (SNA) to explore interactions. Part One (Kinnison and others in press) centred on network level analysis and described factors related to the practice, its size and structure, and their effects on interactions between the team. The results indicated that the interactions were affected by the practice size, with the number of ties decreasing with decreasing practice size and density subsequently increasing. Even when it was possible to have ties with all network members in the smaller practices, this was not the case and individuals clearly choose who to connect with and who not to connect with. Practices with separate branches, especially where staff rarely overlap, were shown to experience a

divide in the knowledge resource flow within the practice as a whole. This is due to structural holes, in this case because of 'physical proximity' (Cott 1997), which surround each practice. This issue will be explored further in the current article. The first article concluded by suggesting that any planned increase in practice size or introduction of another branch site to a practice should be considered carefully, as it will affect interactions and the ability of the team to work as one. This article will explore factors related to the people within the practice, their importance within the team, their interprofessional working and their social interactions, and how these factors relate to interactions within the team. The importance of focussing on the interplay between the whole structure and individual traits has been recently highlighted in healthcare (Tasselli 2015).

Individual level analysis can identify people pivotal to the running of a network. These individuals often link sub-groups of the team. For example, head nurses in a hospital have been shown to link the multiprofessional-subteam above them to the nursing-subteam below (Cott 1997). Creswick and Westbrook (2010) also studied the hospital setting and three people, all senior nurses, were identified who connected otherwise more separated pairs of individuals and were most frequently asked for advice. These examples demonstrate appointed leaders, who may act as representatives, though they may also act as gatekeepers to resources (Currie and White 2012). It is also possible for leaders to be informal and emergent, arising due to the context and their expertise and potentially a lack of appointed leadership (Balkundi and Kilduff 2006). The first hypothesis of this article is: key individuals who link groups will be identifiable in veterinary practices.

While individual people can affect the team's interactions, so can groups such as professions. Within healthcare, hierarchical structures of interactions have been demonstrated, especially between doctors and other professions (Cott 1997; Creswick and Westbrook 2010; Wagter and others 2012). The structures may be complex, with a predominant professional hierarchy, alongside interactions based on experience (Creswick and Westbrook 2010). Factors affecting the structure include opportunity structures, such as physical proximity (explored in Part One) and homophily (whereby people interact with those similar to themselves) (Wagter and others 2012). A homophilous network is not considered ideal for effective team working as similar knowledge is likely to be held by similar people, restricting available expertise (Balkundi and Kilduff 2006; Landon and others 2012). For novel knowledge to transfer around the network, ties must be made to dissimilar individuals. The second hypothesis is: a profession based hierarchical structure will be present in veterinary practices.

Factors relating to an individual outside their work can affect the interactions within the practice team. Recent research has suggested that social ties can be used to gain access to other resources (such as advice, or job prospects) through the concept of appropriability (Adler and Kwon 2002). Cross and Parker (2004)

suggest that when we have a question, we go to someone we trust, whether or not they are the most appropriate individual to answer the question. Truly 'social' interactions are not often considered in workplace SNA. Cott (1997) did consider a social interaction (having coffee with someone); however results suggested that there were very few informal ties and therefore the author concluded that social proximity does not have a strong influence on interactions. More recent research has suggested that social interactions, and being a core member of the team, lead to job satisfaction, which may lead to additional outcomes for the practice (Tasselli 2014). The third hypothesis is: social interactions outside of work will be linked to work interactions.

This article aims to explore the personal effects on the flow of resources within a veterinary practice team. It considers individual level analysis to identify key individuals and network level analysis to research interprofessional interactions and the effect of social ties. The results are important to map the current status of veterinary team-working and for the consideration of team interactions in the future.

## **Methods**

### Participants

Eleven practices took part in the study. The practices ranged in location across England, species treated and size. All individuals identified as being employed by each of the practices were targeted. The study was questionnaire-based. Distribution consisted of visits to the practices and follow up contact. A full account of the methods, including pilot, and details of the participating practices can be seen in the first paper in this series (Kinnison and others in press) .

The project received ethics approval from the Royal Veterinary College's Ethics and Welfare Committee, Ref: URN 2013 0086H.

### The SNA Questionnaire

The questionnaire consisted of demographic questions including age, length of time qualified and length of time in current practice. The main section of the questionnaire asked participants to identify whether they did or did not have specific interactions with all other members of the practice team at the current point in time.


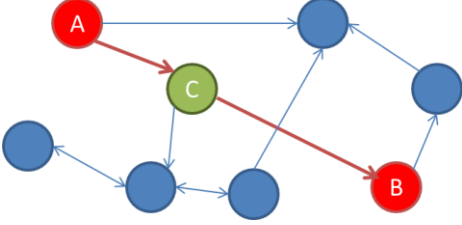
The four work interactions (outlined in Paper One) relate to receiving information, asking for advice, influencing change and problem solving. An additional interaction is included in this paper: 'Who of the following do you meet socially outside work (not including work functions such as Christmas lunch)?'

The interactions were presented along with a list of all members of the practice team. Participants were asked to tick or cross boxes to identify their interactions.

Analysis

The first stage of analysis involved creating diagrams of the networks known as sociograms. Further to this several SNA calculations were employed. SNA software Ucinet and NetDraw were used (Borgatti and others 2001; Borgatti 2002). As these concepts are likely to be novel to many readers, they are explained in Table 1 below.

Table 1. Social Network Analysis statistics with definitions.

Analysis	Description
Group Density	Density (number of ties or connections divided by the total possible number of ties) according to interactions between groups such as professions, range 0-1.
Outdegree	<p>The number of times information (or any resource) travels from one person to another. In the diagram, person A has said that they ask person B for information – therefore information travels from B→A, and person B has an outdegree score of one.</p> 
Betweenness Centrality	<p>Take any two individuals (dyad) within a network (e.g. individuals A and B in the diagram) and consider anyone who is on the shortest path (geodesic) between them (i.e. individual C). Betweenness centrality is the proportion of times an individual appears in the network's geodesics. Networks can be ranked with these central people, who can act as gatekeepers of knowledge, at the top and peripheral individuals lower down.</p> 

Reciprocity	Any two individuals can have no interaction, a one way interaction from $A \rightarrow B$ or $B \rightarrow A$ , or a reciprocated interaction $A \leftrightarrow B$ . Profession reciprocity scores show the density of interactions from profession $A \rightarrow B$ which are reciprocated (from $B \rightarrow A$ ).	
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The social interaction data were compared with the other four interactions through Chi Squared tests to identify relationships between the interactions.

### Results

Hypothesis 1: key individuals who link groups will be identifiable in veterinary practices.

Key individuals were defined in this study as having large outdegree scores (they are sought for many interactions) and high betweenness centrality (they are frequently involved in the transfer of resources between others). All individuals within each practice were ranked for these scores for each of the interactions (excluding the social interaction). Individuals who featured highly (top three or top five) across the interactions for both scores were judged to be key and their perceived central position in the network was confirmed via the sociograms.

In total 50 individuals, out of the 324 staff members identified by the practices, were judged to be key. The demographics of these individuals are shown in Table 2.

Table 2. Demographics of the 50 key individuals (some missing information). Bold indicates modal value

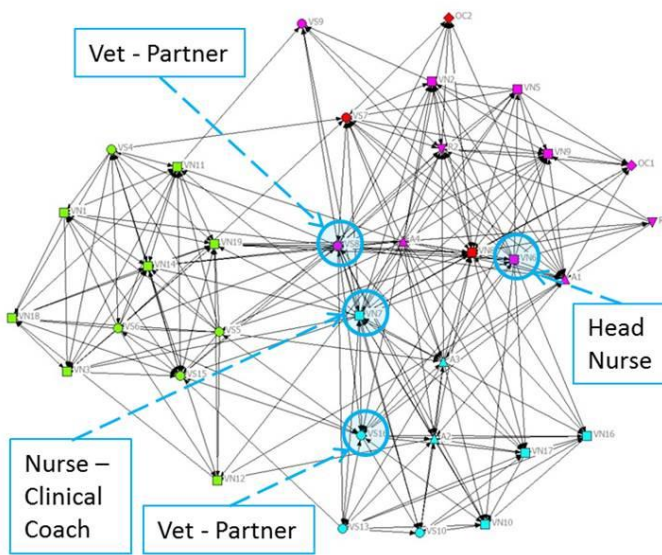
Gender	Male	20	Age (years)	16-24	1
	<b>Female</b>	<b>29</b>		25-34	13
				<b>35-44</b>	<b>17</b>
				45-54	14
				55-64	2
				65+	1
	Total	49	Total	48	
Experience (years)	<10	13	Current Practice (years)	<1	1
	<b>10-20</b>	<b>22</b>		1-5	10
	>20	13		5-10	16
				<b>&gt;10</b>	<b>20</b>
	Total	48		<b>Total</b>	<b>47</b>
Hours	<b>Full Time</b>	<b>38</b>	Branch	<b>Main</b>	<b>41</b>
	Part Time	10		Other	9
	Total	48		Total	50

Key people included 26 veterinary surgeons, 11 veterinary nurses, 11 administrators and two receptionists. This is an overrepresentation of veterinary surgeons and administrators, and an underrepresentation of veterinary nurses, receptionists and 'other' individuals (not represented at all) according to Chi squared tests ( $P < 0.05$ ). Appointed leaders featured highly. There were 22 Directors/Partners, eight Head Nurses and 11 Administrators. All Administrators can be considered appointed leaders as they consisted of practice/business managers, HR managers, branch managers and finance managers. Given that there are relatively few partners (range 0-10, median 2.5) and head nurses (range 0-3) in each practice, these proportions are large. The remaining 11 key individuals were veterinary surgeons, veterinary nurses and receptionists and demonstrate the existence of informal or emergent key people with leadership attributes.

Many of the key individuals, especially administrators, are also physical boundary spanners or brokers, identified in the sociograms as being close to structural holes. Practice Codes 3 and 9 were identified as practices with separation in behaviour according to branch in the first article in this series. Their sociograms are displayed again in Figure 1 (this time for the advice interaction) with key individuals highlighted.



## Practice Code 3



## Practice Code 9

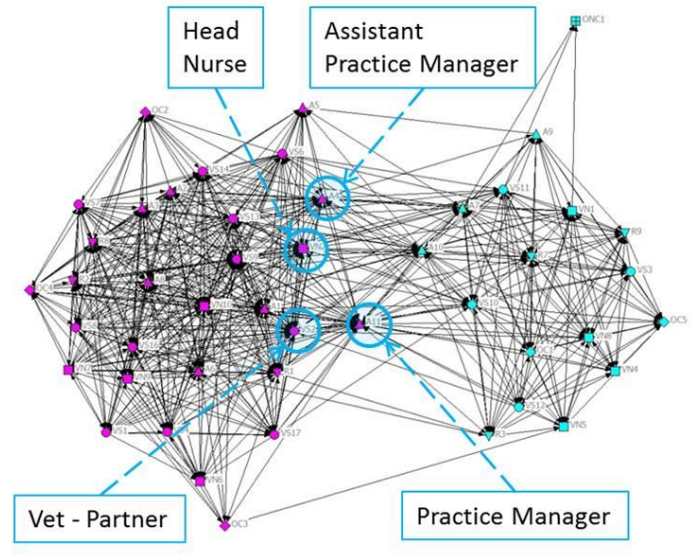


Figure 1. Displaying the key individuals for practice Codes 3 and 9 in the advice sociograms. Key individuals are often boundary spanners between physical locations such as branches of practices, portrayed as different coloured nodes in the sociograms

Key individuals' social scores varied greatly. On average they identified five people with whom they are social, which is slightly higher than the total practices average of 4.33. However while several individuals socialised with many people, others rarely socialised with anyone.

### Hypothesis 2: a profession based hierarchical structure will be present in veterinary practices.

Across all of the professions, the information interaction showed similar interprofessional and intraprofessional densities of ties while the other interactions demonstrated a higher density of intraprofessional interactions than interprofessional interactions. However different professions behaved differently. In several of the practices there were few representatives from some of the professional groups. Therefore this section will concentrate on interactions between the two most abundant groups; veterinary surgeons and veterinary nurses.

Table 3 displays the density of interactions per professional group. Columns represent the receivers of the resource. These are the individuals who, for example, say they ask someone else for information and are the people who answered the questionnaire. The rows represent the senders of advice. These are the individuals who were asked for information, the colleagues in the questionnaire.

Table 3. Density of interactions per professional group (veterinary surgeons and veterinary nurses only). Intraprofessional interactions highlighted in grey, interprofessional interactions in white

		Information		Advice		Problem Solve		Influence Change	
		Receiver							
		VS	VN	VS	VN	VS	VN	VS	VN
Sender	VS	0.564	0.624	0.502	0.607	0.525	0.353	0.387	0.389
	VN	0.473	0.603	0.361	0.554	0.257	0.486	0.161	0.402

For veterinary surgeons as receivers (VS columns), there is a higher density of intraprofessional interactions (grey boxes) than interprofessional interactions with veterinary nurses (white boxes) across all four interactions. For veterinary nurses as receivers (VN columns), the densities of interactions are similar with veterinary surgeons and with other veterinary nurses for all interactions. Receiving information and advice tend to be slightly more interprofessional while problem solving and influencing change are more intraprofessional. Across all four interactions veterinary nurses tend to initiate (receiver) more interprofessional ties than veterinary surgeons.

Reciprocity scores are used to assess team structure. Reciprocity is calculated by identifying the proportion of ties which are reciprocated between all pairs of individuals. Table 4 demonstrates that if a veterinary surgeon asks a veterinary nurse for information or advice, the veterinary nurse is likely to reciprocate (76.4% and 76.9% respectively). The reverse however is not necessarily true. When a veterinary nurse asks a veterinary surgeon for information only 64.9% reciprocate, and even less reciprocate, 48.4%, for advice seeking. This one way lack of reciprocation represents a hierarchical structure between the two professions. It exists across all four interactions and supports hypothesis 2.

The intraprofessional reciprocation scores also indicate a level of hierarchy within professions. There are slightly lower levels of reciprocity between nurses than between veterinary surgeons, indicating a stronger intraprofessional hierarchy within the nursing profession.

Table 4. Reciprocity scores between veterinary surgeons and veterinary nurses. Intraprofessional reciprocation is highlighted in grey, interprofessional reciprocation in white

		Information		Advice		Problem Solve		Influence Change	
		Receiver							
		VS	VN	VS	VN	VS	VN	VS	VN
Sender	VS	0.576	0.649	0.465	0.484	0.584	0.537	0.345	0.272
	VN	0.764	0.513	0.769	0.459	0.746	0.525	0.662	0.328

Hypothesis 3: social interactions outside of work will be linked to work interactions.

The fifth interaction asked participants to consider their social interactions outside of work. Chi squared tests indicated that when the social results are compared with each of the other interactions, there is a significantly different pattern to that expected by chance alone (Table 5). Being social with someone is related to asking them for information, advice and problem solving. Not being social with someone is related to not asking them for advice, problem solving or being influenced by them (higher level interactions). These relationships between social interactions and work interactions support hypothesis 3.

Table 5. Frequency table for the social interaction compared to the four main interactions

		Social Interaction Frequency		Pvalue
		Social	Not social	
Information Interaction Frequency	Receive Information	1272	4417	<0.01
	Do not receive information	410	4821	
Advice Interaction Frequency	Receive Advice	1099	2799	<0.01
	Do not receive Advice	572	6619	
Problem Solving Interaction Frequency	Problem solve with	985	1674	<0.01
	Do not problem solve with	594	7730	
Influence Interaction Frequency	Influenced by another	765	1373	<0.01
	Not influenced by another	925	8024	

**Discussion**

Social Network Analysis is a method which allows team interactions to be mapped. Part One in this series documented practice effects at the network level (size and physical proximity) on interactions, while this article considers the personal effects in terms of individuals acting as ‘key people’ (individual level factors), interprofessional interactions and social relations (network level factors).

Key individuals were identified who linked sub-groups, supporting hypothesis 1. Key people consisted of significantly more veterinary surgeons (within higher order interactions) and administrators (especially for the information interaction) than would be expected by chance. In accordance with previously cited literature (Cott 1997; Creswick and Westbrook 2010), appointed leaders such as Partners and Practice

Managers featured largely; however non-appointed or emergent leaders also existed. Distributed leadership within networks has been suggested to improve team satisfaction (Mehra and others 2006), but is an area identified as requiring further research (Balkundi and Kilduff 2006). Clearly experience had some influence, with the majority of key individuals having been in their current occupation for between 10 and 20 years and in their current practice for over 10 years, giving them time to develop good working relationships based on trust and to progress to appointed leadership roles. Opportunity may also have been a factor with 38 of the key individuals working full time. The stability of a team and presence of leadership have been demonstrated to be factors which foster interprofessional team working in healthcare (Xyrichis and Lowton 2008).

As the key people are the individuals most involved in resource transfer, they can be termed information brokers (Akkerman and Bakker 2011). Many of the key individuals, especially administrators, were also boundary spanners (Cross and Parker 2004) as identified by their position in the network. They allowed resources to flow between the physical separations of practice branches. They will therefore be the first to access new information from one group which they can introduce to another, making them a desirable contact and giving them a degree of control. Key people were also frequently marginal people (belonging to two or more professional or social worlds – such as a veterinary surgeon who is also a Partner) (Star and Greisemer 1989). This may allow them to have a high standing and level of acceptance (Cross and Prusak 2002) within several different groups. However, an independent status can be considered important in coordination and managerial roles (Lewis and others 2008), and may help to explain the administrator's ability to relate to the separate clinical professions.

This research has identified key people who are important in the day-to-day running of practices, either through providing direct advice or help, or acting as gatekeepers to information. These individuals may be the glue keeping the network connected. Previous research has suggested that auditing of interprofessional effectiveness, with subsequent rewards to acknowledge individual contribution, can lead to contentment and ultimately improvements in patient outcomes (Xyrichis and Lowton 2008). Future work in the veterinary field should utilise qualitative research to further investigate these key individuals and how they can be supported.

The interprofessional interactions suggest that advances in the professionalisation of veterinary nurses in the UK have not eliminated the traditional hierarchical structure of a veterinary team. Hypothesis 2 is therefore upheld. Consideration of veterinary surgeons and veterinary nurses inter- and intraprofessional behaviour indicated that they behave differently. Veterinary surgeons primarily interact with other veterinary surgeons. Veterinary nurses interact slightly more with veterinary surgeons compared to other nurses for gaining information or advice, and almost as much for problem solving and being influenced. Veterinary nurses initiate more interprofessional interactions than veterinary surgeons. This reflects the

current situation whereby nurses act under the direction of veterinary surgeons, but now with more responsibility for their own actions. These results mirror advice seeking behaviour between doctors and nurses (Creswick and Westbrook 2010). This intraprofessional behaviour for higher order interactions of both professions demonstrates the importance of learning from members of your own profession. It does however risk the negative consequences of homophily, whereby novel knowledge is not created or spread due to an overreliance on people similar to yourself (Balkundi and Kilduff 2006). Reciprocity scores, in parallel with Wagter and others (2012)'s study, indicate that a veterinary nurse is more likely to reciprocate a veterinary surgeon's behaviour than vice versa. This reveals a vertical hierarchical structure, whereby knowledge and information can easily flow down the hierarchy but may not travel up the hierarchy. When the purpose of a team is viewed as being better than the sum of its parts, adaptive behaviour (Burke and others 2004), including allowing information and knowledge to be shared in any relevant direction, is important. Further, aspects of hierarchy, such as imbalances of power and the subsequent fear to speak up to your superiors (Patterson and others 2001) if you believe they have made an error, can be detrimental to patient outcomes. A hierarchical structure is not, however, necessarily detrimental to the running of a successful business and in many instances it can lead to effective and efficient working. Ideally it should be assumed that the hierarchy is created on evidence based means such as experience, rather than simply the profession to which you belong. The existence of many interprofessional ties in these practices directs us to consider practices as having a more complex structure than simply profession based. The more obvious nursing intraprofessional hierarchy than veterinary intraprofessional hierarchy has also been demonstrated in healthcare (Tasselli 2015).

It is increasingly being recognised that social interactions can have consequent work-related benefits (Adler and Kwon 2002). A good working environment, for example somewhere where it is possible to identify a 'best friend', can be beneficial in terms of working outcomes (Harter and others 2013). Social views can also influence the way people work, for example by guiding who we target for advice (Cross and Parker 2004). The results of the current SNA also highlight the importance of social relations. They demonstrate a link between being social with someone and work interactions. This may be detrimental to practice if we refuse to adopt the better working practices of others simply because we do not see them as a friend. These results imply that practices should support social events, more than just the Christmas party. They also demonstrate that the individuals from whom others are expected to learn, such as Partners and head nurses, should attempt to develop a friendly and approachable demeanour.

It should be noted, however, that the social interaction results cannot explain the causality. It may be that participants choose to interact at work with those with whom they are social outside of work, or that they have become social with those they enjoy working with. This leads on to a limitation of the current study,

which is that it is not possible to identify whether the information or advice which travels through the network is acted upon or not. As the questionnaire asked for their behaviour at the current time, it could tentatively be assumed, however, that someone would have stopped asking an individual for advice if they had never chosen to act upon it previously. Although, it may not always be possible to choose with whom you interact. SNA cannot distinguish between the ties that were based on a choice, and those that are required (for example, asking the sole receptionist on duty for client information). The social results suggest that there is an element of both self-choice and forced choice. SNA is also limited by its quantitative questionnaire based stance. In order to expand upon the current results, and to explain why and how it is that these interactions take place, further in depth qualitative study has been suggested (Creswick and Westbrook 2010; Wagter and others 2012), to produce a fuller understanding of the communication rather than simply the interactions between professions.

Taken together, analysis of practices at network and individual levels have identified a complex picture of intra and interprofessional interactions, as well as those individuals key for knowledge flow. Following from the consideration of the history of the professions, it is clear that relatively new occupations, such as practice managers, are becoming integral to the veterinary team, while the traditional dominance of veterinary surgeons remains.

A greater understanding of this complex pattern, in relation to practice size, structure and veterinary team function, may have implications for team efficacy and efficiency. Veterinary practices are businesses that need to balance quality of service with the economics of their activity. This is particularly relevant at times when the structure, size, and patterns of work (increased part-time) of veterinary practices are rapidly changing. These SNA results suggest that there may be ways to improve the interactions within veterinary practices and, it can be hypothesised, subsequently the practice and patient outcomes. It is not desirable or feasible to aim for densities of 100% for each interaction within the network or for complete reciprocity. Greater numbers of ties will however enable resources to flow more easily and the practice to become more cohesive. Greater reciprocity may allow individuals to benefit from previously unutilised sources. Potential areas for consideration are linking branches, identifying and supporting key individuals, reducing staff turnover to allow working relationships based on trust to develop, encouraging interprofessional interactions to create a more horizontal structure and fostering social interactions. In addition, as has been suggested elsewhere, undergraduate interprofessional education should aim to develop working relationships as early as possible (Kinnison and others 2014).

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