What do veterinary professionals and clients want?
Using discrete choice methods in veterinary research to determine preferences

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Abstract
Discrete choice methods (DCMs) are a suite of research techniques for identifying individual preferences using choice information. Widely utilized by other fields yet rarely employed in veterinary research, DCMs have tremendous potential to improve veterinary healthcare by understanding and incorporating owner and veterinary professionals’ (encompassing veterinarians, veterinary clinicians, technicians, receptionists, attendants, etc) preferences to optimize the care continuum. DCMs have several advantages over other stated preference methods, such as ranking and ratings, including improved data quality and actionability. However, they are not a panacea, and limitations that may affect DCMs’ application to the veterinary field are outlined alongside realistic mitigation strategies. The information provided aims to increase awareness of DCMs and their utility in veterinary research and encourage greater uptake as a more robust method for measuring preferences.

Keywords: conjoint, maximum difference scaling, maxdiff, best-worst scaling, communication

Discrete choice methods (DCMs) are a quantitative approach to uncovering veterinary professional and client requirements and preferences using choice information. Originating in marketing and economics as a more robust approach to predict buying behavior using knowledge of consumer preferences, DCMs are a collection of methods, including conjoint analysis1 and best-worst or maximum difference scaling,2 that have been widely applied in other fields for decades.3,4 These methods measure stated preference (ie, choices made in hypothetical scenarios to reflect real-world considerations) in contrast to revealed preference methods (ie, revealed through examination of records of actual choices made in real-world situations).1 In healthcare, DCMs are used to better understand patient and clinician perspectives on prevention,5,6 screening,7,8 diagnostics,9,10 treatments,11,12 side effects,13 willingness to pay for healthcare products,14,15 communication,16,17 litigation and reducing patient complaints,18 and medical clinic selection.19,20 In public health, DCMs are used to inform policies,21 advise funding allocation,22 and tailor public communication messages.21–23

DCMs are robust, well-developed methods that have been successfully used to tailor human healthcare products and services according to patient preferences. Given the obvious parallels between human and veterinary healthcare, there is great potential for DCMs to improve veterinary healthcare through better alignment with the preferences and requirements of veterinary professionals and clients. DCMs can help to balance the delivery of evidence-based medicine with client expectations. Just as in human healthcare, DCMs can elucidate preferences for the provision and receipt of care, ideally leading to better health outcomes delivered in supportive workplace environments that can adapt to future changes in an evidence-based manner.

DCMs identify the preferences of veterinary professionals and their clients to better inform the design and delivery of veterinary healthcare. These methods have several advantages for veterinary researchers over other preference elicitation methods (eg, ranking, ratings).24 First, DCMs present respondents with realistic choice options and require them to make trade-off decisions as they would in real settings, including a “none” choice option, where appropriate, to represent situations in which respondents would not have to select one of the available choices (ie, leaving a store without purchasing a product).25 This improves the quality of information used to identify...
realistic preferences by using choice information. Second, DCMs are less prone to measurement bias compared to ranking and rating approaches by engaging respondents in natural decision-making processes as opposed to assigning a rank or numeric rating. Third, DCMs provide more actionable information for evidence-based decisions by providing greater discrimination between features and avoiding straight-line responses (e.g., rating all features as excellent). As a more robust methodological approach, DCMs should be strongly considered as an alternative to ranking and rating approaches to identify preferences and gain valuable insights into veterinary professionals’ and clients’ decision-making processes.

For the implementation of these complex methods, robust experimental design is necessary for preferences to be determined. For researchers new to DCMs, we highly recommend collaborating with a more experienced researcher to understand methodological nuances before embarking on your first study. As a basis, there are 5 general steps to the creation of a discrete choice experiment, including 1) asking a relevant research question; 2) generating a master set of items; 3) creating tasks by arranging the master set of items into subsets; 4) collecting choice information; and 5) analyzing choice data. An example of moving through each of these steps is shown (Table 1).

Table 1—An example using the 5 steps for creating a discrete choice experiment.

<table>
<thead>
<tr>
<th>Step</th>
<th>Example</th>
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<tbody>
<tr>
<td>1) Ask a relevant research question</td>
<td>What do dog owners prefer when purchasing dog food?</td>
</tr>
<tr>
<td>2) Generate a master set of research-based items that describe the preferences aiming to be assessed by your research question</td>
<td>Fiber content, Flavor, Cost</td>
</tr>
<tr>
<td>3) Create tasks by arranging the master set of items into subsets (levels), which provides you with overarching themes (attributes) described by the subset of items for which you will assess preference</td>
<td>Attributes: Fiber content, Flavor, Cost</td>
</tr>
<tr>
<td>4) Collect choice information</td>
<td>Collect respondent choices by surveying your target population using online or paper-based formats and best practices in survey design and deployment.</td>
</tr>
<tr>
<td>5) Analyze choice data</td>
<td>Analyze your data using the most appropriate methods of analysis to quantify respondents’ overall relative preferences for fiber content, flavor, and cost as well as specific relative preferences for fiber content levels (high, medium, low), meat flavors (salmon, turkey, chicken), and cost ($108.99, $94.99, $79.99).</td>
</tr>
</tbody>
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of how these methods could potentially be used in veterinary research, tackling the first problem presented. While we do not provide methodological detail, there are several excellent resources for all experience levels. Readers can refer to the following resources: CBC/HB for Beginners by J. Howell, Getting Started with Conjoint Analysis: Strategies for Product Design and Pricing Research by B. Orme, and Statistical Methods for the Analysis of Discrete Choice Experiments: a Report of the ISPOR Conjoint Analysis Good Research Practices Task Force by Hauber et al. Software that will allow veterinary researchers to get started with designing and/or analyzing DCMs in descending order of ease of use, include Sawtooth Software, R-Studio’s logitr package and other R packages, and various SAS procedures. This is not a comprehensive list and selected software should be tailored to the research objective and the familiarity of the researcher. To increase awareness of DCMs, this commentary will summarize previous veterinary applications of DCMs and highlight potential applications in 3 key areas relevant to the veterinary field: veterinary communication, treatment development, and, for researchers interested in optimizing veterinary products or services, medical product optimization and marketing strategies. While companion animal care is the focus of DCMs, this commentary will present. While we do not provide methodological detail, there are several excellent resources for all experience levels. Readers can refer to the following resources: CBC/HB for Beginners by J. Howell, Getting Started with Conjoint Analysis: Strategies for Product Design and Pricing Research by B. Orme, and Statistical Methods for the Analysis of Discrete Choice Experiments: a Report of the ISPOR Conjoint Analysis Good Research Practices Task Force by Hauber et al. Software that will allow veterinary researchers to get started with designing and/or analyzing DCMs in descending order of ease of use, include Sawtooth Software, R-Studio’s logitr package and other R packages, and various SAS procedures. This is not a comprehensive list and selected software should be tailored to the research objective and the familiarity of the researcher. To increase awareness of DCMs, this commentary will summarize previous veterinary applications of DCMs and highlight potential applications in 3 key areas relevant to the veterinary field: veterinary communication, treatment development, and, for researchers interested in optimizing veterinary products or services, medical product optimization and marketing strategies. While companion animal care is the focus of examples used throughout this article, DCMs can and have been used for commodity species, including dairy, beef, bison, pork, poultry, and sheep, as well as in assessing farmer preferences in public health reporting, perceptions of concerns, available treatments, and animal welfare practices.

Veterinary Communication

Veterinary communication is the verbal and non-verbal exchanges between veterinary professionals and their clients regarding an animal, the veterinary...
patient. Communication has been associated with multiple outcomes of care, including veterinarian satisfaction,\textsuperscript{48,49} client satisfaction,\textsuperscript{50,51} client adherence to recommendations,\textsuperscript{52,53} and client recall of information.\textsuperscript{54} The content and quality of these conversations must be continually updated according to client preferences and best practices in clinical communications. In the many different types of conversations veterinary professionals have with their clients, team, and other colleagues, each discussion requires understanding values and expectations to tailor their communication.

DCMs offer an efficient and valid method for utilizing individual choices to determine the preferences and perspectives of a population or population segments. Understanding these perspectives with DCMs supports the advancement of veterinary communication, beyond traditional tools and skills, by allowing veterinary professionals to tailor their communication to those they communicate with most. Implementation of communication skills can be adjusted and improved with insights from DCMs. A motivated veterinary professional looking to describe the preferences of their staff or clients could feasibly utilize a DCM experiment within their clinic or glean understanding from research conducted on larger populations. The professional can then incorporate this general knowledge while continuing to engage in discussion around the individual preferences and values of these clients or staff members. Veterinary communication problems are well suited to DCM solutions by virtue of communication being multifaceted and modifiable. Communication can be broken down into individual features or attributes, such as the content (the words used), process (method), and perception of information,\textsuperscript{55} where DCMs can be used to elucidate preferences for each.

The flexibility to conduct such research is enabled by the flexibility of DCMs to be used on a range of sample sizes.\textsuperscript{1} Sample sizes for discrete choice experiments vary depending on the size of the source population, objectives of the study, experimental design used, and other practical considerations such as cost, time, and feasibility. As such, careful consideration is needed when determining sample size, with sample sizes ranging from tens to thousands of individuals depending on the research question.

The use of DCMs to elucidate veterinary communication preferences has been limited. DCMs have been used to study pet owner communication preferences regarding willingness to pay for recommended services,\textsuperscript{53} antimicrobials,\textsuperscript{56,57} and antiparasitic treatments for companion animals.\textsuperscript{58} The basis of this research is to develop information that can be used to increase acceptance and uptake of treatments, as well as better animal welfare practices, through improved communication. DCMs can also be used to elucidate client preferences for the purpose, format, and content of discussions. Preferences for veterinary-client communication are likely to vary by type of discussion, veterinary professionals, client, and animal characteristics, strength of the human-animal relationship, and other situational features.

We posit that veterinary professionals can provide better care if they tailor their communication to a client’s preferences and the situation by adjusting the type, order, and timing of information. DCMs can generally inform how communication can be modified by enumerating various client communication preferences in a variety of situations. For example, DCMs can assess the following: “What information is most important to pet owners regarding an overweight or obese pet that would encourage them to act on their pet’s weight management?” and “What preferences do veterinary clients have for how information is communicated to them by veterinarians within the examination room, during different appointment types (preventive, problem, and urgent care)?” Through understanding these general preferences, practitioners are better positioned to engage in discussion that seeks to understand an individual client’s preferences. Qualitative research has highlighted the differences in veterinarians’ focuses and approaches to communication, compared to pet owners.\textsuperscript{59–61} Within veterinary communication applications specifically, veterinary professionals must be conscious to not interpret the results of DCM studies as recommendations to ignore individual preferences or values or treat all individual clients the same. Exploring what is important to each individual client still is required. In understanding veterinary client preferences for communication with veterinary professionals, general recommendations can be made to veterinary professionals to tailor or improve their communication, while respecting individual variation.

DCMs can also be used to examine veterinary professional preferences, generating insights into how information can best be delivered to achieve optimal work environments and animal health outcomes. Understanding the veterinary professional perspective and communication preferences, relating to both team and client communication, is important for improving the outcomes of veterinary care for staff and clients. For example, DCMs can be employed to determine the preference of veterinary staff for the flow of information, timing of meetings, and the makeup of ideal professional interactions. In additional cases, specialist knowledge can be better transmitted to general practice to streamline services provided, as DCMs can be used to understand mismatched terminology or nomenclature and general communication preferences between referring and specialist clinics. All members of the veterinary team have a useful and unique perspective that can be readily quantified using DCMs, regarding their perception of team- and client-level communication. These techniques can be applied to assess the preferences and practices of all veterinary team members, enabling the advancement of true relationship-centered medicine.

**Treatment Development**

Using many of the same principles from human healthcare,\textsuperscript{62,63} DCMs can be used to understand veterinary professionals, client, and other
stakeholder perspectives on features of care provided to patients. Within human healthcare, DCMs have been used to bridge gaps between evidence-based medicine and practical considerations for treatment and drug development by fostering an understanding of which treatments patients prefer and which drugs physicians prescribe for different patients.\textsuperscript{10,12,13,17,64,65} For example, in the development of a new treatment plan, DCMs can be used to ascertain whether clients with pets with a specific ailment are more concerned with ease of treatment administration or with limiting risks of potential side effects.\textsuperscript{13,55} Other specific research questions can be answered using these methods, such as, “How do veterinary clients weigh the benefits and risks of treatments given?” and “How important are logistical or financial aspects of this treatment?” Considering multiple perspectives in veterinary healthcare, DCMs can be used to address client priorities in caring for their animal to provide client-centered care, while leveraging the knowledge and perspective of the veterinary team. With these considerations, treatment and drug development may proceed with additional caution toward the inclusion of a specific side effect, ease and frequency of administration, or factors that increase cost.

Through DCMs, veterinary researchers can also understand differences in patient characteristics that lead to differing recommendations from veterinary professionals and varying options for the care being offered. By understanding the choices of veterinary professionals and clients, veterinary researchers can determine which patients might benefit from which treatment and the reasons behind any differing recommendations from veterinary professionals to their clients. For example, in human healthcare, DCMs have been used to understand prescribing behavior of physicians.\textsuperscript{54,65} One study\textsuperscript{65} revealed physicians preferred to not prescribe buprenorphine to patients described as paying for care with government insurance (Medicaid). By understanding prescribing behavior and veterinary client preferences for treatment interventions, new drugs and treatments can be developed with practical and current considerations in mind. As such, all perspectives may be included in treatment development in a meaningful way that has yet to be utilized in the veterinary field.

**Medical Product Optimization and Marketing Tactics**

DCMs, from their start in marketing and economics research, were developed to optimize product design and product marketing to increase awareness, sales, and market share by quantifying consumer preferences and using those preferences to predict future purchasing behaviors.\textsuperscript{66} Different product features, including functions, benefits, price, and others, can be tested, and the resulting preference information can inform design and product marketing decisions.\textsuperscript{11} Preferences for various marketing tactics can be collected and used to guide how products and treatments are presented, focusing on tactics that evoke the most favorable responses. Veterinary researchers can utilize these strategies, leveraging their knowledge of the veterinary industry by creating well-informed DCMs.

Further optimization for different target audiences (eg, veterinary professionals, current clients, or future clients) can be accomplished using DCMs. Previous research\textsuperscript{12} has emphasized the discordance between the healthcare provider and patient preferences and values in the care provided, which supports veterinary researchers in creating targeted information regarding medical products for the individuals making purchasing decisions (ie, practice managers, other veterinary professionals, or clients). Individuals currently receiving care may have differing preferences, including the threshold for paying for such care, compared to future clients, as posited in a study\textsuperscript{14} examining the preferences of individuals undergoing fertility treatment. This can be translated into the veterinary field, allowing for differing advertisement or explanation of medical products to veterinary professionals or clients, and further segmentation to provide more individualized information. DCM studies may answer research questions, such as, “Do populations of pet owners (eg, dog vs cat owners) differ in their preferences for purchasing parasite prevention?” to discover potential niche audiences. Targeted responses can be collected from these groups or post hoc analyses (stratification, latent class analysis) can be applied to explore differential preferences between consumer groups. Veterinary professionals and clients likely differ in how they are influenced to either recommend or use a particular product or service. Uncovering and incorporating these differences can improve product and marketing design.

**Common Pitfalls**

There are at least 3 common pitfalls in conducting DCMs: measurement error, interpreting relative preference as an absolute preference, and lack of consistent, transparent reporting of studies.\textsuperscript{22} Measurement error can be introduced by respondent fatigue during longer surveys or misinterpretation of wording used in discrete choice experiments.\textsuperscript{27} Remaining cognizant of the number of questions presented to respondents and how wording may be interpreted is important for limiting sources of measurement error. In addition, researchers should always use plausible attribute combinations to ensure realistic choices are being made by respondents. This can be accomplished using advanced experimental design options (eg, prohibitions). Second, while DCMs measure relative preferences, it is all too easy for researchers to interpret these measures as ones of absolute preference. To address this, researchers should explicitly indicate that all preferences are relative to one another when interpreting and communicating their results. Finally, a lack of appropriate reporting of DCMs reduces transparency and reproducibility of findings. Reporting guidelines, such as ESTIMATE,
can be used to facilitate transparent reporting of key study features. While not an exhaustive list, maintaining awareness of common pitfalls outlined here, in addition to other robust study design criteria, will help to ensure the proper use of DCMs.

Limitations
The use of DCMs in the veterinary field has limitations. First, DCMs use hypothetical, scenario-based questions that cannot always reflect “real-world” decisions or the settings in which they occur. For example, stresses encountered when making emergency veterinary decisions are not replicated in the survey environment. This can be partially mitigated by asking respondents to imagine or recall an event prior to their responses, directly asking respondents if their choices reflected their would-be real-world responses, or combining this stated preference method with revealed preferences by asking about relevant recent experiences. Further mitigation would involve ensuring questions posed would be designed to closely correspond to real-life situations to increase the generalizability of findings to actual situations encountered by participants. Second, the interpretation of features presented may differ between respondents. To ensure that the most applicable features are included, and wording can be interpreted consistently, researchers can employ a participatory approach, such as some form of qualitative investigation within the target population prior to quantitative data collection. Qualitative investigation may enable members of a study’s target population to inform the possible motivations or meaning behind potential general preferences. DCMs can work in conjunction with qualitative considerations to identify relevant features. With the appropriate use of the techniques mentioned, limitations to the implementation of DCMs in veterinary research can be minimized.

Conclusion
Client decisions regarding their animal’s well-being are complex and influenced by a variety of aspects of care beyond health outcomes. DCMs make use of difficult trade-offs made in decision-making by veterinary professionals and their clients to gain a clearer understanding of underlying preferences that drive decisions. There is significant, untapped potential for DCMs to further the veterinary field through understanding veterinary professionals and client preferences and choice behavior, bolstering evidence-based medicine with practical considerations, and encouraging the uptake of medical services or products. DCMs should be considered as a robust methodological tool for veterinary researchers to uncover practical considerations for care that are likely to support optimal outcomes of veterinary care, including animal health.

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