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PERSPECTIVES

TRANSFORMING VETERINARIANS INTO INFLUENTIAL ORGANIZATIONAL PARTNERS USING COLLABORATIVE BUSINESS RISK ANALYSIS TO DRIVE ANIMAL WELL-BEING PROGRAMS

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Abstract: Traditionally, animal preventive medicine programs have been based on reducing health risks to individuals or groups of animals within a zoo or aquarium collection with an emphasis on transmissible pathogens of concern. An alternative risk analysis method of using animal health risks that impact a zoo or aquarium business to drive animal well-being program strategy is suggested. Business risk lenses of value to the individual organization are determined and weighted prior to use for risk analysis. In this example, the lenses used were 1) partial or complete closure of a park, resort, or attraction; 2) damage to brand integrity; 3) disruption to population management; 4) impact on individual animal or population health (the traditional basis of preventive medicine programs); and 5) other organizational concerns. Using these five business risks lenses demonstrates a holistic view of the zoo or aquarium business that engages all parts of the organization in understanding and preventing animal health concerns, thus giving animals the best opportunity to thrive. This approach increases risk tolerance in veterinarians, as they are no longer held solely accountable for morbidity and mortality: the responsibility for protecting the health of the animals and the business is more evenly distributed across the organization. With veterinarians demonstrating more tolerance and flexibility, their value increases and they are engaged for greater influence across the organization.

INTRODUCTION

Preventive medicine is a core tenet of protecting zoo and aquarium animals from disease and disorders and is an Association of Zoos and Aquariums (AZA) accreditation standard.¹ Preventive medicine programs have traditionally been based on reducing health risks to individuals or groups of animals within a zoo or aquarium collection with an emphasis on transmissible pathogens.² Initially, these programs were very rudimentary, with the aim of eliminating a few key diseases, but as knowledge grew, so did preventive medicine programs, to go beyond prevention and to include proactive pathogen surveillance programs. In the authors' experience, expanding literature sources were used to develop all-encompassing prevention and surveillance programs, often irrespective of true pathogen risk to the collection, and included preshipment, quarantine, annual examination, and necropsy protocols. The authors have seen this pendulum of overcorrection recently being pulled back as more institutions implement a risk analysis of hazards to

the health of their animals.⁵ Risk analysis methods allow institutions to tailor their preventive medicine programs for the taxa within, and the geographic location of, their zoo or aquarium, as well as the actual prevalence of pathogen hazards.

The heavy focus of these programs on prevention can lead to the veterinarian having to say no to animal acquisitions or alternative quarantine practices frequently because of risk intolerance driven by the heavy burden of perceived responsibility: "I must protect the collection and will be held solely accountable for the morbidity and mortality that occurs. Therefore, I must say no and stand my ground." Consequently, the veterinarian is perceived negatively, as a roadblock to the progress of the institution, and can then subsequently be left out of decision-making and miss the opportunity for influence in other circumstances. Using a different set of risk lenses that focuses on the success of the business can shift the narrative, allowing for increased risk tolerance and resulting in more opportunities for greater influence and value for the veterinarian across the organization.

RISK ANALYSIS AND BUSINESS RISK LENSES

Risk analysis is a four-step process that includes hazard identification, risk assessment, risk management/mitigation, and risk communication.⁶

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		Impact				
		Negligible	Minor	Moderate	Significant	Severe
Likelihood ↑	Very likely	2	3	4	5	5
	Likely	1	2	3	4	5
	Possible	1	2	3	4	4
	Unlikely	1	2	2	3	4
	Very unlikely	1	1	2	3	3

Figure 1. Risk assessment chart using likelihood vs. impact.

When it is applied to animal health at aquariums and zoos, there has typically been a focus on transmissible pathogens that impact individual or groups of animals. For a more holistic support of an organization's success, business risk lenses can be used during risk analysis, and these lenses should be individualized and weighted for the organization through discussions with stakeholders. For Disney, five business risk lenses were developed and determined to be of equal value for risk analysis:

1. Partial or complete closure of a park, resort, or attraction
2. Damage to brand integrity
3. Disruption to population management
4. Impact on individual animal or population health
5. Other organizational concerns

Examples for 1: Complete or partial closure of park, resort, or attraction includes complete closure of a zoo because of hoof and mouth disease; closure to a part of an aquarium because of a catastrophic water quality problem; closure of a pool at an aligned hotel resort because of raccoon feces and *Baylisascaris* risk; and closure of avian habitats because of highly pathogenic avian influenza (HPAI).

Examples for 2: Damage to brand integrity includes diseases and disorders to high-profile animals like dolphins and black rhinos (iron overload disorder), elephants (elephant endotheliotropic herpesvirus [EEHV]), and gorillas (cardiomyopathy) or those that might be associated with a visitor perception of uncleanliness (e.g., encephalomyocarditis virus [EMCV], lateral line disease, or neuroangiostrongyliasis).

Examples for 3: Disruption to population management includes diseases that could prevent the shipment of animals and/or participation in species survival plans (e.g., Johne's disease, tuberculosis, and monogenean infestation).

Examples for 4: Impact on individual animal or population health (the traditional basis for preventive medicine programs) includes pathogen and nonpathogen hazards (e.g., dental or hoof disease, allergies, or iron overload disorder).

Examples for 5: Other organizational concerns include those that could impact the budget for the organization, zoonotic diseases, or organizational health concerns (e.g., staff dissatisfaction, compassion fatigue, and grief).

Hazard identification

For this first step at Disney (Disney's Animal Kingdom Theme Park® [DAK], Disney's Animal Kingdom Lodge® [DAKL], The Seas with Nemo and Friends at EPCOT®) and the Tri-Circle-D Ranch®, a series of interviews and surveys were used to gather input from experienced staff.³ These individuals came from areas of husbandry, clinical medicine and pathology, nutrition, science, water science, pest management, and park operations who reviewed their experiences at Disney to identify hazards that posed a current and real risk to the animals and that fell into one or more of the five business risk lenses.

Risk assessment with no mitigation

Once hazards are identified, risk assessment is first performed using a likelihood/impact table (Fig. 1) for each business risk based on no risk mitigation being undertaken. No mitigation assumes that animals are received with absolutely no previous management of the hazard—a scenario that does not typically meet reality, as modern zoo and aquarium practices have some degree of risk mitigation, particularly at accredited institutions. *Likelihood* is based on the degree of likelihood that the hazard is present and therefore does not change across each business risk. It is important though to note that likelihood may be changed by risk mitigation, typically decreasing it. *Impact* is based on each individual business risk and therefore can vary. A spreadsheet is created (Table 1) to record each business risk lens assessment with scores as well as descriptors to ensure complete understanding of differing likelihoods and impacts. The addition of the descriptors makes it very clear to the audience how the hazard was assessed. For example, 3 = “possible, moderate” or “very unlikely, severe” or “very likely, minor”. Scores for each business risk lens are

Table 1. Risk assessment examples premitigation and postmitigation using business risk lenses.

Hazard	Risk level ^a	Premitigation business risk assessment			Business risk assessment score
		Total risk score	Likelihood ^b	Partial/complete closure park/resort/attraction impact ^c	
Encephalomyocarditis virus	H	23	VL	Sig	5
Johne's disease	H	24	VL	Sig	5
Highly pathogenic avian influenza	M	17	L	Mod	3
Elephant endotheliotropic herpesvirus	M	15	P	Mod	3
<i>Haemonchus</i>	H	25	VL	Sig	5
Iron overload disease— <i>Tursiops truncatus</i>	H	20	VL	Mod	4
Monogenean infestation— <i>Aetobatus ocellatus</i>	H	21	VL	Min	3

^a Risk level: H, high; L, low; M, medium.

^b Likelihood: VL, very likely; U, unlikely; VU, very unlikely; L, likely; P, possible.

^c Impact: Sig, significant; Sev, severe; Min, minor; Mod, moderate; Neg, negligible.

summed for an overall risk assessment score for the hazard and that score is used to categorize the level of risk as 0–8 = *low*, 9–17 = *medium*, or 18–25 = *high*.

Risk mitigation

A comprehensive review of literature and stakeholder discussions are performed to determine the mitigation efforts that would reduce the risk of each of the hazards. Mitigation includes any actions that reduce likelihood or impact. Mitigation actions are considered on animals entering the collection (preshipment and/or quarantine), animals leaving the collection (preshipment or necropsy), and resident animals (day-to-day health care including treatments, disease surveillance, and preventive measures). In addition, the standard hierarchy of controls for hazards is considered:⁴ elimination (remove the hazard), substitution (replace the hazard), engineering controls (isolate animals from the hazard), administrative controls (change the way the staff works with the animals), and personal protective equipment (protect the animal/staff). Examples of the hierarchy of control use to mitigate hazards include removal of copper downpipes in a petting zoo to prevent toxicity, replacing particular browse in species prone to phytozoar development, vector trapping and vector proofing buildings and food storage for EMCV, discontinuing sheath cleaning using shared tools in domestic horses for *Taylorella equigenitalis*, and the use of masks and gloves when close to exotic felids for SARS-CoV-2.

Risk assessment with mitigation

Risk assessment is performed twice for each business risk lens, with no mitigation (i.e., premitigation) and postmitigation. The change between the two

risk assessment scores is used to measure the impact on the business of the mitigation efforts. A variation of a risk score delta of equal to or greater than 50% was considered impactful. For example, Johne's disease was considered with absolutely no mitigation (untested, unknown status of animals entering the collection with no collection surveillance, including none at necropsy) and postmitigation (status of animals known through medical history and/or preshipment/quarantine testing and ongoing collection surveillance, including at every necropsy of susceptible animals). Johne's disease premitigation is a risk level of high (score = 24) (Table 1). Johne's disease postmitigation is a risk level of medium (score = 12). The delta is equal to 50% and therefore the mitigation effect is considered impactful. Overall risk assessment scores and potential reduction in scores are used to prioritize efforts and resources for risk mitigation.

RISK ANALYSIS EXAMPLES

EMCV: In 2019, DAK lost six animals in 24 d to an outbreak of EMCV. This was a novel virus for Disney, with no previous deaths attributed to the virus, based on a robust pathology program since inception of the park. Consequently, it was not considered as a hazard in previous risk analyses. As a newly identified hazard, its impact hit four of the business risk lenses as significant or severe: some enclosures were closed as animals were removed to eliminate exposure to the virus; the vector for EMCV may be attributed to the cleanliness of a facility and therefore had the potential to be of significant detriment to the brand; it was devastating to individual and group population health; and mitigating required considerable resource expenditure

Table 1. Extended.

Premitigation business risk assessment							
Brand risk/ public affairs impact	Business risk assessment score	Population management impact	Business risk assessment score	Individual or group health impact	Business risk assessment score	Other business concern impact	Business risk assessment score
Sev	5	Min	3	Sev	5	Sig	5
Sig	5	Sig	5	Mod	4	Sig	5
Mod	3	Sig	4	Mod	3	Sig	4
Sig	4	Neg	1	Sev	4	Mod	3
Sig	5	Sig	5	Sev	5	Sig	5
Mod	4	Min	3	Sig	5	Mod	4
Mod	4	Sig	5	Sev	5	Mod	4

and the outbreak was hugely impactful to the mental well-being of staff. The authors understood what no mitigation looked like as they faced it head-on with the reservoir host population's EMCV prevalence at almost 30%. Hence, premitigation risk analysis resulted in a risk score of 23 = high (Table 1). Multimodal mitigation actions included reducing exposure (reservoir host exclusion), reducing the reservoir host population (harborage reduction, food availability reduction, and pest removal), and vaccination. Ongoing surveillance of reservoir hosts showed that the mitigation actions resulted in a considerable drop in virus prevalence to <5%, and therefore likelihood was reduced considerably postmitigation. Consequently, the postmitigation risk score dropped to 7 = low, a reduction in score by >50%, and the mitigation was therefore considered impactful. Brand integrity and animal health were protected through the actions of the animal health team in partnership with other lines of business. These other lines of business were integral in reservoir host mitigation actions and as such accepted their responsibility in protecting animal health as part of protecting business health.

Johne's disease: Ungulates are integral to Disney's "show" (exhibits), and therefore to the business success of DAK and DAKL. Although it is unlikely that Disney would receive an animal of unknown hazard status from an accredited institution, population sustainability continues to become more challenging, and expansion into partnering with other institutions could result in acquiring untested, unknown-herd-status animals. Using this possibility for premitigation risk analysis, Johne's disease hit all five business risks premitigation (Table 1) with individual or group health being the only risk lens that was not severe or significant. This resulted in a premitigation risk score of 24.

Postmitigation with known sending institution herd status, preshipment/quarantine testing, and ongoing collection surveillance, including at every necropsy, the score dropped to 12, a reduction of 50%, and the mitigation was therefore considered impactful. DAK and DAKL businesses cannot function without ungulates, and consequently Johne's disease is one of Disney's most important hazards to the business. Demonstrating the effectiveness of risk mitigation for critical hazards to the business highlights the value of the animal health team's actions.

HPAI: Although Disney has had comprehensive contingency plans for HPAI since 2015, it was not until the 2022 outbreak in wild birds in the state of Florida that the risk became real. Previous mitigation plans were based on the spread of disease via poultry farms, which was relatively easy to mitigate. With the spread of disease occurring within wild bird populations, and in particular black vultures (*Coragyps atratus*) in central Florida, mitigation without significantly impacting the business became much more difficult. Risk to every bird population within DAK and DAKL was individually assessed and mitigation impacts to the business were discussed with operational partners. Responsibility for mitigation decisions was shared across lines of business, which allowed for greater risk tolerance, and consequently only one bird population was temporarily moved to reduce risk of exposure to black vultures. Although mitigation did not change the risk assessment score, no collection birds died from HPAI and business partners were thankful that operations were very minimally impacted, and governmental agencies were supportive of these response actions.

EEHV: EEHV had not been considered a significant risk for Disney elephants for many

Table 1. Extended.

Postmitigation business risk assessment						
Likelihood	Partial/complete closure park/resort/attraction impact	Business risk assessment score	Brand risk/public affairs impact	Business risk assessment score	Population management impact	Business risk assessment score
U	Neg	1	Min	1	Neg	1
VU	Sig	3	Mod	2	Sig	3
L	Mod	3	Mod	3	Sig	4
VU	Mod	2	Sig	3	Neg	1
U	Min	2	Min	2	Min	2
P	Neg	1	Neg	1	Neg	1
L	Neg	1	Neg	1	Min	2

years because of sporadic negative testing and the apparent lack of deaths in African elephants (*Loxodonta africana*) under managed care. In 2019, following the deaths of this species at AZA-accredited institutions, EEHV was an identified hazard for risk assessment at Disney. With limited opportunities for prevention at this time (i.e., exposing maternal-antibody-protected calves to EEHV-shedding elephants to help develop own antibodies), pre- and postmitigation scores were similar with only a mild reduction. This limited reduction highlights the emphasis that needs to be put on early detection and response efforts and helps share that message with senior organization leadership and financial partners.

Haemonchus contortus: This nematode thrives in the Florida environment, and Disney has developed significant drug resistance to the *H. contortus* population in its ungulates. As said above, ungulates are business imperative for DAK and DAKL, and the loss of these species would be disastrous to both operations. Consequently, premitigation all five business risks ranked highly likely and significant or severe with a risk score of 25 = high. Mitigation through evidence-based testing for nematode drug resistance patterns, correlations between fecal egg counts and hematocrits, and strategic use of copper oxide, nematophagous fungus, and limited anthelmintic use reduced the risk score to 10 (> 50% reduction). By reducing this risk for keystone animal species, Disney is protecting the business needs for the theme park and associated resort.

Iron overload disorder: Iron overload disorder is a condition in which the body stores too much iron and is seen across multiple species under managed care, including many taxa of birds and mammals. At Disney, it is an identified hazard for

bottlenose dolphins (*Tursiops truncatus*). For this species, premitigation of all five business risks was assessed high with a risk score of 20. Mitigation through understanding contributing factors to iron accumulation, using strategies for management to reduce exposure, and implementing and monitoring effectiveness of chelation treatment resulted in an impactful reduction in the risk score if the mitigation could be sustainable. The financial and labor costs for mitigation (dietary analysis and chelation drug acquisition and preparation) reduced the change in risk score, but the risk analysis process enabled the cost-benefit ratio to be understood openly at a senior leadership level.

Monogeneans: Monogenean infestations in aquarium-managed teleosts and elasmobranchs can present as increased mucus production, flashing behavior, lethargy, and respiratory distress, with severe cases showing visible skin lesions, gill damage, and anemia. These parasites pose significant risks in managed-care environments because of their rapid reproduction, potentially leading to stress, secondary infections, and mortalities if left unmanaged. The direct life cycle of monogeneans makes them particularly challenging to manage in aquarium settings, where they can quickly spread to susceptible species. Disney utilizes a multimodal approach for mitigation, including regular skin scrapes, direct gill exams, routine scheduled treatments, and preventive measures such as quarantine procedures and water quality maintenance. Premitigation risk assessment for monogenean infestation in eagle rays (*Aetobatus ocellatus*) was high with a risk score of 20. Mitigation through preshipment testing and treatment, frequent surveillance and treatment, and understanding contributing factors to life cycle and environmental factors to reduce exposure resulted in an impactful reduction in the risk score. This highlights another

Table 1. Extended.

Postmitigation business risk assessment							
Individual or group health impact	Business risk assessment score	Other business concerns impact	Business risk assessment score	Total risk score	Risk level	Risk change	Risk change level
Min	1	Sig	3	7	L	-16	Impactful
Mod	2	Mod	2	12	M	-12	Impactful
Mod	3	Sig	4	17	M	0	None
Sev	3	Sig	3	12	M	-3	Minimal
Mod	2	Mod	2	10	M	-15	Impactful
Min	2	Sig	4	9	M	-11	Impactful
Mod	3	Mod	3	10	M	-11	Impactful

example of the effectiveness of risk mitigation for critical hazards to the business and highlights the value of the animal health team's actions in partnership with the husbandry and water science teams.

Risk communication

Once hazards are identified and risk assessment using these five business risk lenses, mitigation efforts against those risks are documented in the redevelopment of the well-being (preventive medicine) program. The business risk analysis philosophy, assessment spreadsheet (Table 1), and newly developed well-being program are used to communicate the hazards of highest risk and where they may impact the business to operation partners beyond animal care.

CONCLUSION

Taking a novel approach to risk analysis using business risk lenses enabled Disney veterinarians to demonstrate their value to the organization in a way not previously considered. The multifaceted approach using key stakeholders allowed for the identification of a greater number of hazards, including some that had not been identified before. This initial collaborative effort between animal health and other lines of business leaders in the company fostered strong and positive relationships across all teams. The lenses of the risks to the business and associated risk assessment scoring provided a degree of objectivity that gave business partners confidence in outcomes and in supporting animal health activities. Both created a culture of collective decision-making with partnership and trust. Through the risk analysis process, it was identified that day-to-day health care from experienced zoo and aquarium veterinarians is a

significant mitigator for many of the hazards identified. Species with hazards of particular risk to the business, rather than solely to animal health, were identified and mitigation efforts could be focused and prioritized. By increasing risk tolerance and demonstrating collaboration with a business focus beyond the silo of animal health, the veterinarian is transformed from being seen as the roadblock who says no to a positive solution-oriented team player whose value and influence is sought across the organization.

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