Human Behaviour in Veterinary Care

Animal Behaviour and Welfare Cases – Welfare Case Template

CONTENTS

SUMMARY/ABSTRACT

Summary

The role of behaviour in animal welfare is most commonly considered as about the animal's behavioural needs, but understanding and modifying human behaviour in the veterinary context can have great positive impact on animal welfare. This case study will describe the human behaviours that impact on animal welfare.

Abstract

The human in veterinary practice is an oft-neglected component of both human and animal welfare. Those in vet practice, including veterinarians, vet nurses, technical staff, and front-of-house staff all have a role to play in ensuring that animals receive the best possible care. How should clinicians approach the cognitive load of decision making in stressful situations, recognise the biases in their decision making, and balance non-technical skills alongside highly specialised clinical skills to support animal health? Veterinary work requires effective communication across diverse teams in stressful situations, and good animal care necessitates an understanding of human factors in the veterinary practice. Even after care has concluded, veterinarians need to recognise the impact that human behaviour has on supporting animal welfare. We describe how human behaviour impacts veterinary care, and how veterinarians can utilise up-to-date research on human behaviour such as the Knowledge Deficit Model of communication, the Theory of Planned Behaviour, and 5As Behavioural Change model to improve animal welfare.

WHY IS THIS CASE OF VALUE?

Animal welfare is commonly considered to be the animal's ability to cope with its environment given its species' natural history (Broom, 1991). For managed species, the animal's environment is wholly at the discretion of the humans who care for them. Veterinary research into optimal environments

and management for animals cannot make an impact on animal welfare until it is actioned by those who are making the choices about that animal's management. The human component of animal welfare is relevant in two main veterinary settings, within the choices made by veterinary staff and associated professions during veterinary care, and within the choices owners make surrounding animal husbandry. In both settings, veterinary professionals need an understanding of human behaviour and adapt their own behaviour and guidance to support owners. Unfortunately, it is not often the case that simply providing owners with the right course of action results in a favourable animal welfare outcome. While seemingly counter-intuitive, research from public health has shown that simply providing knowledge rarely results in behavioural change. In this case we will explore the human in veterinary medicine, how human factors in veterinary care can impact animal welfare, and how to support owners to make positive changes.

LEARNING OUTCOMES

1. Identify the common behavioural factors which influence veterinary care
2. Identify three behavioural change models that can support clients to make changes to their animal's management
3. Describe the common reasons why owners find it hard to change their animal's management

BACKGROUND AND CONTEXT

Human Behaviour in Veterinary Care

Ensuring optimal animal welfare through appropriate and timely veterinary care in a clinical practice setting relies upon the effective performance of the clinical team including: vets, nurses, animal care assistants and others. Poor provision of medical care has been considered the fault of individual competency (Reason, 2000) but there are many components to competency, including team competency.. Regardless of whether a care team only met for the first time that day (for example in an out of hours emergency hospital) or have worked together for years (in a small rural practice for example), a team must work together to support patient outcomes, and may be a high performing team or a low performing team. While vets are medical experts within these teams, who have undergone many years of training and extensive clinical reasoning practice, they use the same decision-making frameworks and are subject to the same cognitive biases as other humans (Mckenzie, 2014). In veterinary practice, clinical decisions are frequently made under time constraints with limited available information (Vandeweerd *et al.*, 2012). A clinical diagnosis is often made using heuristics based on representativeness, availability, or extrapolation (Graber, Gordon and Franklin, 2002). Decision making is impacted by the clinician's perception of risk and availability of time, leading the clinician to move between recognition primed, rule-based, analytic and creative decision-making frameworks as the level of risk and availability of time increases or decreases (Flin, Youngson and Yule, 2007). Recognition primed decision making occurs as pattern recognition by experts when there is a time pressure involved and delay would cause harm to the patient. The clinician makes the decision rapidly and there is a move to action. Rule-based decision making is algorithm based and favoured by novice clinicians. If situation "X" occurs then decision "Y" is applied for a specific outcome. An example is the use of a cardiopulmonary resuscitation treatment algorithm (Fletcher *et al.*, 2012). Rule-based decision making does not rely upon expertise. It involves applying a step-by-step progressive approach to a clinical problem. The analytic decision-making framework involves gathering as much information as possible and carefully evaluating all available options. It requires high cognitive and time input. The benefit is optimising for benefits and minimising costs. In low-risk situations without time pressure, a creative decision-making framework

can be applied. This involves making a novel decision and is rarely used in real-time clinical scenarios. Further, non-technical skills, such as situational awareness, decision making, communication, and leadership skills complement the clinical decision making skills and 'contribute to safe and efficient task performance' (Flin, O'Connor and Crichton, 2008). It is clear that clinical decision making is impacted by a range of behavioural psychology factors, and that these decisions can impact patient outcomes and welfare. In this case study, we will focus on team dynamics, cognitive bias, non-technical skills as three areas where individual competency can improve their own competencies.

Human Behaviour and Team Dynamics

Effective use of communication tools is a keystone habit of high performing care teams. Communication errors are a major cause of errors in veterinary medicine (Mellanby and Herrtage, 2004; Kinnison, Guile and May, 2015) . This is particularly relevant in veterinary care settings with dynamic teams, such as teaching hospitals or emergency care hospitals. These veterinary teams often have dynamic membership with new members and novice members joining regularly. These teams are often formed quickly with no previous history of collaboration and must form 'swift trust' (Meyerson, Weick and Kramer, 2007). High-stakes clinical cases also impact cognitive bandwidth. Utilising and practising communication tools is critical in these scenarios. Starting the day with a team huddle is one tool that can be utilised to build psychological safety in teams (Lamming *et al.*, 2021). When stabilising critical patients, closed loop communication, where the recipient repeats the instruction or information to the sender to ensure the message has been mutually understood, can be utilised to ensure treatments are administered correctly. Briefing additional team members arriving at the start of a shift to assist with medical care provision ensures clear role allocation. Summarising key information regularly during patient stabilisation at rally points confirms accurate situational awareness. These tools stack up like dominoes to ensure the veterinary team reach the endpoint of accurate diagnosis and effective patient care with a resilient team able to adapt the treatment plan dynamically as the clinical picture changes over time (Babiker *et al.*, 2014).

Training and coaching contribute to NTS performance retention and development in veterinary practice. The use of checklists and goals lists, when managing sepsis patients for example or algorithms for Critical Illness-Related Corticosterioid Insufficiency (CIRCI) patients, acts as a cognitive aid reducing cognitive load and acting as a tool for rally points and closed loop communication when working as a team. Debriefing is a structured discussion of performance to identify knowledge and skill development opportunities (Eppich and Cheng, 2015). Ensuring that significant clinical events receive appropriate debriefing recognises where performance was good while addressing errors Immersive simulation has slowly emerged as a training tool in veterinary education (Farrell, 2020; McCaw *et al.*, 2022), although there has been limited evaluation of its effectiveness. In medical education, immersive sims allow teams to experience flow state or frazzle when dealing with challenging cases in a safe environment (Bowman and Standiford, 2016). Tabletop simulation allows complex events to be recreated from many perspectives (such as a fatal medication error with complex interacting systems factors) to accurately identify causative factors for analysis of adverse events. After Action Reports are a further tool top provide a framework for analysis of positive and negative outcomes. These tools help veterinary care teams to attenuate the effect of behavioural factors on patient care. Training to improve metacognition has been suggested to improve the cognitive component of medical diagnosis (Croskerry, 2003).

Cognitive load and bias

With an understanding of the frameworks that contribute to clinical decision making, we can begin to unmask common cognitive biases that impact choices made by clinical care providers. We can also evaluate cognitive capacity in a veterinary healthcare setting and consider how overloading

cognitive bandwidth can have a detrimental impact on medical care provision and decision-making capacity.

Humans have limited working memory and capacity for cognitive load. Cognitive load refers to "the amount of finite working memory resources an individual must allocate to meet the cognitive demands of a task" (Howie *et al.*, 2023). Factors impacting the cognitive demand of a clinical task include task complexity, familiarity of the task, level of experience, team factors, task-related emotions experienced by the clinician, level of clinical supervision, physical factors such as hunger and tiredness and personal stressors (Szulewski *et al.*, 2021; Howie *et al.*, 2023). Cognitive capacity is required to make effective clinical decisions. When cognitive capacity is overloaded, our ability to complete tasks decreases. By understanding this, we can optimise the work environment and situation to set veterinary clinicians up for success. Examples include minimising interruptions, delegating tasks to colleagues (cognitive offloading), minimising environmental pressure to avoid thoughts about physical discomfort, drilling tasks to automate common procedures (such as placing an IV cannula for example) and having regular breaks and rest to avoid cognitive fatigue (Choi, van Merriënboer and Paas, 2014; Hearns, 2019). We can provide supportive structures for novice clinicians as they require more cognitive effort to complete tasks than expert practitioners. Immersive simulation is a teaching method used in medical education that realistically recreates a clinical experience (So *et al.*, 2019). Immersive simulation scenarios provide a safety container for learning as the students can experience a simulated clinical situation in a supportive environment with tutor support to practise without the fear of adverse outcomes for a real patient. Metacognitive skills and resilience techniques can be practiced through immersive simulation training.

The term cognitive bias was introduced in the 1970s by Amos Tversky and Daniel Kahneman to explain biases that influence decision making in the presence of uncertainty. Wilke and Mata (2012) define cognitive bias as "systematic error in judgment and decision-making common to all human beings which can be due to cognitive limitations, motivational factors, and/or adaptations to natural environments". Awareness of cognitive biases enhances performance because we can be vigilant to avoid them. Cognitive biases contribute to adverse events and errors in veterinary practice and are attributed as the most common cause of decision-making mistakes in veterinary medicine (Mckenzie, 2014). Some frequently encountered cognitive biases leading to diagnostic errors in medicine include bias, availability bias, confirmation bias and framing effect (Morgenstern, 2015). Anchoring bias occurs when overemphasis is placed on the importance of information presented early in a patient investigation, causing the vet to overlook other important pieces of information or other possible explanations (Rehana and Huda, 2021). An example of this is when a patient is referred for further investigation by another colleague and the vet is biased by the initial presumptive diagnosis. Availability bias occurs when decision making is influenced by past clinical cases which had a similar presentation, particularly those that occurred recently (O'Sullivan and Schofield, 2018). For example, having missed a spinal luxation on initial triage of a trauma patient, the vet subsequently requests spinal radiographs on all trauma patients to screen for injury without other supporting clinical indicators of spinal trauma. Confirmation bias presents as looking for evidence that supports an original theory, seeking to confirm the theory is correct (O'Sullivan and Schofield, 2018). This can lead the vet to ignore subsequent contradictory information leading to misdiagnosis. Framing effect occurs based on context or how questions are asked (O'Sullivan and Schofield, 2018). For example, if a geriatric dog presented to an out of hours emergency hospital with a wound, it may be less likely that the vet diagnoses a previously undetected abdominal mass than when the same dog presents to its local practice for a geriatric annual health exam. These examples illustrate how understanding cognitive biases is important to reduce errors and improve patient welfare in medical care (Croskerry, 2003).

Non-Technical Skills (NTS)

NTS behavioural marker systems have been adopted in a variety of human healthcare disciplines including anaesthesia and surgery(Fletcher *et al.*, 2003; Yule *et al.*, 2006).. The importance of NTS to patient outcomes has been reported in veterinary cardiopulmonary resuscitation (CPR) (Hunziker *et al.*, 2011; Krage *et al.*, 2017). Poor NTS skills become evident in the CPR leadership domain, for example when a senior clinician is the resuscitation leader but has less CPR experience than junior staff participating in the resuscitation. This can lead to impaired willingness of the junior staff to voice their opinions throughout the CPR event due to the senior person voicing their opinion first, even when they have a different opinion or perspective on events and the next best treatment step. This is due to the command gradient effect which occurs in teams when individual members have differing levels of seniority, authority, expertise or experience (Cosby and Croskerry, 2004) . The command gradient effect has been shown to impact speaking up behaviours and situational awareness of the team. The decrease in information sharing weakens the shared mental model and collaborative behaviours of the team. Recognition and rule-based decision-making processes are NTS observed during well executed resuscitation events. These skills are developed through team drilling and good knowledge of the CPR algorithm with use of checklists and closed loop communication to support a shared mental model, clear role allocation and team synchrony supporting a reduction of cognitive load for the whole team. Using CPR as an example, it is clear how NTS support good clinical behaviours both by individual clinicians and whole veterinary teams.

Human Behaviour in Post Veterinary Care

After veterinary care has been delivered, animal welfare is mostly determined by the animal's owner. There is often a basic underlying assumption in healthcare that suboptimal choices by patients happen because the patient, or in the veterinary case the client-owner, does not know the correct course of action. This is called the Knowledge Deficit Model, a common approach to public engagement with science (Simis *et al.*, 2016) and a traditional approach to healthcare where the medic is viewed as an 'expert' and the patient as an empty vessel waiting to receive knowledge(Kelly and Barker, 2016). This one-way information flow is often the starting point for veterinarians advising on production animal health, and yet is an ineffective approach which does not support farmers in their herd health planning (Kristensen and Jakobsen, 2011; Calo, 2018; Skjølstrup *et al.*, 2021). In companion animal care, the extensive scientific knowledge around dog welfare has not necessarily translated to improved welfare-related choices on the part of owner s(Philpotts, Dillon and Rooney, 2019; Maclean *et al.*, 2021), indeed owners still make inappropriate choices regarding their dogs, such as failing to recognise welfare challenges relating to conformational disorders such as brachycephalic phenotypes (Packer, Hendricks and Burn, 2012). In many parts of veterinary care, we see that knowing the right course of action does not necessarily lead to the right behaviours being adopted.

Why is the Knowledge Deficit Model ineffective? The Knowledge Deficit Model is an assumption that behaviour changes through a three stage process: the subject's Knowledge changes, promoting Attitudinal change resulting in changing Practice (the Knowledge Attitude Practice (KAP) model (Gustafson and Rice, 2016)). Unfortunately, the link between Attitude and Practice is not clear. We can see this in human public health, such as dietary choices. Often people are aware of healthy choices and would like to make them, but feel somehow unable to make those choices. E.g., people often overeat even though they are not hungry, with social norms such as a person's belief about it being impolite to leave food behind or turning down bargain food can prompt them to eat more even though they are fully aware of the health implications (Herman and Polivy, 2005).

A good example of this is the use of Massive Open Online Courses to promote animal welfare knowledge and understanding. In the early 2010s, the University of Edinburgh developed a number of veterinary science related Massive Open Online Courses, or MOOCs, aimed at members of the public to improve their knowledge and understanding of animal welfare. MOOCs were a popular approach to opening higher education to the public and were short courses hosted entirely online with a high student:teacher ratio (Daniel, 2012; Baggaley, 2013). The design choices and quality of MOOCs was often variable but they were commonly appreciated by their students (Breslow *et al.*, 2013; Kellogg, 2013). In one animal behaviour and welfare MOOC, while there were significant improvements to students baseline knowledge and attitudes to animal welfare, it was noted that existing attitudes were already positive and the changes were a strengthening of attitude, not a change from a negative to positive attitude (MacKay, Langford and Waran, 2016). A follow-up study explored 188 learner 'stories' across three animal welfare related MOOCs. These were short stories supplied by the learners describing their time on the course and what they intended to do next. The stories were thematically analysed (MacKay *et al.*, 2018) to characterise what the learners considered important about the MOOC. While 39% of the learners described their pre-existing positive animal attitudes, only 5% identified a future behavioural change they would make, and there was no association between the positive attitudes and the behavioural change (Figure 1).

Fig 1: *Results of a Pearsons χ^2 test exploring the association between an animal welfare MOOC learner's expression of positive animal attitudes and their ability to identify a future behavioural change as a result of the MOOC. No association was found.*

This finding is limited as learners were not queried directly about their attitudes to animals and their future behaviour changes. It is highly likely that more than 39% of learners held positive attitudes to animals, and if learners were queried more directly, it may be that a relationship could be found. Nevertheless, the link between Attitude and Practice is not clear within the evaluation of large scale public engagement with animal welfare courses. If the KAP model does not result in behaviour change, how then can we change human behaviour?

Effective Approaches to Human Behavioural Change

There is a very wide range of approaches to changing human behaviour. One review of the public health literature found 117 different theories (Kwasnicka, Dombrowski and White, 2016). These theories have not been designed with the veterinary-client consult in mind with the aim of supporting animal welfare, but we do know that the veterinary client consult is commonly 'directive', with little questioning of the client's opinion or seeking out reasons for non-compliance (Bard *et al.*, 2017). In this section, we will provide an overview of just three common approaches to human behavioural change, starting with the Theory of Planned Behaviour, a simplistic model utilised in research, then looking at the Integrated Behaviour Model, which aims to build on that, to the Five A's, a practice based model designed for use in consults. You can use these models to inform your client questions and, hopefully, support clients to make improvements to their animals' welfare.

The Theory of Planned Behaviour

One of the most common behavioural change models is the Theory of Planned Behaviour (TPB). TPB is a development on the Theory of Reasoned Action. It acknowledges that there are external influences which might influence a behavioural choice, such as a person's income or age, but then there are aspects which can be changed: the individual's attitude towards the behaviour, the subjective norms surrounding the behaviour, and the amount of control the individual feels they have over the behaviour (Ajzen, 1991). The combination of these three constructs allows the individual to set an intention to change their behaviour which supports the behaviour change. A person's attitude is formed from their beliefs about a behaviour and the outcomes, e.g. how much does the person believe the behaviour will impact the outcome, and how positively or negatively do they feel about the outcome? An owner may be reasonably convinced that over-feeding their dog will increase the dog's chances of becoming obese, but not believe that obesity is a poor outcome. Indeed they may even think the obese animal is 'cute'. And we do see a link between attitudes and outcomes, in that owners who approve of obesity are more likely to have obese cats (Teng *et al.*, 2020). The subjective norms around behaviours can be thought of as how an individual perceives that their friends consider the behaviour. There is evidence that people will adapt their response to a story about captive monkeys if they are presented with a positive narrative, even if they themselves disagree with keeping monkeys as pets (Riddle and MacKay, 2020). Finally, a person's beliefs regarding the amount of control they have over a behaviour are moderated by how much they feel they are able to perform the behaviour, how certain they are they could adapt to do the behaviour in changing circumstances, and how easy or difficult the behaviour is to achieve.

TPB is primarily a research tool, intended to support the design of research into public health rather than provide a framework for developing an intervention (Sniehotta, Presseau and Araújo-Soares, 2014). It is also heavily critiqued, with many interventions utilising TPB showing only small or no effect in changing the desired behaviour (Hardeman *et al.*, 2002), the causal mechanisms of behavioural change being unclear (Sutton, 2002), and the utility of the model outside of western cultures is debated (Airhihenbuwa and Obregon, 2000). However, it is a useful first concept in changing behaviours by describing some of the ways in which behavioural change is more complex than we might first consider.

Figure 2: *The Theory of Planned Behaviour Model*

The Integrated Behavioural Model

In a response to some of the critiques of TPB, the Integrated Behavioural Model (IBM) agrees that an individual's motivation to perform a behaviour is important, and that it is formed of their attitudes, beliefs about social norms, and beliefs about their personal agency, but that the targeted behaviour is also impacted by other elements (Montano et al, 2008). Does the person have the required knowledge and skill to perform the behaviour? Are their environmental constraints that make the behaviour impossible to perform? Is the behaviour relevant to that individual? And can the behaviour become a habit? In some ways, the IBM encompasses aspects of the KAP as well, by ensuring the individual knows what they need to do, while also recognising that attitude alone is insufficient to motivate behavioural change. It also highlights that some elements are outwith the individual's control. If the environment is a barrier, or the behaviour isn't applicable to the individual, there will be no behavioural change. The IBM highlights that each behaviour is specific and must be considered individually, as there will be unique challenges in each context, in this way it is considered to be more widely applicable than TPB (Fishbein, 2000). The perspective of the individuals being targeted is key in changing behaviour. Elicitation procedures, or open-ended

questions designed to explore what might impact a behaviour (Middlestadt *et al.*, 1996), are a key component of IBM. Only by discussing the behaviours with relevant groups can you understand which behaviours are relevant to them, and where barriers might exist.

Again, IBM is not intended to be a framework for communicating something to an individual (Fishbein and Cappella, 2006), but instead to research how behavioural intention and attitudes influence the likelihood of a behaviour being adopted. The key outcome of IBM is the consideration that environment and behavioural relevance are important considerations. Not only would you offer different advice on vaccinations to an owner in Nigeria than you would Norway, but you would tailor your advice on vaccinations to a single parent in Norfolk versus a Double Income No Kids couple in Norfolk. Each individual case will have different considerations which impact their ability to perform the behaviour of interest. Importantly, one cannot assume what the barriers are for any population, they must be understood through consultation with that population.

The 5As Model

In contrast to the previous two models, the 5As is not a theoretical model intended for research, but was developed in practice at a tobacco addiction treatment centre (Fiore *et al.*, 2000). The model is as follows:

- Assess the patient/client's current behaviours and their associated beliefs and motivations
- Advise the patient/client based on their individual clinical history
- Agree with the patient a realistic set of goals
- Assist the patient to identify barriers and potential solutions to those barriers
- Arrange a follow-up to evaluate progress and next steps.

Each element is integral to the model. For example, the use of the 5As model has been associated with supporting patients to lose weight (Jay *et al.*, 2010), although it is important to note that a key step is to assess the situation by asking the patient "are you happy with your weight?" Without assessing the patients' beliefs and attitudes towards weight loss, it is impossible to give them the specific advice that the IBM tells us is necessary to support behaviour change. A key component of this model is that the patient/client must work with the physician, and where individuals do not wish to change, the best that a physician can do is inform them of the risks and follow-up again later (Whitlock *et al.*, 2002).

In practice, human medicine practitioners utilising the 5As often miss the 'assess' aspect, do not hear where the patient is reticent, and often fail to provide help that is specific to that individual's needs (Carroll, Antognoli and Flocke, 2011). Even the originators of this model note that the Assist and Arrange steps are the aspects delivered the least in practice (Glasgow, Emont and Miller, 2006). There is limited research on the efficacy of the 5A model in veterinary consults, however it is a reasonable bridge between the theory-led approaches and the practice of healthcare, and can be a more constructive approach to supporting individuals to make better animal welfare choices. A theoretical application of the model is shown in Figure 2.

Figure 3: *The 5As Model of Human Behaviour Change applied to a theoretical pet obesity consult, adapted from Whitlock et al (2002)*

DISCUSSION QUESTIONS

Reflecting on these questions can support your learning from the case study:

- How can the veterinary practice environment be optimised to support vets for optimal clinical performance?
- What strategies can be utilised to minimise the impact of cognitive bias on clinical diagnosis?
- To what extent is it the veterinarian's role to manage the behaviour of colleagues and clients?
- How can veterinarians utilise human behavioural change literature to support animal welfare?

COURSES OF ACTION

Veterinarians wishing to make an impact in animal welfare should familiarise themselves with basic human behavioural change theories and the implications for practice. An understanding of how clinical decisions are made, metacognition, cognitive load theory and non-technical skills allows veterinary care providers to implement some of the interventions described according to their specific area of veterinary practice.

CONCLUSIONS

Veterinary medical error has a significant impact on animal welfare. Correct clinical diagnosis and decision making supports the best possible outcome for animals requiring medical care. By understanding the principles of behavioural psychology and cognitive function in a veterinary clinical setting, vets can set themselves and their teams up for success as medical care providers.

The knowledge deficit model, while a prevalent method of communication in healthcare settings, is limited in its ability to promote healthy behaviours. Animal health and welfare is primarily impacted by human choices around the animal's management, and so the human needs support to make positive animal welfare choices. Often, management choices are multifactorial, influenced by a person's attitudes, their beliefs, and factors outside of their control. Utilising appropriate behavioural change models can better support animal welfare through making effective changes.

REFERENCES

Airhihenbuwa, C.O. and Obregon, R. (2000) 'A critical assessment of theories/models used in health communication for HIV/AIDS', *Journal of Health Communication*, 5, pp. 5–15. Available at: https://doi.org/10.1080/10810730050019528.

Ajzen, I. (1991) 'The Theory of Planned Behavior', *Organizational Behavior and Human Decision Processes*, 50, pp. 179–211.

Babiker, A. *et al.* (2014) 'Health care professional development: Working as a team to improve patient care.', *Sudanese journal of paediatrics*, 14(2), pp. 9–16. Available at: http://www.ncbi.nlm.nih.gov/pubmed/27493399%0Ahttp://www.pubmedcentral.nih.gov/articlerender.fcgi?artid=PMC4949805.

Baggaley, J. (2013) 'MOOC rampant', *Distance Education*, 34(3), pp. 368–378. Available at: https://doi.org/10.1080/01587919.2013.835768.

Bard, A.M. *et al.* (2017) 'The future of veterinary communication: Partnership or persuasion? A qualitative investigation of veterinary communication in the pursuit of client behaviour change', *PLoS ONE*, 12(3), pp. 1–17. Available at: https://doi.org/10.1371/journal.pone.0171380.

Bowman, S.L. and Standiford, A. (2016) 'Enhancing Healthcare Simulations and Beyond: Immersion Theory and Practice', *International Journal of Role-Playing*, (6), pp. 12–19. Available at: https://doi.org/10.33063/ijrp.vi6.241.

Breslow, L. *et al.* (2013) 'Studying Learning in the Worldwide Classroom Research into edX's First MOOC', *Research & Practice in Assessment*, 8, pp. 13–25.

Broom, D.M. (1991) 'Animal welfare: concepts and measurement2', *Journal of Animal Science*, 69(10), pp. 4167–4175. Available at: https://doi.org/10.2527/1991.69104167x.

Calo, A. (2018) 'How knowledge deficit interventions fail to resolve beginning farmer challenges', *Agriculture and Human Values*, 35(2), pp. 367–381. Available at: https://doi.org/10.1007/s10460-017-9832-6.

Carroll, J.K., Antognoli, E. and Flocke, S.A. (2011) 'Evaluation of physical activity counseling in primary care using direct observation of the 5As', *Annals of Family Medicine*, 9(5), pp. 416–422. Available at: https://doi.org/10.1370/afm.1299.

Choi, H.H., van Merriënboer, J.J.G. and Paas, F. (2014) 'Effects of the Physical Environment on Cognitive Load and Learning: Towards a New Model of Cognitive Load', *Educational Psychology Review*, 26(2), pp. 225–244. Available at: https://doi.org/10.1007/s10648-014-9262-6.

Cosby, K.S. and Croskerry, P. (2004) 'Profiles in patient safety: Authority gradients in medical error', *Academic Emergency Medicine*, 11(12), pp. 1341–1345. Available at: https://doi.org/10.1197/j.aem.2004.07.005.

Croskerry, P. (2003) 'Cognitive forcing strategies in clinical decisionmaking', *Annals of Emergency Medicine*, 41(1), pp. 110–120. Available at: https://doi.org/10.1067/mem.2003.22.

Daniel, J. (2012) 'Making Sense of MOOCs: Musings in a Maze of Myth, Paradox and Possibility', *Journal of Interactive Media in Education* [Preprint]. Available at: http://www-jime.open.ac.uk/jime/article/viewArticle/2012-18/html.

Eppich, W. and Cheng, A. (2015) 'Promoting excellence and reflective learning in simulation (PEARLS): Development and rationale for a blended approach to health care simulation debriefing', *Simulation in Healthcare*, 10(2), pp. 106–115. Available at: https://doi.org/10.1097/SIH.0000000000000072.

Farrell, R. (2020) 'Beyond the classroom: Insights into the use of virtual simulation in veterinary education', *Veterinary Record*, 186(17), pp. 559–561. Available at: https://doi.org/10.1136/vr.m2103.

Fiore, M.C. *et al.* (2000) 'A Clinical Practice Guideline for Treating Tobacco Use and Dependence: A US Public Health Service Report', *JAMA - Journal of the American Medical Association*, 283(24), pp. 3244–3254.

Fishbein, M. (2000) 'The role of theory in HIV prevention', *AIDS Care - Psychological and Socio-Medical Aspects of AIDS/HIV*, 12(3), pp. 273–278. Available at: https://doi.org/10.1080/09540120050042918.

Fishbein, M. and Cappella, J.N. (2006) 'The role of theory in developing effective health communications', *Journal of Communication*, 56(SUPPL.), pp. 1–17. Available at: https://doi.org/10.1111/j.1460-2466.2006.00280.x.

Fletcher, D.J. *et al.* (2012) 'RECOVER evidence and knowledge gap analysis on veterinary CPR. Part 7: Clinical guidelines', *Journal of Veterinary Emergency and Critical Care*, 22(SUPPL.1). Available at: https://doi.org/10.1111/j.1476-4431.2012.00757.x.

Fletcher, G. *et al.* (2003) 'Anaesthetists' non-technical skills (ANTS): Evaluation of a behavioural marker system', *British Journal of Anaesthesia*, 90(5), pp. 580–588. Available at: https://doi.org/10.1093/bja/aeg112.

Flin, R., O'Connor, P. and Crichton, M. (2008) *Safety at the Sharp End*. 1st edn, *Safety at the Sharp End*. 1st edn. London: Ashgate Publishing. Available at: https://doi.org/10.1201/9781315607467/SAFETY-SHARP-END-PAUL-CONNOR-RHONA-FLIN.

Flin, R., Youngson, G. and Yule, S. (2007) 'How do surgeons make intraoperative decisions?', *Quality and Safety in Health Care*, 16(3), pp. 235–239. Available at: https://doi.org/10.1136/qshc.2006.020743.

Glanz, K., Rimer, B.K. and Viswanath, K. (eds) (2008) *Health behaviour and health education: Theory, Research and Practice*. 4th Editio. Jossey-Bass, John Wiley and Sons.

Glasgow, R.E., Emont, S. and Miller, D.C. (2006) 'Assessing delivery of the five "As" for patient-centered counseling', *Health Promotion International*, 21(3), pp. 245–255. Available at: https://doi.org/10.1093/heapro/dal017.

Graber, M., Gordon, R. and Franklin, N. (2002) 'Reducing diagnostic errors in medicine: What's the goal?', *Academic Medicine*, 77(10), pp. 981–992. Available at: https://doi.org/10.1097/00001888-200210000-00009.

Gustafson, A. and Rice, R.E. (2016) 'Cumulative Advantage in Sustainability Communication: Unintended Implications of the Knowledge Deficit Model', *Science Communication*, 38(6), pp. 800–811. Available at: https://doi.org/10.1177/1075547016674320.

Hardeman, W. *et al.* (2002) 'Application of the theory of planned behaviour in behaviour change interventions: A systematic review', *Psychology and Health*, 17(2), pp. 123–158. Available at: https://doi.org/10.1080/08870440290013644a.

Hearns, S. (2019) *Peak performance under pressure : lessons from a helicopter rescue doctor*. 1st Edition. Class Professional Publishing.

Herman, C.P. and Polivy, J. (2005) 'Normative influences on food intake', *Physiology and Behavior*, 86(5), pp. 762–772. Available at: https://doi.org/10.1016/j.physbeh.2005.08.064.

Howie, E.E. *et al.* (2023) 'Cognitive Load Management: An Invaluable Tool for Safe and Effective Surgical Training', *Journal of Surgical Education*, 80(3), pp. 311–322. Available at: https://doi.org/10.1016/j.jsurg.2022.12.010.

Hunziker, S. *et al.* (2011) 'Teamwork and leadership in cardiopulmonary resuscitation', *Journal of the American College of Cardiology*, 57(24), pp. 2381–2388. Available at: https://doi.org/10.1016/j.jacc.2011.03.017.

Jay, M. *et al.* (2010) 'Physicians' use of the 5As in counseling obese patients: Is the quality of counseling associated with patients' motivation and intention to lose weight?', *BMC Health Services Research*, 10(159). Available at: https://doi.org/10.1186/1472-6963-10-159.

Kellogg, S. (2013) 'How to make a MOOC', *Nature*, 499, pp. 8–10.

Kelly, M.P. and Barker, M. (2016) 'Why is changing health-related behaviour so difficult?', *Public Health*, 136, pp. 109–116. Available at: https://doi.org/10.1016/j.puhe.2016.03.030.

Kinnison, T., Guile, D. and May, S.A. (2015) 'Errors in veterinary practice: Preliminary lessons for building better veterinary teams', *Veterinary Record*, 177(19), p. 492. Available at: https://doi.org/10.1136/vr.103327.

Krage, R. *et al.* (2017) 'Relationship between non-technical skills and technical performance during cardiopulmonary resuscitation: Does stress have an influence?', *Emergency Medicine Journal*, 34(11), pp. 728–733. Available at: https://doi.org/10.1136/emermed-2016-205754.

Kristensen, E. and Jakobsen, E.B. (2011) 'Challenging the myth of the irrational dairy farmer; understanding decision-making related to herd health', *New Zealand Veterinary Journal*, 59(1), pp. 1–7. Available at: https://doi.org/10.1080/00480169.2011.547162.

Kwasnicka, D., Dombrowski, S.U. and White, M. (2016) 'Theoretical explanations for maintenance of behaviour change: a systematic review of behaviour theories', *Health Psychology Review*, 10(3), pp. 277–296. Available at: https://doi.org/10.1080/17437199.2016.1151372.

Lamming, L. *et al.* (2021) 'Fidelity and the impact of patient safety huddles on teamwork and safety culture: an evaluation of the Huddle Up for Safer Healthcare (HUSH) project', *BMC Health Services Research*, 21(1), pp. 1–11. Available at: https://doi.org/10.1186/s12913-021-07080-1.

MacKay, J.R.D. *et al.* (2018) 'Lessons Learned from Teaching Multiple Massive Open Online Courses in Veterinary Education', *Journal of Perspectives in Applied Academic Practice*, 6(2), pp. 22–40.

MacKay, J.R.D., Langford, F. and Waran, N. (2016) 'Massive Open Online Courses as a Tool for Global Animal Welfare Education', *Journal of Veterinary Medical Education*, 43(3), pp. 287–301. Available at: https://doi.org/10.3138/jvme.0415-054R2.

Maclean, E.L. *et al.* (2021) 'The New Era of Canine Science : Reshaping Our Relationships With Dogs', *Frontiers in Veterinary Science*, 8(July). Available at: https://doi.org/10.3389/fvets.2021.675782.

McCaw, K. *et al.* (2022) 'Exploration of Immersive Virtual Reality in Teaching Veterinary Orthopedics', *Journal of veterinary medical education*, 49(6), pp. 716–720. Available at: https://doi.org/10.3138/jvme-2021-0009.

Mckenzie, B.A. (2014) 'Veterinary clinical decision-making: cognitive biases, external constraints, and strategies for improvement', *JAVMA*, 244(4), pp. 271–276.

Mellanby, R.J. and Herrtage, M.E. (2004) 'Survey of mistakes made by recent veterinary graduates', *Veterinary Record*, 155(24), pp. 761–765. Available at: https://doi.org/10.1136/vr.155.24.761.

Meyerson, D., Weick, K.E. and Kramer, Roderick Moreland (2007) 'Swift trust and temporary groups', in Roderick M Kramer (ed.) *Organizational trust : a reader*. Oxford, UK: Oxford University Press, pp. 415–444.

Middlestadt, S.E. *et al.* (1996) 'The use of theory based semistructured elicitation questionnaires: Formative research for CDC's Prevention Marketing Initiative', *Public Health Reports*, 111(SUPPL. 1), pp. 18–27.

Morgenstern, J. (2015) *Cognitive errors in medicine: The common errors*, *First10EM blog*. First10EM. Available at: https://doi.org/10.51684/FIRS.726.

O'Sullivan, E.D. and Schofield, S.J. (2018) 'Cognitive bias clinical medicine', *Journal of the Royal College of Physicians of Edinburgh*, 48(3), pp. 225–232. Available at: https://doi.org/10.4997/JRCPE.2018.306.

Packer, R.M.A., Hendricks, A. and Burn, C.C. (2012) 'Do dog owners perceive the clinical signs related to conformational inherited disorders as "normal" for the breed? A potential constraint to improving canine welfare', *Animal Welfare*, 21(SUPPL. 1), pp. 81–93. Available at:

https://doi.org/10.7120/096272812X13345905673809.

Philpotts, I., Dillon, J. and Rooney, N. (2019) 'Improving the welfare of companion dogs—Is owner education the solution?', *Animals*, 9(662), pp. 1–22. Available at: https://doi.org/10.3390/ani9090662.

Reason, J. (2000) 'Human error: Models and management', *BMJ*, 320, pp. 768–770. Available at: https://doi.org/10.1136/ewjm.172.6.393.

Rehana, R.W. and Huda, N. (2021) 'A Common Heuristic in Medicine: Anchoring', *Ann Med Health Sci Res*, 11, pp. 1461–1463.

Riddle, E. and MacKay, J.R.D. (2020) 'Social Media Contexts Moderate Perceptions of Animals', *Animals*, 10(845), p. 16. Available at: https://doi.org/10.3390/ani10050845.

Simis, M.J. *et al.* (2016) 'The lure of rationality: Why does the deficit model persist in science communication?', *Public Understanding of Science*, 25(4), pp. 400–414. Available at: https://doi.org/10.1177/0963662516629749.

Skjølstrup, N.K. *et al.* (2021) 'Veterinary Herd Health Consultancy and Antimicrobial Use in Dairy Herds', 7(February), pp. 1–15. Available at: https://doi.org/10.3389/fvets.2020.547975.

Sniehotta, F.F., Presseau, J. and Araújo-Soares, V. (2014) 'Time to retire the theory of planned behaviour', *Health Psychology Review*, 8(1), pp. 1–7. Available at: https://doi.org/10.1080/17437199.2013.869710.

So, H.Y. *et al.* (2019) 'Simulation in medical education', *Journal of the Royal College of Physicians of Edinburgh*, 49(1), pp. 52–57. Available at: https://doi.org/10.4997/JRCPE.2019.112.

Sutton, S. (2002) 'Testing attitude-behaviour theories using non-experimental data: An examination of some hidden assumptions', *European Review of Social Psychology*, 13(1), pp. 293–323. Available at: https://doi.org/10.1080/10463280240000019.

Szulewski, A. *et al.* (2021) 'From Theory to Practice: The Application of Cognitive Load Theory to the Practice of Medicine', *Academic Medicine*, 96(1), pp. 24–30. Available at: https://doi.org/10.1097/ACM.0000000000003524.

Teng, K.T. *et al.* (2020) 'Positive attitudes towards feline obesity are strongly associated with ownership of obese cats', *PLoS ONE*, 15(6), pp. 1–22. Available at: https://doi.org/10.1371/journal.pone.0234190.

Vandeweerd, J.-M. *et al.* (2012) 'Understanding Veterinary Practitioners' Decision- Making Process: Implications for Veterinary Medical Education', *Journal of Veterinary Medical Education*, 39(3), pp. 142–151. Available at: https://doi.org/10.3138/jvme.0911.098R1.

Whitlock, E.P. *et al.* (2002) 'Evaluating primary care behavioral counseling interventions. An evidence-based approach', *American Journal of Preventive Medicine*, 22(4), pp. 267–284. Available at: https://doi.org/10.1016/S0749-3797(02)00415-4.

Wilke, A. and Mata, R. (2012) 'Cognitive Bias', in V.S. Ramachandran (ed.) *Encyclopedia of Human Behavior: Second Edition*. 2nd edn. No City Given: Academic Press, Elsevier Inc., pp. 531–535. Available at: https://doi.org/10.1016/B978-0-12-375000-6.00094-X.

Yule, S. *et al.* (2006) 'Development of a rating system for surgeons' non-technical skills', *Medical Education*, 40(11), pp. 1098–1104. Available at: https://doi.org/10.1111/j.1365-2929.2006.02610.x.

FURTHER READING

Ethical approval to process the learner story data was granted on the 22nd August 2016 by the Human Ethics Review Committee at the R(D)SVS, Project: 'Cross MOOC Comparison-10/08/16'