VET nuus•news

Augustus / August 2026

The Monthly Magazine of the SOUTH AFRICAN VETERINARY ASSOCIATION
Die Maandblad van die SUID-AFRIKAANSE VETERINÊRE VERENIGING



THEME

Women's Month

CPD

Otic disorders of backyard poultry

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Suid-Afrikaanse Veterinêre Vereniging

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September 2026

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Venue: Skukuza, Kruger National Park
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21 - 22 September
Venue: Protea Hotel Stellenbosch (Techno Park)
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13th Biennial SAVA & Para-Veterinary Congress

13 - 15 April 2027

Venue: Emperors Palace, Kempton Park, Gauteng

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NOTE





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CPD CONTINUING PROFESSIONAL DEVELOPMENT

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Celebrating Women, Conservation and Veterinary Leadership



Dear members,

August has always been one of my favourite months. It allows us to pause and celebrate the incredible women who have shaped our profession, our communities, and our country. As we mark Women's Month, I find myself reflecting on the many women veterinarians, veterinary nurses, researchers, academics, state veterinarians, wildlife professionals, and support staff who quietly make a difference every single day. Their commitment, compassion, and leadership continue to inspire us, and our profession is undoubtedly stronger because of them.

This month's VetNews also reminds us why veterinary medicine is such an extraordinary profession. One moment we are reading about elephants, the giants that capture the imagination of the world. The next moment, we are exploring the fascinating world of bees, whose importance to biodiversity, agriculture, and food security cannot be overstated. It is a wonderful reminder that whether we are caring for the largest land mammal or one of nature's smallest pollinators, every species matters.

As veterinarians, we have the privilege of working at the intersection of animal health, conservation, food production, biodiversity, and public health. Few professions offer such diversity, and even fewer have such a profound impact on society!

As an association, the past month has been one of active engagement, constructive dialogue, and continued advocacy on behalf of our members and the veterinary profession.

Following the appointment of the Honourable Minister Willem Aucamp as Minister of Agriculture, SAVA had the opportunity to formally congratulate him on his appointment. In our correspondence, we affirmed our commitment to working alongside the Ministry and the Department to strengthen South Africa's veterinary services, animal health systems, and national biosecurity.

That spirit of partnership has also guided our engagement on the proposed Animal Health Regulations. Together with our colleagues from RuVASA and the Wildlife Group, SAVA submitted a comprehensive response to the Department of Agriculture on both the draft Regulations and the underlying Animal Health Act. While we welcomed the government's commitment to modernising South Africa's animal health framework, our submission highlighted several overarching concerns that we believe require careful consideration before implementation.

Our primary recommendation was that the Animal Health Act itself should be reviewed and modernised before new regulations are finalised. Although the Act was assented to more than two decades ago, it has never been brought into operation, and the veterinary landscape has evolved significantly since then. Advances in epidemiology, diagnostics, disease surveillance, traceability, wildlife health, international trade standards, and biosecurity require legislation that reflects the realities of veterinary practice today.

We also emphasised that successful implementation of the Act will depend on a nationally coordinated animal health system supported by clear standards, adequate resources, and consistent capacity across all provinces. Fragmented implementation risks undermining disease control efforts and creating unnecessary disparities in service delivery. Furthermore, introducing an entirely new legislative framework while South Africa continues to respond to Foot and Mouth Disease, Brucellosis, Rabies, and other important diseases carries significant practical risks for both the public and private veterinary sectors.

Our submission further called for legislation that embraces modern, risk-based disease management, stronger public-private partnerships, the One Health approach, and improved coordination between all agencies responsible for national biosecurity, including border management. We remain committed to working constructively with government to develop legislation that is scientifically robust, practical to implement, and capable of supporting an efficient national animal health system for many years to come.

Many of you have also been following the ongoing shortage of Sedabarb (phenobarbitone). I know how challenging this has been for practitioners and, more importantly, for the animals that depend on this essential medicine. We have continued our engagement with Sun Pharma in a constructive spirit and appreciate their willingness to work with the profession in finding sustainable solutions. Sun Pharma confirmed that they were submitting further information and meeting with SAHPRA in the last week of July 2026. We expect more feedback in the first week of August 2026. The SAVA Board together with chairs of the specific interest groups will meet with SAHPRA on 5 August 2026. The matter of availability of veterinary pharmaceuticals is on the agenda. Although it is disappointing that Sedabarb was not available at the end of July, we are encouraged by the progress made by both SunPharma and SAHPRA in resolving the matter and will continue to keep members informed as developments arise.

Collaboration remains central to everything we do. During the month, we held another constructive meeting with the South African Veterinary Council, together with several key stakeholders, to continue discussions on issues affecting our profession. While we may not always agree on every issue, I firmly believe that progress is achieved through respectful engagement, mutual understanding, and a shared commitment to advancing veterinary medicine in South Africa. One of the key issues raised was the importance of having mentorship programmes supporting all veterinary and para-veterinary professions. This is an area of collaboration SAVA continues to pursue.

Looking ahead, August promises to be another exciting month. We are looking forward to attending the 23rd Annual South African Society for Veterinary Epidemiology and Preventive Medicine (SASVEPM) Congress, held under the inspiring theme "Veterinary Preventive Medicine for a Changing World: Southern Africa Leads", with the fitting tagline "Where Disease Prevention Meets Innovation."

At a time when our region continues to grapple with Foot and Mouth Disease, climate change,

emerging diseases, antimicrobial resistance, and evolving biosecurity challenges, this theme could not be more relevant. The congress promises to showcase the innovation, collaboration, and scientific excellence that are shaping the future of preventive veterinary medicine in Southern Africa. The pre-congress workshop on improving early detection and diagnosis of foot and mouth disease and other transboundary diseases is also a much-needed refresher.

SASVEPM is a valued partner of SAVA, and we are particularly excited by their plans to make VetHouse their new home. This is an important milestone that further strengthens our vision of VetHouse as a collaborative hub where specialist groups, professional organisations, and veterinary leaders can work together to advance our profession.

At the end of July, I had the privilege of attending the Foot and Mouth Disease Symposium in Pretoria. Bringing together internationally renowned experts, government leaders, researchers, industry representatives, producers, and veterinary professionals, the symposium provided a timely and much-needed platform for discussion on one of the greatest animal health challenges facing South Africa.

Presentations covered the latest developments in Foot and Mouth Disease epidemiology, diagnostics, vaccine science, surveillance, risk management, and disease control, while highlighting international experiences and local solutions. Most importantly, the symposium reinforced that controlling Foot and Mouth Disease cannot be achieved by government alone. Success depends on strong partnerships between government, organised agriculture, private veterinarians, producers, researchers, and industry, all working towards the common goal of protecting South Africa's livestock sector.

Earlier in July, the RuVASA CEO and I also attended the ARC-hosted Workshop on Risk Analysis of Foot and Mouth Disease. Facilitated by Professor Andrew Robinson from the University of Melbourne's Centre of Excellence for Biosecurity Risk Analysis, the workshop focused on reviewing current FMD risks, identifying gaps in preparedness, strengthening national biosecurity, and exploring practical, risk-based approaches to reducing the spread and impact of the disease. The workshop brought together government, academia, researchers, and industry stakeholders in an open exchange of ideas and international best practice. It was an invaluable opportunity to strengthen our understanding of contemporary risk analysis and to consider how these approaches can better inform policy and disease management in South Africa.

As we celebrate Women's Month, I encourage each of us to recognise the leaders, mentors, colleagues, and friends who have influenced our own journeys. Leadership is not defined by a title but by the positive impact we have on others. Every student mentored, every colleague supported, every animal treated with compassion, and every decision made with integrity contributes to the future of our profession.

Thank you for your continued support of SAVA and for the work you do daily, often quietly and without recognition, to improve animal health, animal welfare, public health, and food security across South Africa.

I hope you enjoy this edition of *VetNews*. Whether your passion lies in companion animals, production medicine, wildlife, conservation, research, academia, or public service, I trust you will find something that informs, challenges, and inspires you.

Until next month, stay safe, stay curious, and thank you for everything you do for our profession.

Groetnis!

Dr. Ziyanda Majokweni – Qwalela
President: South African Veterinary Association

CREDO

We, the members of the Association, resolve at all times:

- To honour our profession and the Veterinary Oath
- To maintain and uphold high professional and scientific standards
- To use our professional knowledge, skills and resources to protect and promote the health and welfare of animals and humans
- To further the status and image of the veterinarian and to foster and enrich veterinary science
- To promote the interests of our Association and fellowship amongst its members.

Ons, die lede van die Vereniging, onderneem om te alle tye:

- Ons professie in ere te hou en die Eed na te kom
- 'n Hoë professionele en wetenskaplike peil te handhaaf en te onderhou
- Ons professionele kennis, vaardigheid en hulpbronne aan te wend ter beskerming en bevordering van die gesondheid en welsyn van dier en mens
- Die status en beeld van die veearts te bevorder en die veeartsenykunde te verryk
- Die belange van ons Vereniging en die genootskap tussen sy lede te bevorder.

Editor's notes / Redakteurs notas



August is Women's Month in South Africa.

A time when we reflect a little on how far females have come in the industry, what their unique contribution is and what their future is. Being a woman, I may be accused of being somewhat biased, but I try to be realistic and know that what could be seen as problem points may be driven by choice and not circumstance. AI helped in drawing up an article sketching the current situation not only in South Africa but also worldwide. It may show the facts, but it will never show the heart behind somebody's choices. In August, you do not need to treat your female colleague, your female employee or your female boss with kid gloves; respect everybody and strive to make the workplace fair for everyone. Females may have other needs and wants that do not equal the playing field. I doubt if women and men can ever be 100% equal, just due to their core differences. But respect does not stop or start with gender.

In a pure, clean scientific and clinical setting, you may not look for friendship between colleagues, but it may be the place where you need friendships to carry each other through hard times. The 2nd of August is Friendship Day.

"A friend is someone who knows all about you and still loves you." — Elbert Hubbard.

Sometimes we do not like ourselves. We may not like the way we handled a situation; the choices or mistakes we made; we may not like the way somebody else treated us, and it injures the way we see ourselves.

Maybe it is the way you feel in your body right now or an undesirable habit you picked up as a crutch. It is sometimes very hard to love or even just like ourselves.

But Elbert Hubbard states unequivocally that a true friend is somebody who will stand by you no matter what. No matter how we judge ourselves, a true friend will not do that. A true friend may advise and sometimes even reprimand, but the motivation is for a better you and not ice-cold judgement.

Within the practice setting, a friend may be the confidant you share your fears and concerns with, all within a confidential relationship. A friend is the one who will sing your praises when you are not in the room.

A friend is the one who will support and defend you no matter what. Can you be this friend? Can you carry the other person's burdens? The reality is that in some practices or businesses, there is nobody else. Can you be your own best friend and forgive your own mistakes? Let's make August not only Women's Month, but also Friendship Month.

Find that friend, be that friend.

The rest of the magazine is jam-packed with articles on bees (my favourite animal – World Honey Bee Day 15 August), something on Echinococcosis in Lions in the Kruger Park and the summary of the National Elephant Heritage Strategy published in July. It may be of interest to vets who have clients they need to advise.



I had a teacher in high school who said people are always friendlier when it is cold. I hope that the cold in your area will bring the warmth of great and long-lasting friendships.

Andriette

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References:
1. Kowalski T, Schuette S. The second-generation Janus kinase inhibitor atinvicitinib is a potent and highly selective inhibitor of JAK1. Vet Dermatol. 2026;0:17. https://doi.org/10.1111/vde.70046
2. Kowalski T, Prohaczik A, Locke K, et al. The second generation Janus kinase inhibitor atinvicitinib significantly reduces pruritus 2-4 hours after dosing dogs in a canine interleukin-31 model. Vet Dermatol. 2026;0:17-18. https://doi.org/10.1111/vde.70046

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A Profession Transformed, A Ladder Still Uneven: Gender in South African and Global Veterinary Medicine

Walk into any South African veterinary faculty today, and you'll find a lecture hall that would be unrecognisable to the profession's founders. Onderstepoort, like veterinary schools the world over, now graduates classes that are majority female. Yet walk into the boardroom of a veterinary council, a corporate group practice, or a university faculty, and the picture changes. And drive two hours out of any major city, into the districts where livestock outnumber people, and the picture changes again. This is the paradox at the heart of veterinary medicine in 2026: a profession that has feminised faster than almost any other in science, while its leadership, ownership, and geographic distribution have lagged stubbornly behind.

The numbers: a global feminisation, unevenly distributed

South Africa's story mirrors a worldwide trend. Women now make up more than half of all registered veterinary professionals in South Africa, a remarkable shift from a profession once almost entirely male, and one that traces back to Joan Morice, the first South African woman to graduate as a vet from Onderstepoort.

The same pattern holds across most of the developed world. In the United States, women represent well over 60% of practising veterinarians, and more than 80% of current veterinary school classes are female. In the United Kingdom, close to 60% of RCVS-registered vets are women, rising to roughly three-quarters among vets under 30. New Zealand reports a similar picture, with women making up around 64% of the workforce, and in much of South-East Asia, women account for 70–80% of new veterinary enrolments.

But this feminisation is not universal. Across much of Sub-Saharan Africa, the profession remains male-dominated: in Nigeria, for example, women are estimated to make up only 20–30% of the national animal health workforce. This creates an unusual dynamic for South Africa, which sits at the more "feminised" end of the African veterinary landscape while still functioning within a continent, and a WOAH region, where the more senior technical and inspection roles remain overwhelmingly male — 88% of veterinary experts deployed on official missions in Africa are men.

Where the split happens: specialisation and setting

Even where women dominate headcounts, the profession is not evenly distributed across its sub-fields — a pattern researchers call occupational segregation. In South Africa, women in veterinary science describe the barriers they face as "field-specific," differing sharply between small-animal practice, large-animal medicine, wildlife work, rural and regulatory roles, and research. Large-animal and wildlife practice, along with regulatory work such as enforcing slaughter or export standards, are areas where South African women vets report being underestimated or having their authority questioned by farmers and clients more accustomed to male practitioners. Regulatory officials in particular describe clients refusing to accept instructions from a woman, or questioning her qualifications outright, when enforcing rules such as bans on illegal slaughter.

Internationally, the same segregation shows up in specialist training. US data on veterinary residency matching between 2011 and 2020 found women were proportionally under-represented as applicants to large-animal surgery and large-animal internal medicine relative to their share of veterinary graduates, even though, once they applied, women were not disadvantaged in actually matching into these highly competitive programmes. In other words, the gap opens earlier — in who chooses to apply — rather than in who gets selected.

Educational pathways and specialization

South African veterinary education has opened opportunities for both genders, and women are now well represented among graduates. However, specialisation choices may still differ.

Women may be more likely to pursue:

- Companion animal medicine
- Diagnostic work
- Teaching and research
- Animal welfare
- Preventive medicine and public health

Men may be more likely to pursue:

- Production animal medicine
- Mixed farm practice
- Surgical and field services
- Certain industry-linked roles

These differences are not universal, but they matter because specialisation strongly shapes long-term career opportunities, earnings, and mobility.

Changing trends in the profession

The veterinary profession in South Africa is gradually changing. More women are entering the field, and many are now visible in leadership, private practice, academia, and diverse clinical settings. Younger generations are also more likely to question older gender norms.

At the same time, structural differences have not disappeared. The profession still shows:

- Gendered sectoral clustering
- Unequal access to ownership
- Leadership imbalances
- Work-life tensions that affect advancement

The long-term trend suggests increasing gender balance, but not automatic equality. Progress depends on mentorship, fair hiring, inclusive workplace cultures, and support for flexible career paths.

Rural versus urban: the fault line within the fault line

If there is one axis that cuts across every other statistic in this story, it is geography. Small-animal, urban practice has become heavily feminised almost everywhere; large-animal, rural and mixed practice has not — and the reasons are structural as much as personal.

South African women veterinarians describe rural work as its own distinct set of obstacles: isolation, long-distance travel over rough terrain, poor animal-handling infrastructure that raises the physical risk of injury, and gender-based scepticism from traditional farming communities more accustomed to male vets. These are not abstract concerns — they shape where graduates choose, or are able, to build a career, and they help explain why interventions like South Africa's veterinary paraprofessional training programmes have had to be deliberately "gender-responsive" to attract and retain women in rural livestock health work at all. One such programme has trained over 100 animal health paraprofessionals for rural smallholder communities, more than 70% of them women — evidence that with the right support structures, the rural gender gap is not fixed, but it currently requires active correction rather than happening by default.

Research from Australia's rural veterinary workforce inquiries — echoed in similar findings from the US and UK — sets out why rural and urban practice diverge so sharply along gender lines. Rural veterinarians report higher workloads, tougher financial sustainability, and more strain on health and wellbeing than urban colleagues; a persistent industry perception (contested by many practitioners themselves) holds that women are less inclined toward physically demanding "country work" and gravitate toward small-animal, urban roles instead.

>>>10

Workforce surveys lend partial support to the pattern without settling the causal question: female veterinarians are less likely to report full-time employment than male colleagues, often linked to career breaks or a shift to part-time work around child-rearing — though researchers are careful to note this doesn't apply to all women, and that blaming feminisation alone for rural shortages oversimplifies a problem also driven by low rural pay, poor practice profitability, and simple lifestyle mismatch with what young graduates, of any gender, are willing to accept.

The consequence is a quiet geographic sorting: urban and suburban small-animal practice, the most visible and often best-supported segment of the profession, skews female; large-animal, mixed, and remote rural practice — frequently the segment facing the most acute national shortages, in South Africa as much as in Australia, the US, or the UK — remains disproportionately male, or in South Africa's case, structurally under-resourced regardless of who is willing to do the work. For companion-animal-heavy urban markets this has meant fast-growing, majority-female workplaces; for rural service delivery it has meant a workforce crisis that gender alone cannot explain, but that gendered expectations and rural working conditions clearly compound.

Leadership: a gap that widens with seniority

If entry-level numbers suggest women have "arrived" in veterinary medicine, leadership numbers tell a different story. In the United States, more than 80% of the veterinary class of 2025 is female, yet 64% of veterinary school deans are male — a striking inversion that researchers warn can create barriers for female students throughout their academic careers, since who occupies senior visible roles shapes who students see as a plausible future for themselves.

At the international regulatory level, the picture is similar. Chief Veterinary Officer is one of the most senior roles a public-sector vet can hold, and it typically aligns with being a country's Delegate to the World Organisation for Animal Health (WOAH). As of 2023, only 38 of 182 WOAH Delegates — 21% — were women. WOAH's own gender task force, interviewing senior female veterinary leaders, found that organisational culture, access to training, and supportive leadership were the critical factors shaping whether women advanced into these roles at all, with some organisations now experimenting with dedicated leadership-development programmes and quota systems to close the gap.

South Africa's own veterinary governance sits within this broader pattern: despite women forming the numerical majority of the registered profession, the country's veterinary sector — like its African neighbours — continues to see leadership, inspection, and mission-level roles skew male, echoing global findings that numerical dominance in a profession does not automatically translate into proportional representation at its top. Notably, the interviews WOAH's gender task force conducted with senior female leaders found that those who had reached the top often described adopting a more open, inclusive leadership style than their male predecessors — suggesting that closing the leadership gap may not just diversify who leads, but how veterinary organisations are run.

South African Statistics show the following trends based on the latest registration figures issued by the South African Veterinary Council on 1 July 2026.

Family responsibilities and career choices

Family life has a strong influence on occupational differences. Veterinary work can be demanding, with early mornings, emergencies, after-hours calls, and travel. These demands may shape choices differently for men and women.

Women are often more likely to adjust their careers around:

- Childcare
- Pregnancy and maternity leave
- Elder care
- Household responsibilities

This may lead to preferences for:

- Urban practices
- Part-time work
- Schedules with limited after-hours burden
- Non-clinical roles such as teaching, administration, or public health

Men may face fewer social expectations to make such adjustments, which can result in more uninterrupted career accumulation and faster advancement in some settings.

Promotion, ownership, and pay: the practical ceiling

Perhaps the clearest structural barrier is practice ownership — because in veterinary medicine, ownership is where wealth, autonomy, and career-long earning power are actually built. In the US, the share of private-practice veterinarians who own their practice has fallen for both genders since 2007, but women remain significantly less likely to own than men, even as the share of women among owners has risen from 29% in 2007 to 41% by 2019. Recent US research on veterinary students confirms the pattern persists in the pipeline too: men are still significantly more likely than women to aspire to practice ownership in the first place, which researchers link to caregiving responsibilities, access to start-up finance, and role modelling.

Pay follows the same trajectory. In the US, the gender pay gap among new graduates is small — around 3% — but widens to roughly 20% by mid-career, and among the top quarter of

earners, the average gap reaches close to $100,000 a year, driven largely by who owns a practice and who doesn't. In South Africa, the salary gap is narrower in percentage terms but still real: male veterinarians earn around 8% more than female veterinarians on average (roughly R467,700 versus R433,400 a year), a gap that compounds over a career through pensions, bonuses, and retirement savings.

Researchers point to several intertwined causes: unconscious bias that penalises women for negotiating assertively; a "motherhood penalty" that disproportionately slows career progression for mothers, while research suggests fathers in the profession face less workplace support for caregiving than mothers do, not more; and, more structurally, a documented tendency for occupations to be paid less, and valued less, as they become more female-dominated — a pattern observed in veterinary medicine as clearly as in other historically male professions that have feminised over time.

Practice ownership is not a clear category in Registree details; the available data show a Principal veterinarian. A principal veterinarian may have more than one practice.

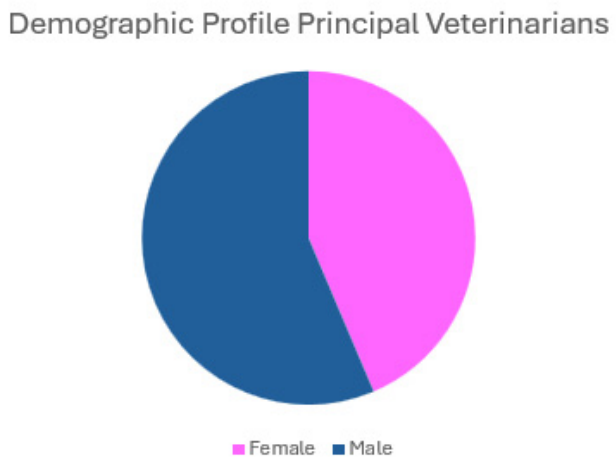


Figure 1:
The ratio between Female and Male Principal Veterinarians

Throughout the race spectrum, this graph represents more or less the same trend with two exceptions. With coloured people, there is one female and one male principal veterinarian; with indian people, the pendulum shifts a little toward females. 18 Indian females are principal veterinarians in comparison to 16 males.

A profession at an inflexion point

None of this is static. Practice ownership among women in the US is projected to overtake men within the next decade if current trends hold. WOAH is piloting the inclusion of gender considerations into its formal evaluation missions from 2025 onward.

And in South Africa, women veterinarians are increasingly visible not just in clinical practice but in export certification, disease surveillance, food security policy, and research leadership — roles that quietly build the case for their representation at more senior tables.

Targeted rural training programmes, of the kind now running in South Africa, also point to a template for closing the geographic gender gap: not by leaving distribution to chance, but by designing recruitment, mentorship, and support specifically around it.

The occupational story of veterinarians, in South Africa and globally, is ultimately a story in three parts.

- The first — who enters the profession — has been substantially rewritten in a single generation.
- The second — who leads it, who owns it, and who is paid what for the same work — is still being actively contested.
- The third — where in the country, or the world, that work actually gets done — remains the least resolved of all, with rural and remote communities on both sides of the equator still waiting for the profession's gender transformation to reach them.

Sources:

South African Veterinary Council; University of Pretoria Faculty of Veterinary Science; World Organisation for Animal Health (WOAH); American Veterinary Medical Association (AVMA); Journal of the American Veterinary Medical Association (JAVMA); American Animal Hospital Association (AAHA); Royal College of Veterinary Surgeons (RCVS); Veterinary Council of New Zealand; Food and Agriculture Organization (FAO); Cornell University College of Veterinary Medicine; NSW Parliamentary Inquiry into the Veterinary Workforce Shortage; International Journal of Veterinary Research and Allied Science.



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Honey bee medicine: a lack of knowledge, education, skills, and training identified as the most commonly cited challenge for veterinary medicine practitioners

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Objective

Honey bees (Apis mellifera) are food-producing animals. Veterinarians are necessary to provide appropriate antibiotic treatment for bees and can support beekeepers by learning to diagnose diseases, manage parasites, and provide nutritional and husbandry recommendations similar to other livestock industries. The objective of this study was to identify the challenges faced by veterinarians contemplating the addition of honey bee medicine to their practice.

Methods

In this observational, cross-sectional study, the survey was deployed via multiple electronic avenues across the US to veterinarians, veterinary technicians, and veterinary students starting on February 20, 2023. Information from the first 22 months of data collection is included herein. Survey response frequency distributions are presented as counts and percentages, and associations between variables as $\chi 2$ and P values. On the basis of survey distribution channels, self-selection bias is expected to be present.

Results

Nearly 1,400 surveys were included in the analysis. Over half of the respondents indicated moderate to high interest in working with beekeepers. Numerous challenges were identified; the most commonly cited (40.2%) was a lack of knowledge, education, skills, and training. The challenges identified did not vary by type of practice, but did vary significantly by interest level.

Conclusions

While interest levels are high, many barriers to accepting beekeeping clients have been identified.

Clinical Relevance

As a livestock species upon which we are highly dependent for food production, honey bees are suffering from an unacceptable mortality rate. There is both a need and an opportunity for veterinarians to engage in this important and emerging area of practice.



Honey bees (Apis mellifera) play a critical role in global food security and ecological stability, not only through pollination but also through the production of high-value products such as honey, propolis, pollen, beeswax, venom, and royal jelly.

These products contribute to human nutrition and health, and they serve as essential inputs in various industries, including agriculture, medicine, cosmetics, and food processing. Honey bees pollinate over $15 billion worth of crops in the US each year, including more than 130 types of fruits, nuts, and vegetables.[1] Despite their importance, honey bee populations worldwide face significant threats due to environmental stressors, habitat loss, pesticide exposure, parasites, and infectious diseases.[2] These pressures have contributed to high colony mortality rates and volatility in the number of colonies available for necessary pollination services, with consequences for both ecosystem health and agricultural productivity.[3,4]

As the challenges facing honey bees continue to mount, the role of veterinarians in supporting honey bee health is becoming increasingly vital. However, most veterinary training programs in the US do not yet offer instruction in apiculture and honey bee medicine, leaving many practitioners underprepared to meet the needs of beekeepers or to confidently provide bee-specific veterinary services.

The involvement of veterinarians in honey bee health in the US began in 2017 through changes to the Code of Federal Regulations involving the US FDA Veterinary Feed Directive (VFD).[5] The VFD applies to any food-producing animal with the overall goal of decreasing the amount of antibiotics entering the human food supply. While the changes were not targeting honey bees in particular, they were included in the new rules as a minor species. Before 2017, US beekeepers could purchase antibiotics (tylosin, oxytetracycline, and lincomycin) from beekeeping suppliers, farm and ranch stores, or online, and then use the antibiotics in their colonies to control the bacterial brood diseases European foulbrood (caused by *Melissococcus plutonius*) and American foulbrood (caused by *Paenibacillus larvae*). Since January 1, 2017, a beekeeper can legally only access antibiotics from a veterinarian with whom they have an established valid veterinarian-client-patient relationship,[6] through either a prescription or VFD. After a licensed veterinarian issues an appropriate order, the beekeeper can then work with a distributor of prescription drugs or a distributor of VFD medicated feed, or the beekeeper can manufacture their own feed in compliance with applicable regulations.

Some large beekeeping suppliers have become approved feed mills so they can dispense medicated feeds when a beekeeper provides a valid VFD. When the changes to the Code of Federal Regulations were implemented, there were no veterinary schools in the country that included honey bee health or medicine as part of their curricula, meaning that most veterinarians and veterinary students had no training on how to work with honey bees or beekeepers. At the same time, the burden of bacterial disease in honey bee colonies was growing; USDA data indicate that the bacterial disease European foulbrood had been steadily increasing over the last 3 decades to a staggering record high of 34% of brood samples tested by the USDA Agricultural Research Service in 2022.[7] Recognizing this gap, Michigan State University (MSU), along with collaborating institutions including Texas A&M University, the University of Florida, and the University of Minnesota, began a coordinated effort to develop honey bee medicine training for veterinarians, veterinary students, and veterinary technicians.

To guide this effort, MSU launched the Veterinary Needs Assessment survey on February 20, 2023, targeting veterinary practitioners across the US. The survey collected information from veterinarians, veterinary technicians, veterinary science educators, and veterinary students to gauge their current (or planned) areas of practice, their interest level in practicing honey bee medicine, their experience working with bees, any barriers they felt may prevent them from taking on beekeeping clients, and what resources would be helpful to encourage them to begin to see beekeeping clients or increase the number of beekeeping clients seen in their practice. This paper describes the survey results for the first 22 months of data collection as well as responses to pre- and post-program evaluations and a follow-up survey of people who participated in MSU's Honey Bee Medicine for Veterinary Practitioner clinics.

Methods

The veterinary needs assessment survey was built with Qualtrics and included both open- and closed-ended questions. The survey was made available on MSU's website for veterinarians (https://pollinators. msu.edu/programs/bees-need-vets/) on February 20, 2023, and is still available as of the time of this publication. People were referred to the survey during training programs offered by MSU and other universities affiliated with the efforts to train veterinarians in honey bee medicine. A link to this survey was posted on the Honey Bee Veterinary Consortium website and sent to all state veterinarians (n = 51), US college of veterinary medicine deans (33), state and national veterinary associations (72), veterinary technician associations (16), and apiculture extension specialists and educators, with a request to further distribute, as appropriate. The survey was also sent to all licensed veterinarians in Michigan with registered email addresses (N = 7,887). In Minnesota, the survey was sent to all colleges of veterinary medicine staff and students, and it was included in the Minnesota Board of Animal Health newsletter. In Florida, the survey was sent to the email list kept by the Institute of Food and Agricultural Services' Honey Bee Research and Extension Laboratory at the University of Florida (N = 9,335). In Texas, the survey was advertised through the social media platforms administered by Texas A&M University's Honey Bee Research Program. This distribution effort took place from September 2022 to June 2023; data collection is still ongoing. The data included in this analysis consist of responses collected from February 20, 2023, to December 12, 2024.

Questions in the survey include the following:

- Where do you currently reside/work/practice?
- Describe your level of veterinary training/experience.
- What area(s) of veterinary medicine do you practice or intend to practice in the future?

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- How interested are you in working with beekeepers in your current/future veterinary practice?
- How often does your practice receive questions about bee husbandry or medical concerns for honey bees?
- Have you or your practice ever been approached by a beekeeper seeking veterinary assistance with their bees?
- What is your level of experience with animal husbandry, honey bee disease identification, writing a prescription for bees, writing a VFD for bees, or handling bees?
- What barriers or challenges prevent or inhibit your ability to work with beekeepers?
- Would the following resources or experiences (dropdown list provided) increase the likelihood of you taking on more beekeeping clients?

Question format

Most of the questions required the respondent to choose a single answer from a dropdown list, while a couple of questions offered a "select all" option. Most questions offered an "other" option with an associated free-text box for elaboration. Any question could be skipped by the respondent.

Summarisation

Responses were summarised for each question, including the total number of responses and percentages for role, speciality, interest level, experience levels, barriers and challenges, resources needed, and a map for geographic location. Additionally, cross tabulation was performed (χ^2 test, or Fisher exact test if cell size was < 5) or χ^2 test for trends was used to assess the relationship between veterinary specialty and type of challenges indicated, interest level (no and slight combined, compared to moderate to extremely combined) and challenges identified, and interest level and value (likelihood to use) of various resources, tools, and experiences. We set the level of statistical significance for all tests to $\alpha = .05$. As the main targets of the survey were veterinary professionals, most of the question summaries and the cross-tabulation analyses were restricted to veterinarians only.

Barriers or challenges question

Categorisation of the free-text responses to the question "What barriers or challenges prevent or inhibit your ability to work with beekeepers?" was necessary for analysis. The first author (MJW) carefully read responses to this question and sorted them into several main headings. This process was repeated a second time to create more specific groupings and reduce the number of "other" responses. Category titles and example responses were as follows:

- **None** — If a response specifically mentioned "no barriers" or "none."
- **Lack of knowledge, education, skills, or training** — Examples included "no training in vet school," "lack of experience/knowledge/training/experience," "lack of bee veterinary mentors," and "lack of veterinary-specific training."
- **Lack of access to bees or beekeepers** — Examples included "no beekeepers nearby" and "lack of interaction/networking opportunities with beekeepers/beekeeper networks."
- **Questioning the need for bee veterinarians** — Examples included "do beekeepers know vets can help?" "Beekeepers are not asking for our help," "Are beekeepers willing to pay?" and "Do beekeepers see any need/value in consulting with a vet?"
- **No intention to practice bee medicine** — Examples included "in a speciality practice without option to see bees," "personal interest only, not practising," and "outside current scope of practice."
- **Business viability/resource concerns** — Examples included "practice does not offer mobile services," "concern about return on investment," "how and what to charge for services," and "Lacking tools, gear, equipment."
- **Lack of confidence** — Examples included comments about the lack of confidence, comfort, or competence working with bees.
- **Lack of time** — Examples included lack of time to see additional clients/workload and/or being too busy to learn/attend trainings.
- **Afraid** of bees/stinging insects.
- **Allergic** to bees.
- **Physical barriers** to lifting, moving, or working in the heat or at an advanced age.
- **Other**.

Practitioner clinic participant surveys: before and immediately after the clinic and long-term follow-up

Michigan State University instructed 12 Honey Bee Medicine for Veterinary Practitioner clinics from 2023 to 2025, with a total of 154 clinic attendees. Attendees were practising and retired veterinarians, veterinary technicians, and veterinary students. Michigan State University invited attendees to fill out a pre- and postclinic survey to measure changes in confidence, knowledge, and skills via participation. In addition, from December 5, 2025, to January 5, 2026, MSU administered a longer-term follow-up survey to 101 prior clinic attendees via email to assess whether the participants had taken on beekeeping clients or taken steps toward taking on beekeeping clients in the months or years following their participation in the clinics. The multiyear veterinary needs assessment survey was submitted to the Institutional Review Board at MSU and was determined to be exempt; the longer-term follow-up survey was also reviewed and determined to not be research.

Results

Responses to the veterinary needs assessment survey

A total of 1,695 surveys were reviewed. Of those, 308 were deleted because they were blank, leaving 1,387 surveys in the initial analysis. If a survey contained at least 1 variable, it was retained in the analysis.

Responses by role and scope of practice

A total of 1,387 responses were captured by level of training: 879 from veterinarians, 256 from veterinary technicians, and 200 from veterinary students.

Respondents were also asked, "What area(s) of veterinary medicine do you practice or intend to practice?" Seven valid responders left this question blank.

Forty-seven responses placed in the "other" level of training category, as well as the 7 blank responses for areas of practice, were excluded from further analysis by role and scope of practice.

The scope of practice of the veterinarians was predominantly small animal medicine (77.7%). The second highest role for veterinarians was "other" (6.8%), followed by food animal veterinarians (5.8%), teaching and research (4.7%), exotic animals (2.7%), and equine (1.9%).

In terms of scope of practice, veterinary technicians worked predominantly in small animal practice (87.5%), followed by teaching and research (5.5%), exotic animal (3.5%), "other" (2.0%), food animal (1.2%), and undeclared (0.4%). Veterinary students were omitted from the analysis of this question, as they were not yet practising.

Geography

Almost every state (except Kansas) was represented in the answers to the question "Where do you currently reside, work, or practice?" Respondents could select more than 1 state, capturing 1,445 answers from 1,387 responders. Michigan was listed most often (n = 495), followed by Minnesota (137) and Florida (123).

Responses from 1,387 veterinarians, veterinary technicians, and veterinary students were included for a total of 1,445 answers (because participants could select more than 1 state where they practice or reside); 55 people did not answer this question.

The number of responses per state is displayed in **Figure 1**.

Gauging participant interest

Responses to the question "How interested are you in working with beekeepers in your current/future veterinary practice?" are summarised in **Table 1**.

Over half of the veterinarians (60.3%) and veterinary medicine students (53.5%), as well as nearly half of the technicians (49.4%), indicated that they were either extremely or moderately interested in working with beekeepers in their practice.

Approached for help with bees?

When veterinarians and veterinary technicians were asked, "How often does your practice receive questions about husbandry or medical concerns for honey bees?" 3 respondents (0.28%) indicated > 10 requests per month, 189 (17.9%) indicated 1 to 10 requests per month, and 862 (81.8%) indicated they had never received a request.

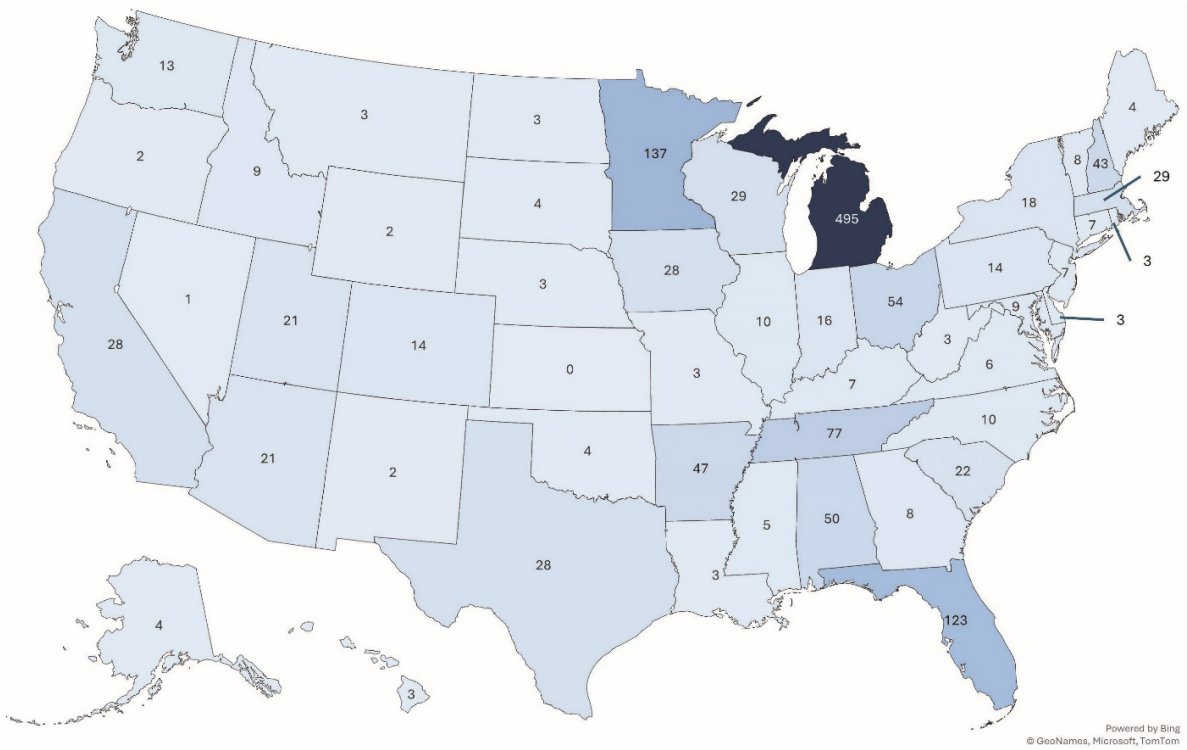


Figure 1:
Geographic distribution of respondents to the question "Where do you currently reside, work, or practice?" in the veterinary needs assessment survey administered from February 20, 2023, to December 12, 2024.

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Interest level	No. (%) of veterinarians	No. (%) of veterinary medicine students	No. (%) of veterinary technicians
Extremely	211 (24.2)	45 (22.5)	58 (22.9)
Moderately	315 (36.1)	62 (31.0)	67 (26.5)
Slightly	242 (27.7)	71 (35.5)	78 (30.8)
Not	105 (12.0)	22 (11.0)	50 (19.8)
Total	873 (100)	200 (100)	253 (100)

Table 1: Survey respondents' interest in working with beekeepers, by role

When veterinarians and veterinary technicians were asked, "Have you or your practice ever been approached by a beekeeper seeking veterinary assistance with their bees?" 770 (68.3%) said never, 143 (12.7%) indicated they were approached but did not offer any service, 150 (13.3%) were approached and did offer a service, and 65 (5.8%) indicated they were informally helping friends, family, or neighbours or working strictly with their own bees.

Experience level (veterinarians only)

Most veterinarians (73.5%) did not know how to prescribe honey bees. However, 7.3% were currently writing prescriptions for beekeepers or felt that they could do so comfortably (19.1%). Similarly, most veterinarians (74.1%) had never written a VFD, but 18.6% had done so for other animals, and 7.2% had written a VFD for honey bees. Experience level with bee disease identification was mixed, with 11.5% reporting they were able to identify diseases, 57.8% reporting that they had heard about diseases, and 30.8% reporting that they did not know anything about honey bee diseases. Sixty-two per cent had never handled a hive before, 9.4% reported that they were proficient and could perform an inspection with confidence, and 23.3% had some or extensive (1.9%) beekeeping experience (full details in **Table 2**).

Survey response	%
Specify your experience level with animal husbandry (N = 864)	
I have no background with bees	39.5
I have not kept bees, but I'm interested in honey bees	35.4
I have some beekeeping experience	23.3
I have extensive beekeeping experience	1.9
Specify your experience level with animal/hive handling (N = 863)	
I have never handled a honey bee hive before	62.5
I have inspected a honey bee hive with guidance, never on my own	12.1
I have experience handling honey bees, but I am not proficient	16.1
I am proficient in handling honey bees and can perform an inspection	9.4
Specify your experience level with disease identification (N = 864)	
I don't know anything about identifying honey bee diseases	30.8
I have heard about honey bee diseases, but I cannot comfortably identify them	57.8
I can identify honey bee diseases and am comfortable with diagnostic techniques	11.5
Specify your experience level with writing a VFD (N = 860)	
I have never written a VFD	74.1
I have written a VFD for other animals, but never for honey bees	18.6
I have written a VFD for honey bees	7.2
Specify your experience level with writing a prescription for bees (N = 861)	
I do not know how to prescribe bees	73.5
I have not prescribed bees, but could do so comfortably	19.1
I have written prescriptions for bees	7.3

Table 2—Veterinarians' responses detailing experience with beekeeping, handling hives, identifying honey bee diseases, and writing Veterinary Feed Directives (VFDs) and prescriptions for honey bees

Barriers and challenges

Based on the categorization and then summarization of the open-ended question "What barriers or challenges prevent or inhibit your ability to work with beekeepers?" a lack of knowledge, education, skills, and/or training was the most frequently cited challenge for veterinarians to work with beekeepers (40.2%), followed by lack of access to bees or beekeepers (10.6%), questioning the need for bee veterinarians (10.6%), and lack of time to offer services and/or learn a new species (8.2%). The frequencies for each challenge or barrier are detailed in **Table 3**.

Barriers/challenges by veterinary scope of practice—For each barrier, the respondents were divided by role (ie, working with small vs food animals) to determine, via cross-tabulation, whether the barriers identified would vary by scope of practice. There were no statistically significant differences in the barriers identified by small animal practitioners compared to food animal practitioners. This analysis was repeated, comparing small animal versus mobile practice types (food animal and equine practitioners combined), with similar nonsignificant findings. Barriers/challenges by interest level—Cross-tabulations were used to examine the association of each barrier with the interest level of the veterinarian in working with beekeepers. For analysis, the interest variable was defined as "interested" (extremely or moderately interested responses combined) versus "not interested" (slightly or not interested responses combined). Veterinarians who were "interested" were significantly less likely to identify "lack of knowledge, experience, skills, and training" as a barrier compared to veterinarians who were "not interested" ($\chi^2 = 6.643$; $df = 1$; $P < .01$).

Barrier or challenge[a]	n (%)
None	31 (3.8)
Lack of knowledge, education, skills,training	330 (40.2)
Lack of access to bees or beekeepers	87 (10.6)
Questioning the need for bee veterinarians	87 (10.6)
No intention to practice bee medicine	74 (9.0)
Lack of time to offer services or learn new species	67 (8.2)
Business viability/resource concerns	56 (6.8)
Confidence/comfort working with bees	39 (4.7)
Allergic to bees	14 (1.7)
Afraid of bees	11 (1.3)
Other	11 (1.3)
Physical	8 (1.0)
Antibiotic management	7 (0.8)
Total No. of responses	822[b] (100)

Table 3—Veterinarian responses to the question "What barriers or challenges prevent or inhibit your ability to work with beekeepers?" by barrier category

[a] Examples of responses for each category can be found in the Methods.[b] More than 1 category possible per respondent; 664 of 879 (75.5%) veterinarians answered this question for a total of 822 answers.

"Interested" veterinarians were also significantly more likely to indicate they intended to practice bee medicine ($\chi^2 = 29.905$; $df = 1$; $P < .001$).

"Interested" veterinarians were also significantly more likely to list concerns about access to bees and beekeepers ($\chi^2 = 9.943$; $df = 1$; $P = .002$) and to question the need for veterinarians ($\chi^2 = 8.319$; $df = 1$; $P = .004$) than their less interested counterparts. No other associations reached statistical significance.

Looking to the future: tools and resources

Participants were provided a list of tools, resources, and experiences and were asked, "Would the following increase the likelihood of you taking on more beekeeping clients?" Over 80% of veterinarians indicated that having access to training on diagnostics, interacting with veterinary medicine professionals who work with beekeepers, having standard operating procedures, or having veterinary formularies on honey bees would definitely or probably increase the likelihood that they would take on more beekeeping clients (details provided in **Figure 2**).

Clinic participant surveys

Pre- and postclinic surveys yielded the following positive results: before the clinic, 44% (26 of 59) of respondents reported a medium to high level of confidence in working with honey bees versus 94% after the clinic; 34% (20 of 59) of respondents reported a medium to high level of confidence in working with beekeeper clients versus 93% (62 of 67) after the clinic; 100% (67 of 67) of respondents reported they increased their knowledge of how to perform a basic hive inspection as a result of the clinic; 99% (66 of 67) of respondents reported they knew how to perform a varroa mite check using an alcohol wash; 93% reported they understood resources available to them as a result of the clinic; 41% (26 of 63) of respondents reported they intended to take on new clients who are beekeepers; and an additional 49% (31 of 63) reported they "maybe" intended to take on new clients who are beekeepers.

Thirty-eight clinic participants responded to the longer-term follow-up survey administered in late 2025 to early 2026. The survey yielded additional encouraging results: 47% (16 of 34) of participants took steps toward taking on beekeeping clients as a result of participating in a clinic, and 6 participants did take on new or additional beekeeping clients as a result of participating in a clinic.

Discussion

Managed honey bees in the US have been dying at alarming rates in recent years.[8,9] Preliminary data from 2025 surveys indicate that beekeepers lost over 50% of their colonies in the previous winter, making it the worst loss in recorded history.[10,11] The causes of these high mortality rates have been linked to parasites, pathogens, and pesticides.[12] In no other segment of the livestock industry would this level of annual mortality be acceptable. Besides providing antibiotics, veterinarians who are knowledgeable about honey bees could also offer advice regarding disease management in general, pest control, nutrition, biosecurity, and regulatory compliance.

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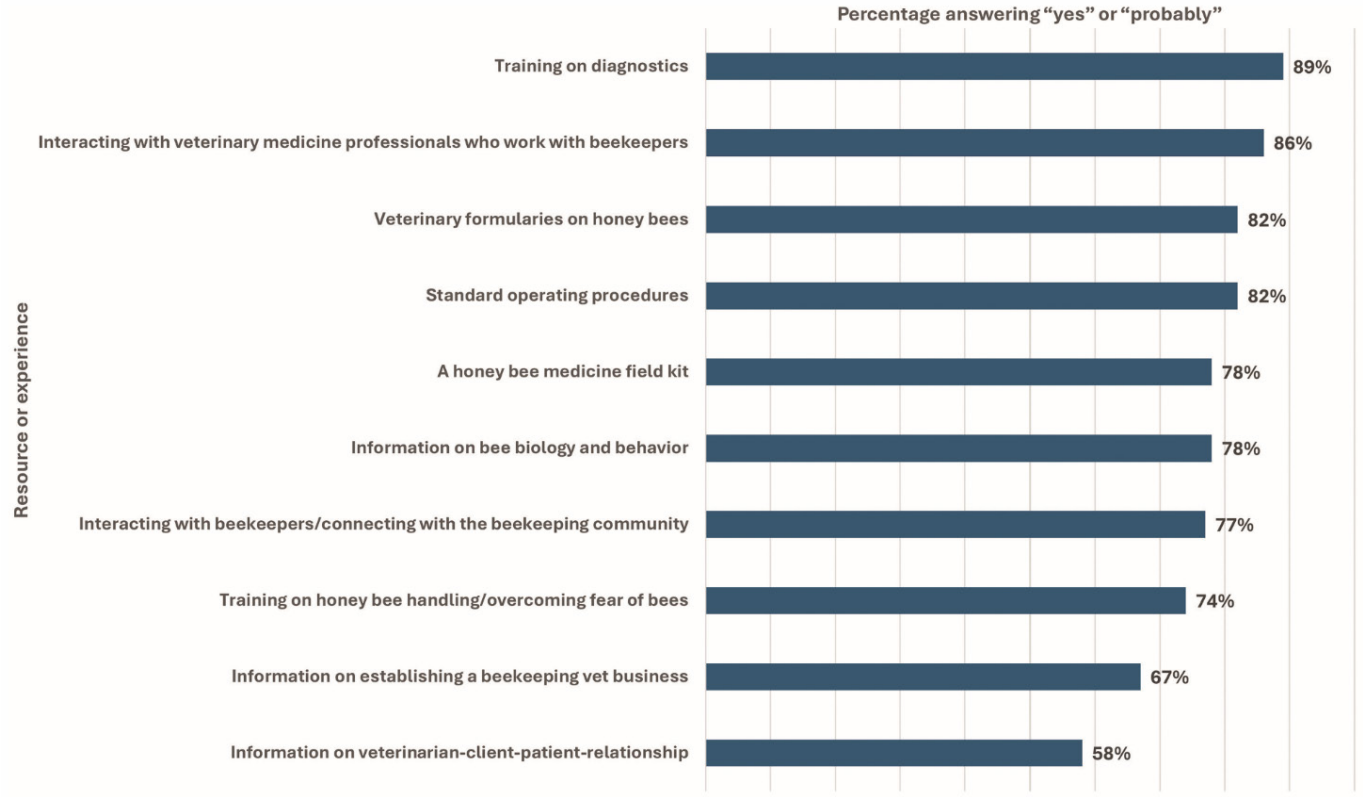


Figure 2—Veterinarians' answers to the question "Would the following resources or experiences increase the likelihood of you taking on more beekeeping clients?" The number of veterinarians who responded ranged from 740 to 766 per resource or experience listed.

Veterinarians can offer a new voice to this discussion from a welfare perspective, such as addressing the exceedingly high annual colony mortality rate, lack of access to antibiotics leading to vulnerable untreated colonies, methods to perform humane colony euthanasia, and support of beekeepers who are struggling to cope with a myriad of challenges, including disease, pests, poor nutrition, pesticide exposure, and climate change.

Based on the cross-tabulation analysis, our results indicate that a moderate to high level of interest in working with beekeepers is necessary for a veterinarian to seriously consider taking on beekeeping clients. Veterinarians with a moderate to high level of interest were significantly more likely to have beekeeping or hive-handling experience, be able to identify honey bee diseases, or have written a VFD or prescription for a beekeeper. These "interested" veterinarians were less likely to identify lack of knowledge as a barrier and significantly more likely to list concerns about having access to bees and beekeepers or to question the need for veterinarians compared to their less interested counterparts.

The results of the survey provide a mixed picture of how veterinarians view honey bee medicine as a potential new area of practice. Several of the identified barriers indicate that veterinarians are not convinced that incorporating beekeepers into their client base makes sense from a time use, business viability, or client need/demand perspective. During the time period of the survey, there did not appear to be an urgent demand for veterinary involvement in beekeeping, with 82% of veterinarians and technicians indicating that their practice had never been approached for help. Furthermore, 67% of respondents identified a lack of time to become proficient in bee medicine, and 56% reported that business viability concerns were a barrier to taking on beekeeping clients.

In contrast, the results indicate a strong level of interest in learning about honey bee biology and/or beekeeping (moderate and high interest combined) on the part of veterinarians (60%), veterinary technicians (54%), and veterinary students (49%). Focusing on veterinarians, 217 of the 873 respondents had some to extensive beekeeping experience, 81 were proficient in handling honey bees and could perform a hive inspection, 99 could identify honey bee diseases and identify them on their own, 62 had written prescriptions for beekeepers, and 62 had written VFDs for beekeepers. Acknowledging that the respondents were strongly self-selecting, these results are nonetheless encouraging, especially if these veterinarians can support the disease-control efforts of commercial beekeepers who manage the vast majority of the estimated 2.6 million honey-producing colonies in the country in 2024.[13]

There is likely a progression in thinking for veterinarians, from initial interest in a novel topic, to seeking knowledge of the industry, to questioning the need for veterinary involvement and access to clients, to business model feasibility concerns. Raising awareness among veterinary professionals via readily available continuing education programs will be beneficial for sparking initial interest in honey bee medicine, and these efforts should be encouraged. To increase the willingness of interested veterinarians to expand their practices to include beekeepers, in-depth, intensive, and hands-on training is necessary. Over 80% of veterinarians indicated that access to training on diagnostics, interacting with veterinary medicine professionals who work with beekeepers, having standard operating procedures, and having veterinary formularies on honey bees would definitely or probably increase the likelihood that they would take on more beekeeping clients. Many of these veterinary-specific clinical activities have already taken place and provide evidence of increased confidence, knowledge, skills, and willingness to take on beekeeping clients as a result of participation. Additional clinics are planned for the future by MSU and other universities.

There were several limitations to the needs assessment study. Although results were collected over 22 months, as a cross-sectional survey, it provides only a snapshot of the topic. The survey was particularly focused on veterinarians in Michigan, as MSU was the lead institution for the grants supporting the work, and all veterinarians licensed in Michigan were individually invited to participate. Most of the country was represented to some degree (except Kansas) in the responses. The broadcast method of survey distribution did not allow a participation rate calculation. Selection bias was undoubtedly present, as persons with some level of interest in honey bees would be more likely to complete the survey than someone with no interest. Nonetheless, this survey provides important data regarding veterinary interest in incorporating beekeeping clients into their practice, current experience levels, and, perhaps more importantly, next steps for educators and trainers in this emerging area of practice.

Several excellent new tools for veterinarians have been developed through the support of grant funding. In addition, veterinarians interested in gaining hands-on experience are encouraged to join their local beekeeping clubs. Beekeepers generally enjoy teaching others and talking bees, and the networking opportunities may produce clients for veterinarians. Several resources for continuing education, beekeeping clubs and associations, and veterinary-specific resources can be found on university extension websites.

For veterinarians interested in honey bee medicine, excellent online resources are available, and for interest in apiculture in general, there is access to beekeepers via numerous county, state, and national beekeeping associations and clubs. Small animal practitioners can expand their practice, especially working with small-scale beekeepers who may view their colonies as pets and may be willing to pay for both medical and management advice. Mobile veterinarians have the infrastructure in place to add medium- and large-scale beekeepers into their routes, are familiar with VFDs, and understand livestock movement and biosecurity needs as well as the financial implications of treatment decisions. Beyond providing antibiotics for bacterial brood diseases, veterinarians can support beekeepers by learning to diagnose all diseases, manage parasites, provide nutritional and husbandry recommendations, and participate in drug development, research, and policy advocacy similar to other livestock industries. For honey bee medicine, the next steps should be building the veterinary capacity at the same pace as beekeeper demand for veterinary services.

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Morphological characterisation of Echinococcus equinus from lions (Panthera leo) in the Greater Kruger National Park, South Africa

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Abstract

Echinococcosis is a global zoonotic infection caused by larval stages of *Echinococcus* species. In sub-Saharan Africa, cystic echinococcosis caused by *Echinococcus granulosus* is prevalent, but comprehensive data are limited. This study investigates the role of lions (*Panthera leo*) as potential hosts for *Echinococcus* species, particularly *E. equinus* and *E. felidis*, in Greater Kruger National Park, South Africa. Four lion intestinal samples were macroscopically examined. High burdens of *Echinococcus* spp. worms were observed in 2 lions, a low-level infestation was detected in 1 lion and no parasites were identified in the fourth lion due to advanced decomposition of the sample. PCR analysis identified *E. equinus* in 2 samples and *E. felidis* in 1. Morphological and scanning electron microscopy studies provided detailed descriptions of the adult form, confirming the presence of these parasites. The findings underscore the importance of lions in the sylvatic cycle of echinococcosis and suggest potential implications for the epidemiology of the disease in African wildlife ecosystems. This study contributes to the understanding of the transmission dynamics of *Echinococcus* species in southern Africa.

Introduction

Echinococcosis is a worldwide zoonotic disease caused by the larval stages of the cestode genus *Echinococcus* (Rudolphi, 1801). In sub-Saharan Africa, cystic echinococcosis (CE) caused by *Echinococcus granulosus* has been described from South Africa (Ortlepp, 1937; Verster, 1965), although more comprehensive data are lacking (Aschenborn et al., 2023). Several different lifecycle patterns occur. The most significant cycle involves humans as accidental or intermediate hosts, together with a variety of livestock species and domestic animals acting as definitive hosts. A sylvatic life cycle that uses a variety of wild ungulate species as herbivorous intermediate hosts also exists and was previously discovered in Africa (Romig and Wassermann, 2024). In the past, wild canids, such as hunting dogs or African wild dogs (*Lycaon pictus*), jackals (*Canis mesomelas* and *C. aureus*), hyaenas (*Crocuta crocuta*) and sometimes the domestic dog (*Canis lupus familiaris*) were found to act as definitive hosts (Ortlepp, 1937; Verster, 1965; Verster and Collins, 1966; Young, 1975; Hüttner and Romig, 2009). A recent study conducted in Namibia identified all 5 species of *E. granulosus sensu lato* in the country (Aschenborn et al., 2023).

A sylvatic cycle involving the African lion and several intermediate host species, including the warthog (*Phacochoerus africanus*), bush pig (*Potamochoerus larvatus*), Burchell's zebra (*Equus burchelli*), wildebeest (*Connochaetes taurinus*), buffalo (*Syncerus caffer*) and various antelope species, has also been reported from several African countries, these include South Africa, Namibia, Botswana, Kenya, Uganda, Tanzania and Zambia (Verster and Collins, 1966; Thompson et al., 1995; Hüttner et al., 2008; Halajian et al., 2017; Zaffarano et al., 2021).

The *E. granulosus sensu lato* complex comprises several recognized species, including *E. granulosus sensu stricto* (sheep-associated), *Echinococcus ortleppi, Echinococcus equinus, Echinococcus canadensis* and *Echinococcus felidis* (Thompson et al., 1995; World Health Organization and World Organisation for Animal Health, 2001, 2008; Thompson and McManus, 2002; Xiao et al., 2005; Hüttner et al., 2008; Nakao et al., 2013; Vuitton et al., 2020).

The molecular identification of *Echinococcus* species in South Africa has been limited to cysts obtained from human patients (including *E. canadensis* G6/7, *E. granulosus sensu stricto* and *E. ortleppi*), a cow (*E. ortleppi*), a white rhinoceros (*Ceratotherium simum*) (*E. equinus*), 3 hippopotamuses (*E. felidis*) and worms from 1 lion (*E. felidis*) (Hüttner et al., 2008; Mogoye et al., 2013; Halajian et al., 2017; Zaffarano et al., 2021; Aschenborn et al., 2023). Despite the extensive history of wildlife research, including studies on lions, a significant knowledge gap remains regarding lions as hosts *of Echinococcus*.

In sub-Saharan Africa, *E. granulosus sensu stricto, E. ortleppi* (cattle-associated), *E. equinus* (horse-associated), *E. canadensis* (notably camel-associated) and *E. felidis* have been reported, with *E. felidis* maintained predominantly in a wildlife (sylvatic) cycle involving lions and a range of wild ungulate intermediate hosts. Among these, *E. ortleppi* and *E. equinus* are well-established as distinct

species, supported by clear genetic differentiation and host specificity (Thompson and McManus, 2002). Although canids are regarded as the primary definitive hosts of *Echinococcus* species, *E. felidis* was first reported in lions in South Africa in 1937 (Ortlepp, 1937), demonstrating that felids can also serve as definitive hosts. The species was identified based on the distinctive rugosity of the rostellar hooks and its presence in a felid host (Hüttner and Romig, 2009). This classification has been supported by various authors (Verster, 1965; Hüttner et al., 2008; Thompson, 2008).

Genetic characterisation of lion-derived *Echinococcus* isolates is crucial for confirming their taxonomic relationship with other species and genotypes of *Echinococcus* (Thompson, 2008). A study by Hüttner et al. (2008) compared taeniid eggs from a Ugandan lion's faeces with a preserved sample from a South African lion collected in the 1960s (Verster, 1965), revealing genetic similarity, though the DNA was distinct from *E. granulosus* based on partial genome analysis.

Mitochondrial genome-based phylogenetic analysis has since confirmed a sister relationship between *E. felidis* and *E. granulosus sensu stricto* (Nakao et al., 2013). A recent study provided the first molecular confirmation of *E. felidis* in Tanzania, identifying the African lion and the leopard as definitive hosts within the Serengeti ecosystem (Ndossi et al., 2025).

Echinococcus equinus, formerly known as the horse strain of *E. granulosus*, is recognised as a distinct species (Saarma et al., 2009). It was first described morphologically in Great Britain (Williams and Sweatman, 1963) and appears to use equids (such as horses, donkeys, mules and zebras) exclusively as intermediate hosts (Young, 1975; Thompson and McManus, 2002; Jenkins et al., 2005; Thompson, 2008; Saarma et al., 2009). Canids, including dogs and foxes, can serve as definitive hosts for *E. equinus* (Howkins et al., 1965).

Additionally, recent findings have reported infections of *E. equinus* in lions, Black-backed jackals and Burchell's zebras in Namibia's Etosha National Park (Wassermann et al., 2015). The presence of *E. equinus* was confirmed for the first time in white rhinoceros (*C. simum*) in Kruger National Park (KNP) in 2021 (Zaffarano et al., 2021). The life-cycles of *E. felidis* and *E. equinus* appear to be entirely or predominantly sylvatic (Aschenborn et al., 2023).

While extensive research has been conducted on wildlife dynamics and various aspects of *Panthera leo* ecology, our understanding of lions as potential hosts of *Echinococcus* spp. remains significantly limited. Despite a longstanding history of studies focused on the biology, behaviour and conservation of lions, the implications of these large carnivores as reservoir hosts for this genus of parasitic tapeworms have not been thoroughly explored.

This gap is likely attributable, in part, to the logistical and ethical challenges associated with sampling apex predators in natural ecosystems. Consequently, a gap in the literature persists regarding the role of lions in the transmission and epidemiology of *Echinococcus*, warranting further investigation to elucidate the interactions between these felids and the parasite's life cycle.

Materials and methods

Study area

KNP, situated in the northeast of Mpumalanga and Limpopo provinces of South Africa, encompasses nearly 2million hectaresof undisturbed wilderness. This region presents a remarkable mosaic of diverse ecosystems and rich wildlife. As one of Africa's largest game reserves, it serves as a vital sanctuary for the iconic 'Big Five' species – lions, elephants, buffalo, rhinoceroses and leopards – while also supporting a diverse array of avian, reptilian and floral species. The KNP is home to 147 mammal species (Zaffarano et al., 2021).

Sample origin

Based on the availability of post-mortem examinations, complete intestinal tracts from 4 lions were collected in 2012 from KNP. During necropsy, the small intestines were carefully removed and ligated at both ends to prevent leakage of contents. All procedures were conducted under appropriate biosafety conditions, including the use of personal protective equipment such as gloves, protective clothing and face shields, to minimise the risk of zoonotic transmission. The intestinal contents were handled with caution and transported in sealed, clearly labelled containers in accordance with established biosafety and biosecurity guidelines for parasitic infections. Each intestine was then dissected, the mucosal layer was scraped using a glass microscope slide, and the scrapings were suspended in phosphate-buffered saline at pH 7.4 and incubated at 37 °C for 30 min. Following incubation, the samples were macroscopically and microscopically examined for the presence of Echinococcus parasites. Positive samples were subsequently divided into 3 groups and preserved in different solutions: (i) 95% ethanol, (ii) 20% ethanol and (iii) cold 2.5% glutaraldehyde (GA) solution. All samples were stored at 4 °C.

Sample processing for morphological examination

Adult parasites were stained and cleared by using Lacto Carmine (lacto-propiono-dimethylsulfoxide carmine) (Bonga, 1976), Van Cleave's haematoxylin (method obtained from Prof R. M. Overstreet, 2003, Gulf Coast Research Laboratory, University of Southern Mississippi) and polyvinyl lactophenol clearing (Gray and Weiss, 1950). Samples were mounted, viewed and photographed after staining or clearing using a Nikon Eclipse Ni light microscope (100× magnification) and a Nikon Stereo SMZ745T microscope (7.5× zoom magnification) for a full morphological description. Samples preserved in 2.5% GA solution were cleaned and routinely processed for scanning electron microscope (SEM).

PCR analysis

For each lion sample that was evaluated microscopically positive for Echinococcus worms, 20 worms previously stored in 95% ethanol were randomly selected for further analysis. The worms were placed into a 1.5 mL Eppendorf tube and used for DNA extraction using the QiAamp®DNA Blood Mini kit (Qiagen, Netherlands) according to the manufacturer's protocols.

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A fragment of the mitochondrial cytochrome *c* oxidase subunit I (*cox1*) gene was amplified using the published JB3/JB4.5 primer set (Bowles et al., 1992). PCR amplifications were performed in a final reaction volume of 50 µL containing 5 µL of template DNA, 1X reaction buffer, and 200 mm of deoxynucleotide Triphosphates(dNTP), 0.4 µm of each primer and 0.5 units of Diamond *Taq* DNA polymerase (Roche).

Description	Number of worms	Segment length (µm)	Segment width (µm)
Total length	23	2234–3848 (2937 ± 574.9)[a]	
Scolex with rostellum	23	436–609 (529 ± 47.9)	291–401 (342 ± 31.8) wide
Neck	23	109–232 (159 ± 32.4)	145–264 (200 ± 32.5) wide
1 Segment	23	202–346 (268 ± 41.9)	192–294 (237 ± 26.8)
2 Segments	23	308–678 (457 ± 88.1)	246–389 (310 ± 44.4)
3 Segments	23	532–1270 (882 ± 181.9)	311–464 (389 ± 47.2)
4 Segments	8	913–2447 (1347 ± 465.8)	258–489 (407 ± 60.8)
5 Segments	2	1078–1501 (1290 ± 299.3)	367–608 (487 ± 170.5)

Table 1. Measurements of 23 E. equinus adults

[a]*All measurements are in micrometres as minimum to maximum values, followed by the average and standard deviation in parentheses.*

Thermal cycling comprised an initial denaturation at 95 °C for 5 min, followed by 35 cycles of 50 s at 94 °C, 50 s at 55 °C and 50 s at 72 °C, and a final extension step at 72 °C for 10 min. The amplicons were visualised by 1.5% agarose gel electrophoresis. Amplifications of the correct size (441 bp) were submitted for purification and sequencing at Inqaba Biotechnical Industries (Pty) Ltd (Pretoria, South Africa). For initial identification, each DNA sequence was used in a BLASTn search of the GenBank nucleotide database at the National Centre for Biotechnology Information (NCBI).

Results

In this study, the intestines of 4 lions, comprising 1 male and 3 females with estimated ages ranging from 3 to 10 years, were examined. These lions originated from the Greater KNP area. A significant number of *Echinococcus* worms ($n \geq 500$) were detected in the small intestines of 2 lions (female ± 5 years of age; female ± 6 years of age), only few were present in 1 lion ($n \leq 20$) (male ± 10 years of age) and the fourth lion's (male ± 3 years of age) remains were too decomposed to provide viable data.

Light microscopy and scanning electron microscopy study

The adult form of *Echinococcus* spp from 2 with abundant worms was collected manually after post-mortem examination of the intestines, where they appeared as small, white worms. A total of 23 worms were investigated and measured as described in Table 1. The worms were characterised by a typical scolex at the anterior end, featuring 4 well-developed suckers and 2 distinct rows of rostellar hooks – 1 large and 1 small (Figure 1). The number of hooks on the rostellum ranged from 34 to 38. The hook arrangement was highly uniform, with 2 alternating rows of large and small hooks present on the rostellum (Figure 2). The large hooks measured 43.35–50.81 µm, averaging 47.08 µm, while the small hooks ranged from 27.95 to 35.97 µm, averaging 31.96 µm. The rostellar hooks exhibited a smooth outline, with a pronounced groove along the inner blade surface on both sides (Figure 3A). The hooks had long handles, some of which tilted upward at the tips; this feature was variable, with other hooks exhibiting a straighter profile toward the tips. The guard portion of the hooks had a consistently rounded appearance across both large and small hooks (Figure 3A). Although sharp claw-like hooks attached to the rostellum were mostly observed (Figure 3B), some SEM images also revealed that the hooks could be retracted into a membranous sheath within the rostellum (Figure 3C).

Scanning electron microscopy of the specimens' tegument revealed that the outer membrane of the cestode tegument projected toward the host as fine, finger-like structures known as microtriches, which covered the entire surface of the worm, including the suckers. Two morphologically distinct types of microtriches were identified. The first type, located on the scolex, was thinner, more filamentous and contained electron-dense material (Figure 4A and B). The second type, observed on the strobila, was thicker and blade-like (Figure 4C). On the strobila, these microtriches were densely packed and flattened, forming a network that encapsulated the bulbous sensory endings. The number of testes observed ranged from 32 to 43, with some positioned posterior to the vitelline gland within the segment. The cirrus sac exhibited a shape that varied from round to slightly oval and was oriented more parallel to the genital pore opening, situated closer to the centre of the segment.

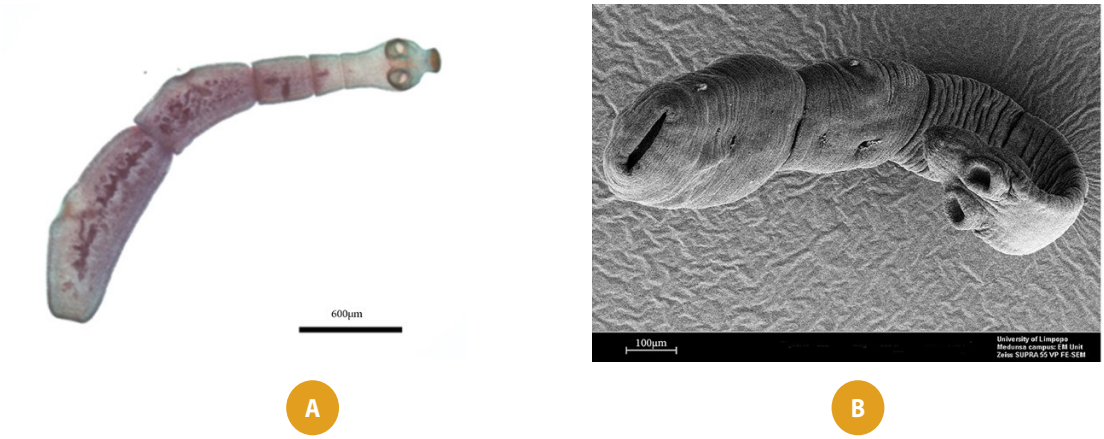


Figure 1. (A) Light micrograph and (B) SEM micrograph of E. equinus recovered from P. leo

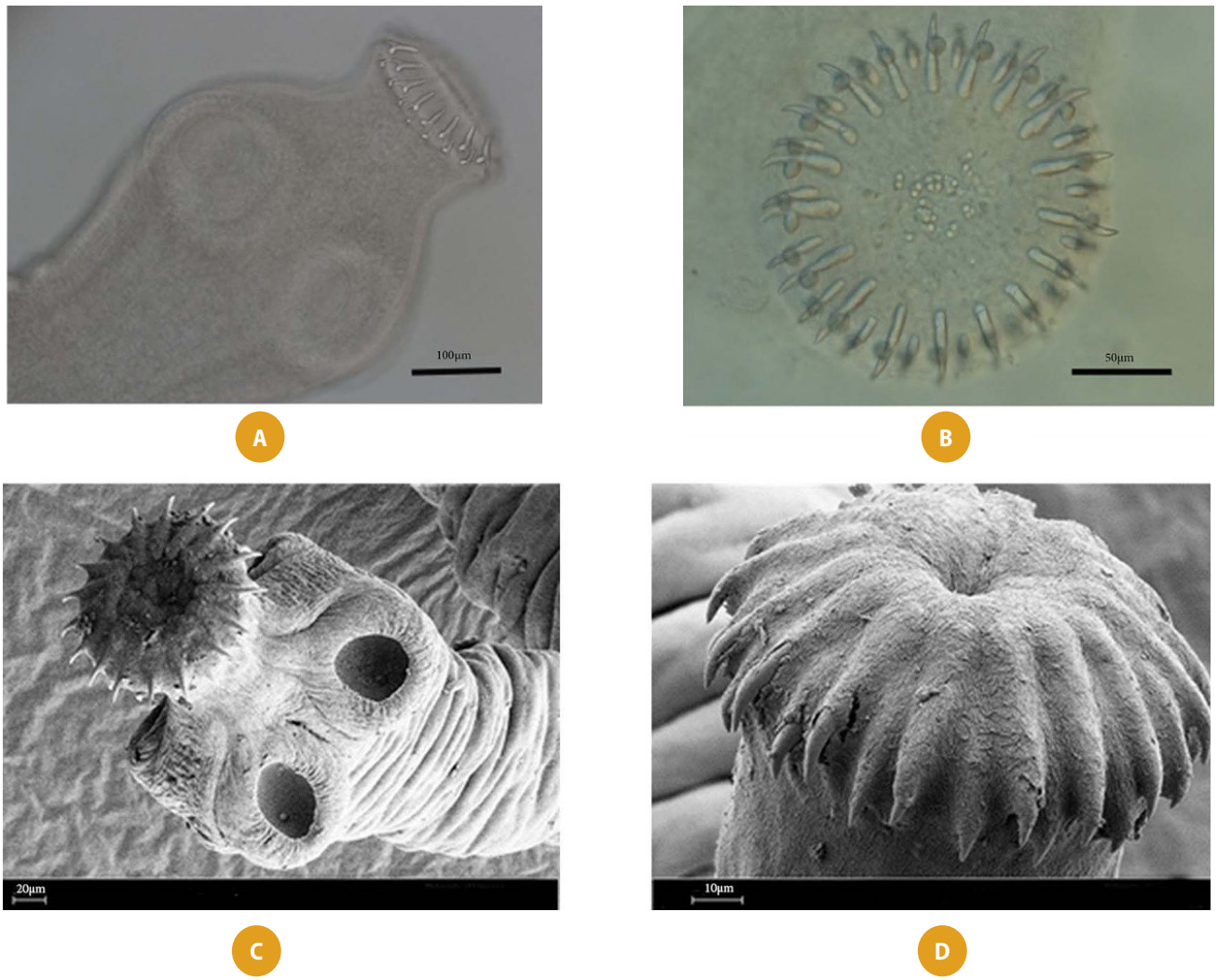
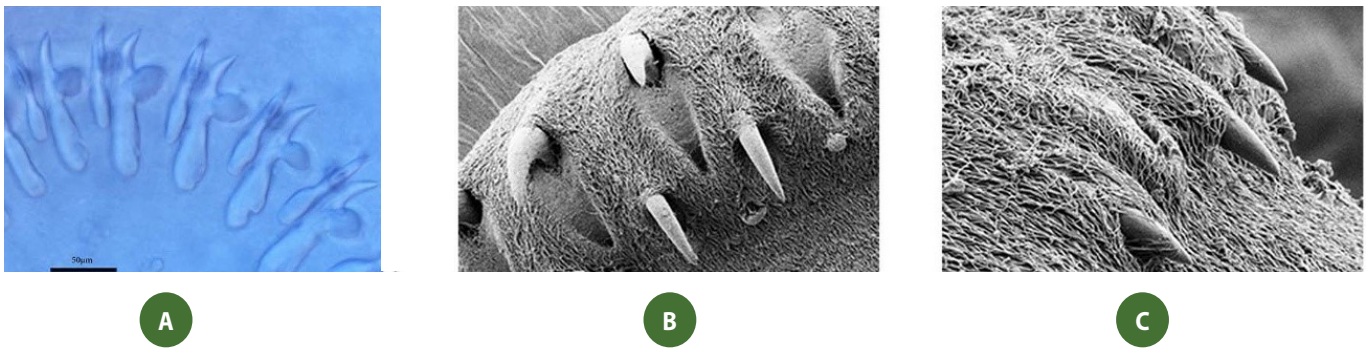


Figure 2. Light and SEM micrographs of E. equinus showing (A) the scolex with suckers and hooks under light microscopy, (B) the rostellum with a double row of hooks, (C) the scolex with protruded rostellum, extended hooks and suckers under SEM and (D) the rostellum bearing hooks.

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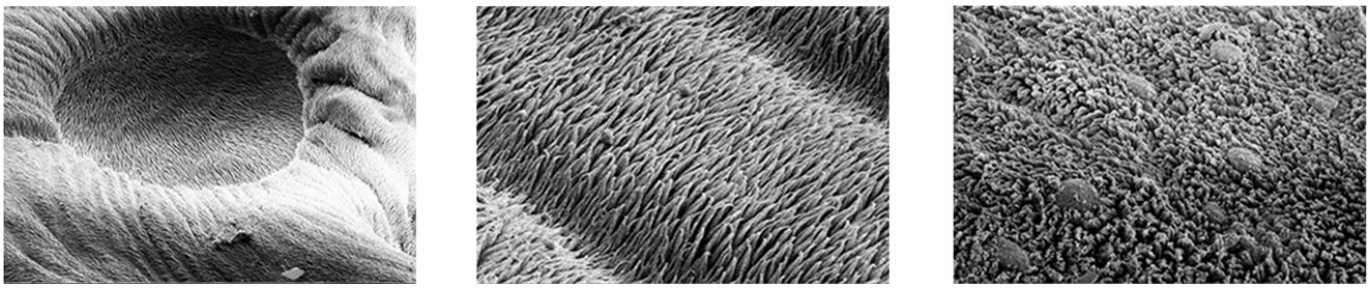
A B C

Figure 3. Light and SEM micrographs of E. equinus showing (A) large and small rostellar hooks under light microscopy, (B) a double row of large and small hooks under SEM nd (C) a scolex with retracted hooks

The cirrus tube displayed an anterior bend, which was acute in most specimens but less pronounced in others, due to variations in relaxation prior to segment fixation. In mature segments, the genital pore opening was located near the middle of the segment, while in gravid segments, it was more posteriorly positioned. The 2 lobes of the ovary were generally spread horizontally and demonstrated a distinctly irregular shape (Figure 5A). The male copulatory organ, represented by the cirrus, was identified in some light micrographs (Figure 5B) and SEM images (Figure 5C).

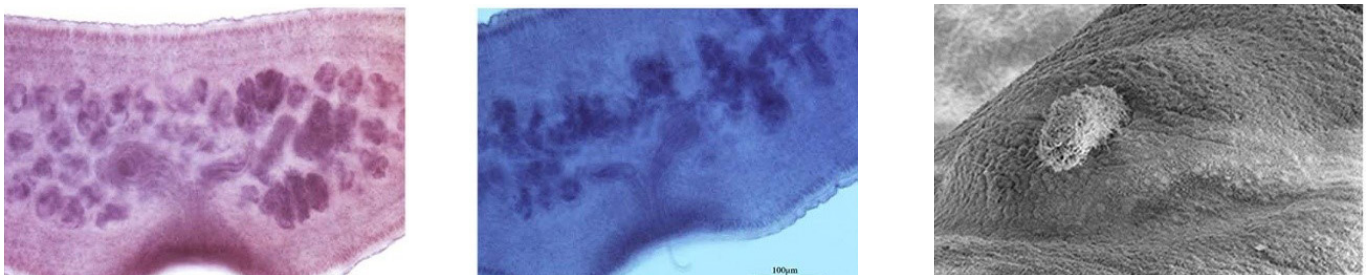
PCR analysis

DNA from 3 samples was successfully amplified with primers JB3/JB4.5, yielding the expected 441 bp fragment of the mitochondrial cox1 gene. A neighbour-joining tree was constructed using 390 bp of the *cox1* gene, depicting the relationships of the investigated samples with previously published *Echinococcus* genotypes (tree not shown). Two of the samples were grouped with the *cox1* sequence for isolate G4–horse-dog strain (NCBI accession number AF346403, Le et al., 2002). The third sample was grouped with a representative sequence for *E. felidis* (NCBI accession number EF558356, Hüttner et al., 2008). The 2 samples identified as *E. equinus* were selected for further microscopic analysis because adult worm samples were available.



A B C

Figure 4. SEM micrographs of E. equinus showing the tegumental surface structures: (A, B) sucker regions bearing microtriches and (C) bulbous sensory endings with blade-like microtriches



A B C

Figure 5. (A) Light micrograph of a mature proglottid; (B) mature proglottid with cirrus; and (C) SEM micrograph of the cirrus organ

Discussion

This study contributes to expanding knowledge of the role of lions as potential definitive hosts of *Echinococcus* species, particularly *E. equinus* and *E. felidis*, in the Greater KNP, South Africa. The presence of these parasites in lions has significant implications for understanding the epidemiology and transmission dynamics of echinococcosis in African wildlife ecosystems, given the limited recent data available (Aschenborn et al., 2023).

The detection of *E. felidis* in 1 lion sample is consistent with earlier reports of this parasite in South African lions (Ortlepp, 1937; Hüttner et al., 2008). *Echinococcus felidis*, also known as the 'lion strain' of *E. granulosus*, has been identified based on genetic characteristics. The genetic analysis in this study, which grouped the *E. felidis* sample with previously published sequences, reinforces the taxonomic distinction of this parasite from *E. granulosus sensu stricto*. The finding of *E. felidis* in lions from the Greater KNP highlights the potential role of these predators in maintaining the sylvatic cycle of echinococcosis in southern Africa.

The identification of *E. equinus* in 2 lion samples aligns with previous reports of this parasite in other wild carnivores, such as black-backed jackals and Burchell's zebras in Namibia's Etosha National Park (Wassermann et al., 2015). A recent study also reports a first incident of *E. equinus* in a Southern white rhinoceros from KNP (Zaffarano et al., 2021). A comprehensive morphological study was performed on random specimens from the intestines of 2 lions in the KNP, from the same batch prepared for genetic characterisation, to determine the status of this species. Similarities between the present *E. equinus* description and the studies done by Williams and Sweatman (1963) and Kumaratilake et al. (1986a) include the total body length, number of segments, length of the large and small hooks, the number of testes and their position, the position of the genial pore, shape and position of the cirrus and form of the ovary and seminal receptacle. The morphological characteristics observed in the current study, including the rostral hooks and segment structure, are consistent with the descriptions of *E. equinus* provided by Saarma et al. (2009) and Thompson and McManus (2002). The major difference between the *E. equinus* specimens compared in this study and the 2 morphological studies by Williams and Sweatman (1963) and Kumaratilake et al. (1986a) is that the host in this study is lions, whereas in the other studies it is horses or other equids. The finding of *E. equinus* in lions suggests that these large carnivores may play a more significant role in the life cycle of this parasite than previously recognised, potentially contributing to its transmission within wildlife populations.

The discovery of both large and small hooks on the rostellum, with the large hooks measuring 47.08 µm on average, is consistent with previous studies and confirms the morphological distinction of *E. equinus* from other *Echinococcus* species (Kumaratilake et al., 1986b). The presence of a well-developed cirrus sac and the number of testes observed further corroborate the identification of *E. equinus*. The presence of 2 morphologically distinct types of microtriches on the tegument, as revealed by SEM, provides insights into the adaptation to its felid host. Microtriches are specialised tegumental projections that increase the surface area available for nutrient absorption and facilitate attachment and interaction with the host intestinal environment in cestodes (Chervy, 2009). The detailed morphological and SEM analyses provide a comprehensive description of this parasite's structure, which can be useful for future comparative studies.

The identification of *E. equinus* and *E. felidis* in lions underscores the importance of understanding the role of wildlife in the epidemiology of echinococcosis. Lions, as predators, may serve as reservoir hosts for these parasites, facilitating their transmission to other susceptible species, including wild ungulates, potentially domestic animals and humans. Lions (*P. leo*) are opportunistic yet selective predators whose prey choice reflects both availability and behaviouraldecision-makingduringthehuntingsequence. Studies from KNP show that medium-sized ungulates dominate lion diets, with species such as zebra, wildebeest and kudu accounting for a substantial proportion of kills, with zebra alone contributing approximately 15–16% of recorded prey items across long-term datasets (Maruping-Mzileni et al., 2017). Similarly, behavioural studies reveal that lions preferentially prey on species such as plains zebra (*E. burchellii*), not only because of abundance but also because of higher encounter rates and active selection during hunting. Lions tend to forage in habitats where preferred prey is more likely to occur and are more likely to initiate hunts on these species once encountered. However, prey selection is dynamic and influenced by environmental factors such as rainfall and prey condition; for example, during droughts, lions may shift toward larger or more vulnerable prey such as buffalo. Overall, zebras represent a common and consistent component of lion diets across African savanna systems, reflecting both their ecological availability and their suitability as preferred prey (Hayward et al., 2011).

While extensive research has been conducted on wildlife dynamics and various aspects of *P. leo* ecology, our understanding of lions as potential hosts of *Echinococcus* spp. remains significantly limited. This gap is likely attributable, in part, to sampling challenges, including the opportunistic nature of postmortem access, limited availability of suitable carcasses and restrictions within protected areas. In addition, the zoonotic risk posed by *Echinococcus* spp. necessitates stringent biosafety procedures, further constraining field and laboratory investigations. Prioritisation of livestock and human health over wildlife reservoirs in many African research settings may also contribute to the lack of data. Consequently, a gap in the literature persists regarding the role of lions in the transmission and epidemiology of *Echinococcus*, warranting further investigation to elucidate the interactions between these felids and the parasite's life cycle.

Conclusion

This study provides new insights into the role of *P. leo* as a definitive host of *E. equinus* and *E. felidis* in the Greater KNP. However, the relatively small sample size limits the ability to accurately determine the true positivity rate of lions for *Echinococcus* spp. in this ecosystem. Further studies with larger sample sizes are required to better estimate infection prevalence, although such efforts remain challenging due to the logistical, ethical and biosafety constraints associated with sampling apex predators in natural settings, as previously discussed.

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The morphological and genetic analyses confirm the presence of these parasites in lions, with potential implications for wildlife health and the transmission dynamics of echinococcosis in southern Africa. The molecular and morphological findings and data generated in this study and in future studies in the KNP and surrounding conservation areas will contribute to knowledge and a better understanding of *Echinococcus* spp. (especially *E. felidis* and *E. equinus*) in southern Africa as a whole. V

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through Innovation, Integration, and Impact

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IMPORTANT DATES

- 01 Aug. - Abstract Submissions Open
- 01 Aug. - Early Registration Open
- 30 Oct. - Abstract Submissions Close
- 30 Nov. - Abstract Notices Sent
- 11 Dec. - Early Registration Close
- 31 Mar. - Regular Registration Close

SAVA 2027

NATIONAL ELEPHANT HERITAGE STRATEGY FOR SOUTH AFRICA 2026 - 2036



This document links to an extensive background document that provides details of the status of South Africa's elephants, as well as the co-development process with National, provincial, and local governments, community organisations, traditional leaders, traditional healers, academic institutions, non-government organisations, the wildlife industry, and the research and wildlife sector.

Available on *https://www.dffe.gov.za/legislation/gazetted_notices https://www.gpwonline.co.za/egazettes/*

African elephants (*Loxodonta africana and L. cyclotis*) have played an important role in human history, culture, religion, and spirituality for centuries. They are valued not only for their ecological role but also for the cultural, spiritual, and economic benefits they bring. At the same time, living alongside elephants can be challenging. They can pose risks to people, livestock, and crops, which can affect the livelihoods and well-being of the communities that share the landscape with them.

Elephants have long been a meaningful part of people's lives—through history, culture, spirituality, and daily experience. Because of this deep, shared relationship between elephants and people, especially in South Africa, it's important to look beyond just the biological aspects of conserving the species. While protecting elephant populations is crucial, it's equally important to recognise the broader heritage they represent.

In South Africa, elephants are woven into the country's traditions, history, and sense of identity.

They hold cultural and spiritual significance for many communities and contribute to how people see themselves as South Africans, in all their diversity. This elephant heritage connects people to the land, to each other, and to their past and future generations, and it also influences livelihoods, well-being, and even national politics and the economy.

Therefore, South Africa should not only focus on protecting elephants as a species but also work to strengthen and celebrate the deep connection between elephants and people. This rich heritage deserves to be preserved and supported as an essential part of the country's cultural and spiritual fabric.

The primary threats to elephant survival globally remain habitat loss and illegal killing of individuals for their ivory. However, in South Africa, elephant poaching is minimal, affecting less than 0.01% of the national population annually. In contrast, habitat fragmentation, the small size of many populations, and habitat loss are increasingly important concerns.

By the end of 2024, South Africa was home to about 44,000 African savanna elephants (*Loxodonta africana*), and the population continues to grow. This is a major conservation success, especially when compared to the decline of elephant numbers in some other African countries. Over the past 40 years, elephants in South Africa have also expanded their range. Most elephants in the country live in government-protected areas like Kruger National Park, Mapungubwe National Park, and Tembe Elephant Park. These parks are part of larger Transfrontier Conservation Areas (TFCAs), where elephants often move freely across national borders and are shared with neighbouring countries.

In addition to these large parks, 89 smaller, fenced reserves also support elephant populations. About 6,000 elephants are owned privately, or by communities, and in recent years, more and more communities have started to manage elephants themselves.

Elephants are now being seen more frequently roaming freely in provinces such as Limpopo, Mpumalanga, North West, and KwaZulu-Natal, and there is one free-ranging elephant in the Garden Route National Park.

The National Elephant Heritage Strategy (NEHS) guides managing all these elephants as a collective national herd. It aims to fulfil the aspirations South Africans have for elephants, including conservation, cultural values, economic opportunities, and responsible use.

In South Africa, elephants are considered nationally as IUCN category Least Concern, despite being considered globally as IUCN category Endangered. The private sector has played an important role in developing and implementing many innovative elephant management approaches and tools that have contributed significantly to this conservation success. *L. africana* is currently listed as a Protected species in terms of section 56(1) of the National Environmental Management: Biodiversity Act, 2004 (Act No. 10 of 2004) (NEM: BA). In addition, South Africa's African elephant population is included in the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES) Appendix II; however, ivory is deemed to be included in Appendix I, for which international commercial trade is currently prohibited.

Because of its value and importance for people and the environment, and its dependence on active conservation management, including protection against poaching, the African elephant warrants special attention as a species. Hence, the development of this NEHS.

South Africa's success in recovering elephant populations offers hope for the species but brings difficult trade-offs in the context of the country's developmental agenda. Currently, the management of individual elephant populations in South Africa is informed by the National Norms and Standards for the Management of Elephants in South Africa (Elephant Norms and Standards), which were published for implementation in 2008 (Government Gazette No. No. 30833). These norms require each reserve with elephants to have an approved Elephant Management Plan, aligned with the reserve objectives, which govern how elephants are managed and used on that reserve.

Managing elephants is context-specific and requires an integrated approach that addresses the particular ways in which elephants influence socio-ecological systems at a locality, whether across or within a site. Management therefore needs to consider the full range of available tools, which may also be applied simultaneously. These include water and fire management, fencing, translocation, contraception, and, in some cases, culling.

These activities are framed by the Elephant Norms and Standards. The Norms and Standards set out a progression of management actions in Annexure VI, beginning with non-lethal approaches such as translocation, contraception, range expansion, and range manipulation, and moving toward more interventionist or lethal options, such as culling, only when earlier steps are not feasible.

While the current Elephant Norms and Standards provide important guidance on available management approaches, they do not yet fully present the complete suite of management opportunities in an integrated manner that systematically addresses the diverse socio-ecological conditions that differ from place to place. In practice, effective elephant management often requires combinations of tools applied in ways that reflect local ecological processes, landscape characteristics, and social contexts. A more integrated framing could therefore assist managers in considering how different interventions may work together to respond to the specific circumstances of each site in a rational and context-appropriate way. Furthermore, the Elephant Norms and Standards, together with associated reserve management plans, primarily focus on site-level management. They do not address broader strategic policy considerations, such as the management of elephants in South Africa as a national meta-population, ensuring that all South Africans benefit from the full range of values that elephants provide, and promoting equitable, sustainable, and inclusive access to the benefits associated with elephants. Developing such a broader strategic perspective could complement the existing guidance and support more coherent and balanced decision-making across the country.

Several processes, including the National Biodiversity Research and Evidence Strategy (NBRES) Indaba, highlighted an urgent need to develop a national approach to, and goals for, elephant conservation and sustainable use. This will have a different purpose to the existing Norms and Standards which regulate management, reserve elephant management plans that govern management of elephants on reserves, the National Elephant Meta-population plan (under development, and which facilitates best-practice management across reserves), and the 2014 Elephant Research Strategy, all of which may require review to align better with the NEHS. A national heritage approach should be focused on the conservation of the national elephant herd, and the various benefits, services and values which should equitably flow from it to all South Africans, for current and future generations. Our newly developed NEHS provides the framework to achieve this.

This NEHS includes key elements typically found in conservation strategies, such as those outlined in a National Elephant Action Plan (NEAP), as guided by the African Elephant Action Plan agreed by all range states under CITES.

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As such, the NEHS serves as South Africa's NEAP. A National Heritage Strategy, however, goes further by focusing on South African societal aspirations, emphasising the promotion of a sustainable intergenerational legacy for all South Africans. In addition, the strategy is structured to give effect to the White Paper on Conservation and Sustainable Use of South Africa's Biodiversity, the Policy Position on the Conservation and Sustainable Use of Elephant, Lion, Leopard and Rhinoceros, and the draft National Biodiversity Economy Strategy, with specific reference to the African savanna elephant.

Consistent with the principles of the Kunming-Montreal 2022 Global Biodiversity Framework, the strategy took a whole-of-society approach in its development. Phase 1 included focus group consultation for the development of the vision and goals based on the values that participants expressed regarding elephants. Phase 2 included further focus group engagements to provide feedback and refine the vision and goals, and to develop the activities. Phase 3 provided the formal public participation process, which included further focus group engagements and the opportunity for interested and affected parties to submit written comments.

Over 700 people participated in our focus group consultative engagements. These delegates represent a broad spectrum of the key stakeholder groups, including NGOs and Associations with large memberships, representatives of large communities living with elephants (National People and Parks, and delegates at site-based community engagement workshops), Traditional Health Practitioners, Traditional Leaders, elephant owners and managers, elephant specialists and academics, representatives from the private sector, and spheres of national, provincial, and local government concerned with elephants. During Phase 3 public participation, we received 25 written submissions from a wide range of stakeholders as reflected in the participants in Phases 1 and 2 above.

Six community consultations included 614 participants representing a wide range of communities as above. In addition, on 12 and 13 August 2025, a National Elephant Indaba was led by the Deputy Minister of the DFFE, Mr Narend Singh, at Bonamanzi Game Reserve, northern KwaZulu-Natal. The National Elephant Indaba aimed to bring together key stakeholders to discuss the complexities around human-elephant conflict and to shape a national, unified response rooted in science, lived experience, and constitutional principles of environmental justice.

The Indaba was attended by approximately 180 participants in-person and online, with representatives of a wide range of stakeholders including community representatives, traditional leaders and traditional health practitioners, government departments and entities, industry organisations, and NGO's.

Stakeholders provided input on values and aspirations they associate with South Africa's elephants. By weighing the values expressed by stakeholders, according to their level of stake in elephants and the species' impact on their lives and/or livelihood, a collective South African aspiration was distilled, as now captured in the strategy's vision.

The **Vision** of the National Elephant Heritage Strategy of South Africa is:

Resilient elephant populations help nature thrive, support cultural and spiritual traditions, and give South Africans fair and inclusive chances to live well now and in the future.

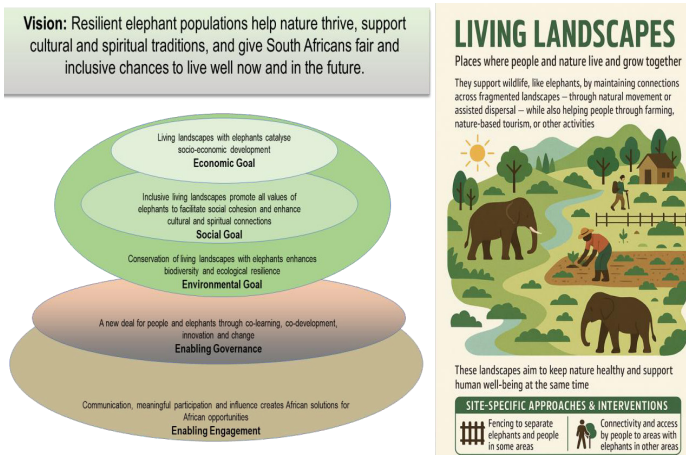


Figure 1: Diagrammatic summary of South Africa's National Elephant Heritage Strategy

Living landscapes are places where people and nature live and grow together. They support wildlife, like elephants, by maintaining connections across fragmented landscapes - through natural movement or assisted dispersal - while also supporting people through farming, nature-based tourism, or other activities.

These landscapes aim to keep nature healthy and support human well-being at the same time. This is promoted through site-specific approaches and interventions, such as fencing to separate elephants and people in some areas, while ensuring connectivity and access by people to areas with elephants in order areas.

The emergent vision has three core elements: environmental outcomes and the influence that elephants can have on these; social outcomes that embrace all the values of elephants, including their cultural and spiritual importance; and economic outcomes and how elephants can contribute to these.

The vision is aspirational, aiming to do better than just achieving sustainability (*i.e.*, the ability to be maintained at a certain rate or level, or avoiding depletion), or only resilience (*i.e.*, the ability to recover quickly after a disturbance), rather encompassing restorative and regenerative practices that enhance and build up the world's natural and social capital.

The aspiration seeks to ensure that thriving elephants contribute to improving the well-being of people and ecosystems simultaneously. Using whole systems approaches, South Africa must harness collaboration, co-learning and co-working, so that our collective wisdom, capacity and actions bring forth a flourishing world and thriving life. Elephants play a significant role in maintaining a balance where the creation of value exceeds consumption, crucial

for sustaining and increasing South Africa's social and natural capital, which are fundamental for inclusive socio-economic development. Hereby, elephants serve as a flagship for driving change toward "Thriving People and Nature".

The three key goals of the National Elephant Heritage Strategy are:

Goal 1:

Conservation of living landscapes with elephants that enhances biodiversity and ecological resilience.

Goal 2:

Inclusive living landscapes promote all values of elephants to facilitate social cohesion and enhance cultural and spiritual connections.

Goal 3:

Living landscapes with elephants catalyse inclusive socio-economic development.

However, achieving these goals requires the establishment of good governance and meaningful stakeholder engagement that recognises key trade-offs particular to elephants, given increasing elephant populations. The country must balance ecological impacts in landscapes, reduce human-elephant conflict, and still realise the cultural and economic value of elephants—all while acting with compassion.

These trade-offs reflect the complexity of managing elephants in line with the White Paper's vision. Navigating such trade-offs among the diverse aspirations of South Africans will substantially benefit from inclusive, equitable and transparent engagement, ensuring the acknowledgement and inclusion of the values, needs, and aspirations of all stakeholders. Enablers within the strategy provide for facilitating these aspects.

The two enablers are:

Enabler 1:

Enabling governance - A new deal for people and elephants through co-learning, co-development, innovation, and change.

Enabler 2:

Enabling engagement - Communication, meaningful participation, and influence create African solutions for African opportunities.

Stakeholders provided further input through a second round of consultation that helped identify key activities to achieve the goals and enablers that capture specific values expressed by stakeholders, and outcomes which contribute to achieving the Goals of the White Paper: 1) Enhanced Biodiversity Conservation, 2) Sustainable Use, 3) Equitable Access and Benefit Sharing, and 4) Transformation.

These strategic activities are captured under each Goal and Enabler.

1. This strategy contributes to achieving, amongst others, the outcomes of: Thriving people, nature and elephants are considered and realised. Expanded, connected, thriving, state, private, and community-owned land that conserves viable populations of elephants in living landscapes.

2. Financial support and incentives are harnessed and leveraged to ensure the biodiversity sector is adequately resourced and inclusive.

3. Improved livelihoods and well-being of local communities, through meaningful participation, and increased and more inclusive access and fair benefit sharing.
4. The role of elephants in African cultural and spiritual traditions is respected and strengthened, and, where necessary, restituted and restored.
5. Improved governance, co-management and partnerships, and contribution to the biodiversity economy, with meaningful community participation, influence, benefit, and empowerment as equal and influential participants, ensuring an inclusive biodiversity sector.
6. Clear understanding of the intent and aspirations of South Africa, in promoting the conservation and management of elephants and their landscapes for the well-being of people and nature.

This strategy intends to provide a strategic framework for planning and decision-making around living landscapes with elephants. As such, this strategy guides the development, revision and implementation of strategies, frameworks, mechanisms and tools, such as the Norms and Standards for the Management of Elephants in South Africa, the National Elephant Research Strategy, the Non-Detrimental Finding for Elephants, the Elephant Red-list Assessment, reserve-level Elephant Management Plans, the National Elephant Meta-Population Framework, and engagements regarding elephants in relevant consultative fora, *etc.* Even so, the National Elephant Heritage Strategy embraces evidence-based elephant management and seeks to adapt approaches upon reflection and identifying new lessons learned.

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Yarns – Part 2 of 10

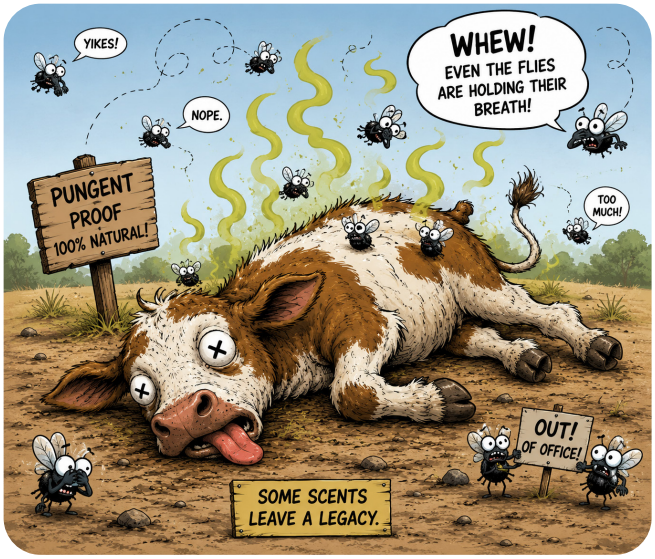
by Jay Malherbe

Seeing Practice

It was fairly common practice that if a school child was interested in becoming a vet, we would let them tag along with one of us as long as they were in grade 11 or 12. An older friend asked me if his son could come and observe for a few days.

This young chap wasn't sure if he wanted to do human medicine or veterinary medicine, so these few days might help him to decide.

A Durban businessman owned a large farm in the Tala Valley area. This was the farm that later became Tala Game Reserve. If you have been there, you will know that a lot of the area is covered in very thick bush. The farm had a fairly large herd of mixed-breed cattle roaming around in and about this bush, and as a result, some of the cattle weren't seen for days at a time. I got a call that there was a cow in distress and was having trouble calving. So, a bright young student and I set off for said farm. It turned out that the animal had been missing in the bush for a few days. On inspection, I found that she had been trying to calve for at least three days. The calf inside was not only dead but very rotten and smelly.



It is a dreadful job to pull a stinking, swollen foetus out of a cow. Without more detail, I got it all out, by which time I was really smelly, and there wasn't much water to wash in at the pens.

We drove home with all the windows open to help with the smell. I dropped the young man at the clinic, and I went home for a long hot shower and a change of clothing.

I never saw the young fellow again, but some years later I heard that he had done medicine and was specialising in Canada!

Maybe I helped him in the right direction.



South African Veterinary Association
Suid-Afrikaanse Veterinêre Vereniging

VISION AND MISSION STATEMENTS

Vision:

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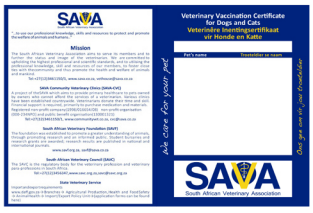
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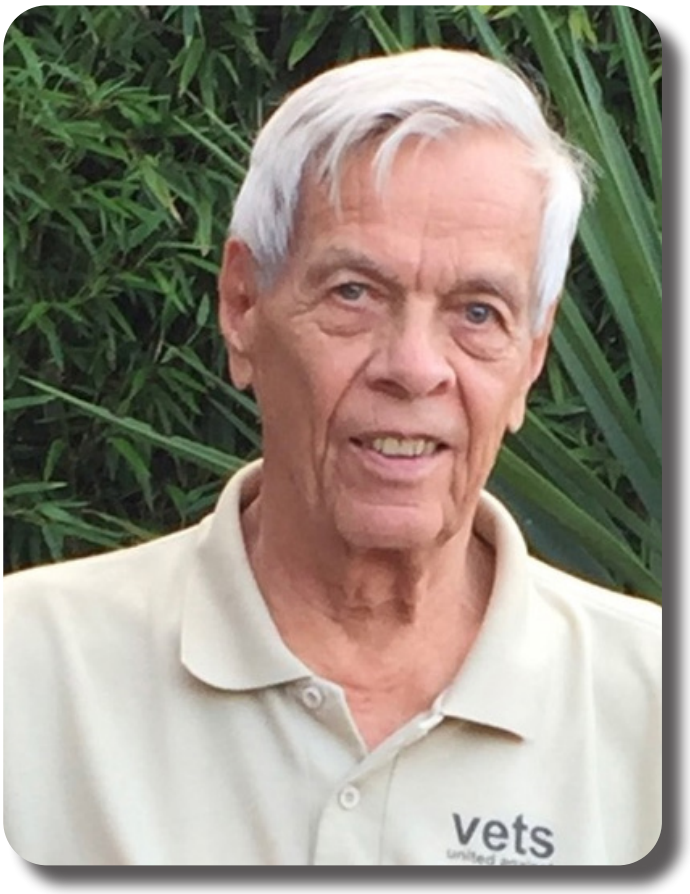
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In Memoriam

Daniel Wynand Verwoerd

19 November 1933 – 15 May 2026



Daniel Wynand, or Daan as he was known to his family and colleagues, was born in Stellenbosch to parents Hendrik Frensch Verwoerd and Elizabeth, nee Schoombee. He completed his schooling at the Helpmekaar Hoër Seunskool in Johannesburg in 1950 and then took the BVSc degree at Onderstepoort in 1955, followed by an MSc (Biochemistry) in 1958, a DSc (Biochemistry) in 1963 and a DVSc in 1969, all at the University of Pretoria.

Daan married Catharina Christina (Rina) Gilliland, and they had 3 children: Frans, Kobus and Jana. Daan was initially employed at Onderstepoort as a researcher from 1956 to 1972, as an Alexander von Humboldt Fellow (1960-1962) in Biochemistry and then Visiting Scientist in Virology (1962-1963) at the very highly rated Max Planck Institute in Germany, followed by an Eleanor Rooseveldt Fellowship at the National Cancer Institute at Bethesda, USA in 1974.

He was successively promoted at the Onderstepoort Veterinary Institute to Assistant Director 1972-1986, Deputy Director 1986-1988, and Director 1988-1998. To prepare for these roles, Dr Verwoerd completed structured courses in Public Management for Senior Managers and Time Management.

Over his professional career, Dr Verwoerd served on 12 national or international committees dealing with cancer, virology, microbiology, biotechnology, animal disease control and veterinary history. He authored or co-authored 62 articles in peer-reviewed journals and 8 book chapters, as well as 135 veterinary biographies and 16 articles in conference proceedings.

Major contributions to advances in veterinary science include his recognition of the value of molecular biotechnology in understanding animal diseases, leading to the establishment in 1964 of the first research group in South Africa being formed at Onderstepoort under his leadership. This expertise has since spread beyond virology to include important pathogens like Ehrlichia, Theileria, Anaplasma and Babesia, and to research groups at other South African universities outside the veterinary field. Expertise established at Onderstepoort enabled the purification of the bluetongue virus that led to its molecular characterisation and served as a worldwide model for the study of other important orbiviruses like African Horse Sickness. Clarification of the structure of the bluetongue virus also enabled the development of the first recombinant vaccine for this important sheep disease.

Work by the Onderstepoort group led to the solution of a century-old mystery: the cause of Jaagsiekte in sheep, found in many countries worldwide under different names. They identified a retrovirus as the cause and discovered why sheep are unable to develop an immune response – there was a close genetic similarity between the virus and the animal. The team also identified a lentivirus responsible for Graaff-Reinet Disease, known elsewhere as Maedi-Visna. Daan also served on the editorial committees of 5 scientific journals, including as Editor of the Onderstepoort Journal of Veterinary Research.

Dr Verwoerd's contributions were recognised by the conferral of 12 Awards and other forms of honour: from the Max Planck Institute a Fellowship in 1960, from the Bethesda Cancer Institute a Fellowship in 1972, the Yamagawa Yoshida Award in

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1977, the Gold Medal of the SAVA in 1985, the Havenga Prize (1987) and then the MT Steyn Prize in 2004 from the SAAWK, the Silver Medal of the SA Microbiological Society in 1991. He was a Founder Member of the SA Academy of Science in 1994, received the OIE Merit Award in 1998, and an Honorary Doctorate in 2000 and the Laureatus Award in 2003 from the University of Pretoria, and the HH Curson Award in 2020 from the SA Veterinary History Society.

Daan was a multi-talented man, an exacting, thorough academic and scientist as well as a handyman of many projects. He had wide interests, was very well-read and loved nature as well as the intricacies of biotechnology; he loved gardening and had a special interest and expertise in growing a variety of orchids in his hothouse and he spent years trying and succeeding in growing and flowering the Red Cape Disa in is purposely designed and home built greenhouse to simulate water and climate conditions of the Betty's Bay area. A true scientist even in his hobby.

To his family and colleagues, Daan was kind, generous, supportive, selfless and patient. His soft-spoken humility endeared him to all who knew him. The veterinary profession is deeply indebted to Daniel Verwoerd for his many exceptional contributions to veterinary science over the decades, and extends its condolences to his family on his passing.

Gareth Bath



We remember the contributions made by our colleagues who recently passed away.

Dr Tammy Hilton: 1995 – 2026

Dr Colin Skinner: 1946 – 2026

We honour their contribution to our profession and society in general and pray that their families and loved ones will find the strength to carry them through these times of bereavement.



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Greetings, everyone, and I hope winter has been kind to everyone! Working in a veterinary practice is deeply meaningful, but it can also be emotionally demanding. Every day, veterinarians and paraveterinary professionals support animals, guide worried clients, and work closely with colleagues under time pressure.

In such a human and high-stakes environment, conflict can arise easily. A misunderstanding, a stressed client, a rushed handover, or an unresolved workplace tension can affect the whole team.

The good news is that conflict does not have to control your day. With awareness, calm communication, and a few simple strategies, you can reduce unnecessary conflict and handle difficult moments with more confidence. **Conflict avoidance is not about ignoring problems**. It is about noticing tension early, responding wisely, and protecting your peace while still acting professionally and kindly.

Why conflict happens in veterinary settings

Conflict in veterinary practice often comes from stress, fear, grief, fatigue, or pressure. Clients may be anxious about their animal's health or worried about costs. Colleagues may be tired, overloaded, or unsure about roles and expectations. Even small issues, like unclear instructions or tone of voice, can escalate quickly in a busy practice. Understanding this can help you respond with more compassion. Often, **conflict is not about you personally**. It may be about someone else's stress, pain, or feeling of helplessness. This does not excuse disrespectful behaviour, but it can help you stay grounded instead of reacting emotionally.

1. Start by regulating yourself

Before you can manage conflict well, you need to **manage your own response**. If you feel your heart racing, your voice tightening, or your frustration rising, **pause** before you speak. Take one slow breath in and a longer breath out. Even a few seconds (as little as four seconds can be useful) can help you think more clearly. A calm presence often prevents conflict from growing. You do not need to have the perfect response in the moment. You only need to avoid adding heat to an already difficult situation.

If necessary, say something like:

- ✓ "Let me take a moment to think about that."
- ✓ "I want to respond carefully."
- ✓ "Can we pause and come back to this in a minute?"

These simple phrases create space and prevent impulsive reactions.

2. Listen to understand, not just to reply

One of the most powerful ways to avoid conflict is to **listen well**. Many difficult conversations become worse because people feel unheard. When a client, colleague, or team member is upset, allow them to speak **without interrupting** if possible. Show that you are paying attention by using brief responses such as:

- ✓ "I understand."
- ✓ "That sounds stressful."
- ✓ "Thank you for explaining that."

Listening does not mean agreeing with everything being said. It means **making the other person feel seen.** In many cases, once people feel heard, the tension begins to soften.

3. Use clear, respectful language

In veterinary practice, clear communication can prevent many misunderstandings. **Be direct, but kind**. Avoid vague statements that could be misinterpreted. If there is a concern, speak about the issue specifically and calmly.

For example, instead of saying, "You never follow instructions," you might say, "I noticed the medication schedule was different from what we discussed. Let's clarify the plan together." This approach reduces blame and keeps the conversation **focused on facts and solutions**.

Clear language also helps when speaking with clients about treatment plans, costs, or follow-up care. When people understand what to expect, they are less likely to become frustrated later.

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4. Set healthy boundaries early

Many conflicts become bigger because boundaries are not clear. In a caring profession, it can be tempting to overextend yourself, take on too much, or tolerate behaviour that is not acceptable. But boundaries protect both your energy and your professionalism. Examples of healthy boundaries include:

- ✓ Clarifying your role and responsibilities
- ✓ Being honest about what you can and cannot do
- ✓ Staying respectful while firmly addressing rude or aggressive behaviour
- ✓ Not taking responsibility for other people's emotions

You might say, "I want to help, and I can do that best if we speak respectfully," or "I can explain the options again, but I cannot change the treatment plan without the veterinarian's assessment." Boundaries are not unkind. They are a form of care.

5. Choose timing carefully

Some conversations are important, but not every moment is the right moment. If emotions are high, **it may be better to delay a discussion until everyone is calmer**. This is especially true in busy veterinary settings where people are already under pressure. If a colleague or client is upset, try saying, "This is important, and I'd like to give it the attention it deserves. Can we continue in a few minutes when things are quieter?" This can prevent an emotional exchange from becoming a damaging confrontation.

6. Focus on solutions, not winning

In conflict, it is easy to become focused on being right. But in professional practice, the goal is usually to move forward constructively. Ask yourself: What is the best next step for the animal, the client, the team, and the situation? A solution-focused mindset helps you stay useful rather than reactive. You might ask:

- ✓ "What outcome are we trying to achieve?"
- ✓ "What information do we still need?"
- ✓ "What would help resolve this quickly and respectfully?"

This keeps attention on progress instead of blame.

7. Look after your emotional wellbeing

Repeated conflict can wear down even the strongest professional. If you are often feeling drained, tense, or on edge, it may be a sign that you need more support. Speak to trusted colleagues, mentors, or a professional coach if needed.

Make time for rest, reflection, and recovery outside work. Self-care is not a luxury. It is part of sustainable professional practice. When you are emotionally supported, you are better able to stay calm, compassionate, and effective in difficult moments.

8. Remember that courage can be quiet

Avoiding conflict does not mean being passive. It means responding with wisdom instead of fear. Sometimes courage looks like speaking up gently.

Sometimes it looks like walking away from a heated exchange until you can return with a clearer mind. Sometimes it means holding a boundary with kindness.

You do not need to be perfect to handle conflict well. You only need to be willing to learn, pause, and respond with care. In veterinary practice, where compassion is already at the heart of what you do, those small choices matter deeply.

Finally, conflict will always be part of human interaction, especially in emotionally charged environments like veterinary practice. But it does not have to define your work or drain your spirit.

With self-awareness, calm communication, respectful boundaries, and a solution-focused mindset, you can handle tension more confidently and protect both your wellbeing and your professional relationships.

You are doing important work. And even on difficult days, you can choose steadiness, dignity, and care.

Next month, we will continue looking at more ideas for improving our quality of life and overall performance both at work and at home.

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Ocular Pharmacology

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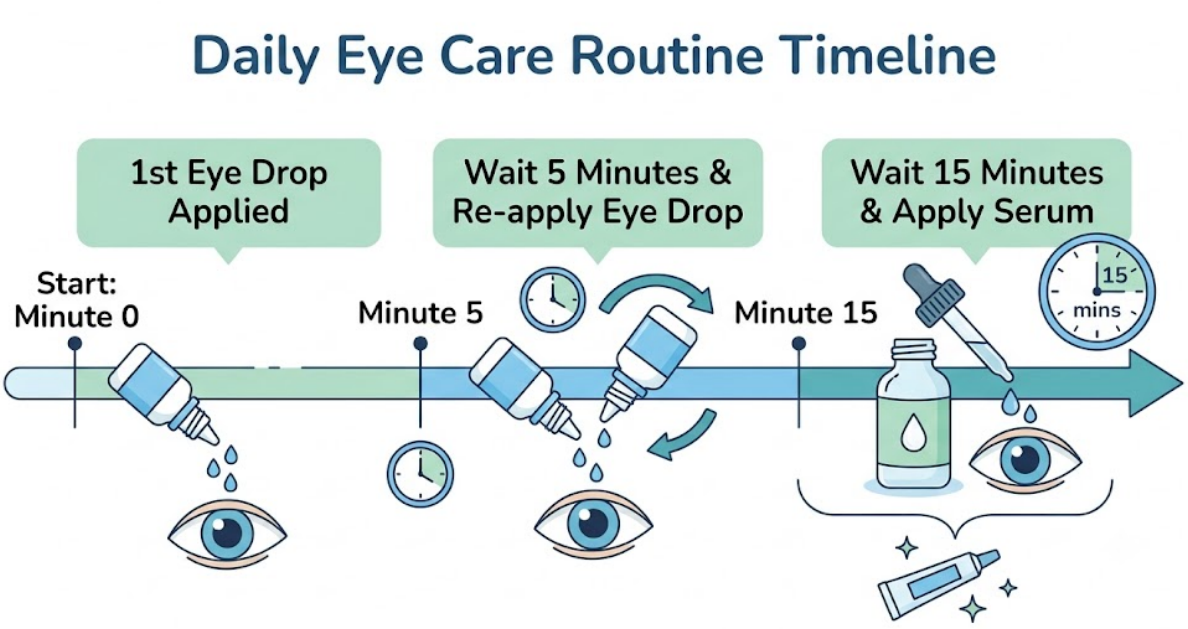
Every year, members from our hospital [Johannesburg and Cape Animal Eye Hospital] make a point of attending the European College of Veterinary Ophthalmology (ECVO) congress. This congress is hosted annually by the ECVO and attracts veterinary ophthalmologists and other professionals interested in veterinary ophthalmology from around the world. It has become the premier event on the veterinary ophthalmology academic calendar. This year, in Madrid, was no exception. The congress has a whole day of master classes on a specified topic before the three-day academic research component begins. This year the topic was ocular pharmacology.

There is currently much research being done in this area, and the concepts presented at this congress are so important to veterinarians that I felt it was essential to share these with our South African colleagues. These principles can be adopted immediately in our consulting rooms.

Much of what we know in clinical veterinary ophthalmology pharmacology may be based on hearsay or even concepts handed down and have become urban legends. There is a renewed emphasis on research to confirm some very basic principles on how we make use of eye medications. Much of the current knowledge is taken from pharmacological studies done on healthy eyes and not pathologic cases. Our patients have ocular pathology. A further problem is that much of the research was also done on rabbits, small rodents and other laboratory species, and it may be incorrect to extrapolate results to cats and dogs. A simple concept to consider is that the blink rate in rabbits is once every 10-20 mins and so data collected in rabbits may be profoundly different to that in other species. Small rodent eyes may have a very different ability to manage dose volume in small eyes and the ability to penetrate the cornea.

Recent research is now describing the Blood-Tear-Barrier [BTB] as an extremely important structure that affects the way we need to manage ocular pharmacology. There are tight junctions between the conjunctival cells, allowing stabilisation of the ocular surface, but when the tissue is inflamed and congested [conjunctivitis], there is a breakdown of the tight junctions and measurable amounts of albumin may leak to the ocular surface and be present in the tear film. This albumin in the tears may increase 2.7-14 fold the levels in the healthy eye. With conjunctivitis, this breakdown of the BTB also enhances the permeability of the ocular surface, resulting in increased absorption of products placed on the ocular surface.

Let's look at the first concept of increased albumin in the tear film. It is now shown that the albumin in the tear film will bind to the medication and reduce the bioavailability of the administered medication. The percentage of binding varies between products but is at least 8%. When we consider the application of an antibiotic eyedrop to the eye, it appears that only the unbound component of the antibiotic drop is microbiologically active. This may have significant effects on the minimum inhibitory concentration [MIC] for specific bacteria and affect the efficacy of the medication that is being applied or the frequency with which one must apply it in order for it to be effective.



Changes in the MIC's may explain the suboptimal clinical outcomes or the rise in antimicrobial resistance. One way around this is to increase the frequency of administration or at least apply the first drop, wait 5 minutes before applying the second drop. The second and subsequent drops provide more unbound drug.

The use of serum for the treatment of serious corneal pathology and melting ulcers is well known, and both canine and equine serum can be used. There are many advantages of this product, such as the fibronectin, neuro-regeneration through NGF and VEGF factors, down-regulating proinflammatory cytokines and its antimicrobial effects. The most important is its anti-collagenolysis through the alpha-2-macroglobulin. There, however, may be some disadvantages that are worth mentioning. These include availability, no preservative, short shelf life [2 weeks refrigerated], rich in TGF_{B} [causing corneal scarring] and rich in albumin that binds medications.

Because serum [via albumin] can bind some of the drug, it would be advantageous to reduce this negative effect. This can be done in two ways:

1] The current advice is to medicate the eye with the antibiotic eye drop and then wait 5 minutes before applying a further drop of the same product or an alternative product, followed by a 15-minute wait before the serum is applied. This is then repeated 2 hrs later. The initial rapid succession of antibiotics allows any protein binding to occur with the first treatment and more bioavailability of the active drug with the second dosing.

2] The serum that is collected could be diluted to 20% serum and thus reduce the albumin content but still be effective.

During ocular inflammation, there potentially can also be increased drug perfusion of systemically administered medications. It has been shown that giving a Convenia injection will result in about a 120-fold increase in the drug in the conjunctival tissue versus in healthy eyes. This effect is apparently active for 10 days. Further studies are in progress for other drug groups. Oral Famcyclovir for FHV-1 in cats can be present in the cat's tear film at very high levels. It is important to note that studies are underway regarding oral Doxycycline. No definitive results are known regarding therapeutic levels in the tears for this drug, although it most likely will be the case. Watch this space!

Other strategies can be employed to reduce the negative effect of increased albumin levels in the tear film during ocular inflammation. These can include:

1. Increase the concentration of ophthalmic formulations. This means there is more unbound drug that can achieve its biological effect. Fortified eyedrops may be needed in some cases, specifically where an antibiogram shows resistance to common eyedrops. Plumb's Veterinary Manual describes some useful recipes.

2. Increase the frequency of administration. The second and subsequent drops provide more unbound drug. Although this is an easy concept to apply, it requires pet owner compliance and already owner non-adherence is a major issue in veterinary medicine.

3. Add products into drug formulations that show competitive inhibition to bind albumin [currently a new area of research].

4. Stabilisation of the blood-tear-barrier. This must be done by controlling the primary ocular disease if this is possible. Currently there are no specific concepts that can be instituted to directly change the BTB.

It should be obvious now that with a breakdown in the blood-tear-barrier, the leakiness of the conjunctiva not only results in increased albumin release in the tears but also allows ingress of products. Veterinarians should be very conscious of the possible negative effects of this. This may include the topical use of corticosteroid drops [eg Pred Forte] affecting diabetic patients and beta-blocker eyedrops [eg Cosopt] in congestive heart failure patients, especially small breed dogs. Multiple speakers also suggested that veterinarians need to pay more attention to client education when it comes to ocular medications. We need to be very aware that nonadherence to our intended dosing instructions is a major problem, and the frequency of dosing simply will not be done in most cases, leading to failure. We need to be proactive in demonstrating patient handling and medication techniques in the consulting room. We need to be sympathetic to owners as they may legitimately have an uncooperative patient, the eyes may be painful, or they may physically be unable to perform the requested task.

In view of these problems, there is active research into new innovations in drug delivery techniques. These include maximising the routes of delivery such as episcleral, intrastromal and intracameral methods.

Eye drops: There is only a 1-10% absorbance of topical eye drops [90-99% wastage]. The latter occurs due to tear turnover, nasolacrimal duct drainage and protein binding. The medication then enters the systemic circulation. It is for this reason that initial frequent dosing may be required in order to reach a steady-state therapeutic level in the eye. Many are now advocating an initial dose followed by a subsequent dose after 5 minutes and then the application of a good quality lubricant. The hyaluronic acid-based products are best. The rationale for this is that the subsequent drop is able to bind to the complex longer chain molecules of the lubricant and provide a longer contact time and more efficient drug release. Even pre- treating with hyaluronic acid drops can increase drug retention by 1.8-fold and 2.0-fold if X-linked HA is used.

The conjunctival and episcleral routes: A subconjunctival injection provides a high concentration of medication to the front part of the eye. Only to be used when there is no topical formulation. This may include triamcinolone, amphotericin B, cephalosporins and mesenchymal stem cells. This type of injection may only last 12-24 hours. Non-depot type drugs rapidly drain directly into the systemic circulation. Sustained delivery systems [silicone implants] include subconjunctival implants of cyclosporine, tacrolimus, Bromfenac, brinzolamide, and other medications.

Intracorneal injection: These include injection techniques with 27-31G needles and use of microneedles [600um] delivering an injection directly into the stroma of the cornea. This can be used for Amphotericin B and Voriconazole medication of equine stromal abscesses.

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I**ntracameral drug delivery**: Slow-release implants [for glaucoma] deposited into the anterior chamber may show great promise in the future. Simply injecting drugs into the anterior chamber shows rapid systemic absorption, and the procedure alone is traumatic. This is not a routine technique.

Excessive use of ophthalmic antibiotics is a global problem, and speakers at this congress emphasised the necessity of taking antibiotic stewardship seriously. Over the last few years at our hospital, we have radically changed our policy regarding antibiotic use. Here are a few simple ideas that veterinarians can apply.

a) Is an antibiotic actually required? If excellent pre-operative ocular surface cleaning has been done, then antibiotics may not be required post op.

b) Choose the antibiotic for the most likely pathogen.

c) Perform more advanced diagnostics that can assist in making a better decision. Make use of cytology [cocci or bacilli], cultures and antibiograms.

d) What is the anatomical target? The eye is a complex organ with different compartments, so choose the most effective formulation and route to maximise the MIC in the target structure.

Take home messages;

1. Albumin released in inflamed eyes raises the tear albumin levels, and this binds to topical mediations decreasing their efficacy.
2. Owner non-adherence is a serious issue.
3. Restrict the use of topical fluoroquinolones [Eg Exocin and Vigamox] as a primary treatment as much as possible; use based on culture.
4. Chronic or repeated low-level exposure, for example through prolonged twice-daily administration of antibiotic eye drops for a non-infectious disease, is identified as a key driver of resistance selection. Avoid the use of fixed antibiotic–steroid formulations or "triple antibiotic" type formulations.

"As little as possible, and only as much as necessary"

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Adverse Skin Reactions to Food

Adapted by Dr Angeliki Kaldelis (BSc, BVSc, MRCVS) from the article published by Royal Canin Academy:

Adverse Food Reactions in Dogs: what do we currently know? | Royal Canin Academy

Adverse food reactions in dogs are still incompletely understood; this article reviews what we know about the condition and how it may interlink with atopic dermatitis.

Canine atopic dermatitis (AD) is a complex and multifactorial clinical syndrome that arises from a combination of genetic predisposition, skin barrier abnormalities, immune dysfunction, and neurogenic hyperreactivity. This chronic, inflammatory, and intensely pruritic skin disease affects many dogs worldwide and is often complicated by hypersensitivity to environmental allergens, food, and microorganisms. While environmental allergens are more commonly implicated in AD, adverse reactions to food antigens are reported in up to 50% of cases, particularly in young dogs presenting with perennial itching. Understanding the role of food allergens in exacerbating or triggering atopic dermatitis is essential for effective diagnosis and management.

Food allergens are primarily protein molecules that, when ingested, can provoke hypersensitivity reactions. Although proteins are the main culprits, carbohydrates and lipids—especially when conjugated to proteins—can also act as allergens. In dogs, the majority of adverse food reactions (AFRs) are linked to allergens found in beef, dairy, and wheat, but chicken, pork, and soya are also frequent offenders. For example, dogs often react to specific proteins such as IgG, phosphoglucomutase, and serum albumin from beef. Cross-reactivity is common due to structural similarities between proteins from different species, such as between bovine and ovine immunoglobulins. Dairy allergens like β-lactoglobulin, casein, and lactalbumin are also significant triggers. Chicken meat contains several allergenic proteins, including serum albumin and enzymes like pyruvate kinase and enolase. Eggs contribute allergens such as ovomucoid and ovalbumin, while fish allergens like enolase and aldolase have been identified, with cross-reactions noted between fish and chicken proteins. This broad spectrum of allergens and their potential cross-reactivity complicate the clinical picture and management of food-induced allergic reactions.

Adverse food reactions encompass both food hypersensitivity (FH) and food intolerance (FI). Food intolerance is a non-immunological response, often caused by pharmacologically active ingredients, metabolic reactions, or idiosyncratic responses. In contrast, food hypersensitivity is an immune-mediated reaction to food allergens and can involve immediate IgE-mediated responses (type 1 hypersensitivity), immune complex deposition (type 3 hypersensitivity), or chronic cell-mediated inflammation (type 4 hypersensitivity). While immediate IgE-mediated reactions are most common in humans, dogs can exhibit a mixture of immune responses. Normally, the immune system develops oral tolerance to food proteins, preventing hypersensitivity. However, factors that impair the mucosal barrier—such as infections, toxins, or alterations in gut physiology—can increase antigen penetration and abnormal presentation to the gut-associated lymphoid tissue (GALT), promoting sensitisation and allergic reactions.

In the context of atopic dermatitis, food allergens can act as precipitating or exacerbating factors in approximately 25 to 50% of cases. The pathogenesis of AD involves a compromised epidermal barrier and an overactive immune response, predominantly driven by type 2 helper T lymphocytes (Th2). When food allergens enter the system, they are captured by pro-inflammatory dendritic cells and presented to naïve T cells (Th0), which differentiate into Th2 cells. These Th2 cells release cytokines, which stimulate B lymphocytes to produce allergen-specific IgE antibodies. These IgE molecules bind to mast cells, basophils, and keratinocytes, triggering inflammatory cascades upon allergen re-exposure. IL-31, in particular, is strongly associated with pruritus, the hallmark symptom of AD. Beyond this type 2 inflammatory response, dendritic cells can also induce a type 1 cell-mediated immune response, involving Th1 lymphocytes that secrete cytokines like IL-2, interferon-gamma, and TNF-α. This response recruits cytotoxic T cells, neutrophils, and macrophages, contributing to chronic inflammation, tissue damage, and skin thickening (lichenification). Chronic stimulation can also lead to upregulation of Th22 cytokines, which promote keratinocyte proliferation and epidermal hyperplasia, further impairing the skin barrier.

Clinically, dogs with food-induced atopic dermatitis (FIAD) often present with early-onset, chronic, and non-seasonal pruritus affecting the distal limbs, axillae, inguinal areas, and flexural regions. Otitis externa is a common and often bilateral feature, occurring in up to 80% of affected dogs, and tends to be recurrent and difficult to manage. Secondary infections, including pyoderma and yeast overgrowth, frequently complicate the clinical picture. Some dogs also exhibit perioral and perianal pruritus. Chronic cases may show hyperkeratosis, acanthosis, and lichenification, reflecting ongoing inflammation and skin remodelling. Gastrointestinal signs such as vomiting, diarrhoea, flatulence, and abdominal discomfort are reported in 20 to 83% of dogs with AFRs, highlighting the systemic nature of food hypersensitivity. Certain breeds, including West Highland White Terriers, Boxers, Pugs, German Shepherds, French Bulldogs, and Shih Tzus, appear predisposed to FIAD.

The management of FIAD hinges on minimising exposure to offending food allergens, which is critical for controlling the

inflammatory cascade and improving quality of life. Diagnosis often involves elimination diets followed by controlled food challenges to identify specific allergens. Because the immune responses involved can be both immediate and delayed, and because cross-reactivity is common, dietary management can be challenging and requires careful planning and monitoring.

In conclusion, adverse skin reactions to food allergens represent a significant factor in the pathogenesis and exacerbation of atopic dermatitis in dogs. These reactions provoke chronic, intense pruritus and widespread skin lesions that severely impact affected dogs' well-being. Understanding the immunological mechanisms, clinical manifestations, and common allergens involved is essential for veterinarians and pet owners alike. Through careful dietary management and multimodal therapeutic approaches, it is possible to mitigate the effects of food-induced atopic dermatitis and improve outcomes for affected dogs.

For a comprehensive understanding, detailed guidance, and references, please visit the Royal Canin Academy for the full article "Adverse Skin Reactions to Food", written by Marconi Rodrigues de Farias and Vanessa Cunningham Gmyterco (Sept 6, 2024)

https://academy.royalcanin.com/en/veterinary/adverse-skin-reactions-to-food



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Willem Schultheiss	082 323 7019	schultheisswillem@gmail.com
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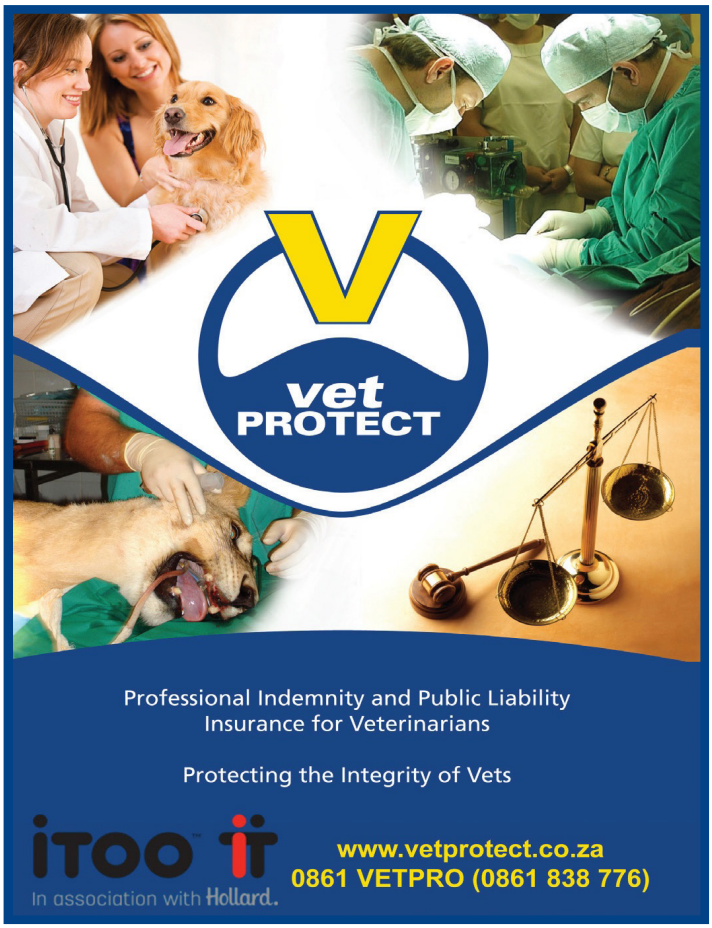
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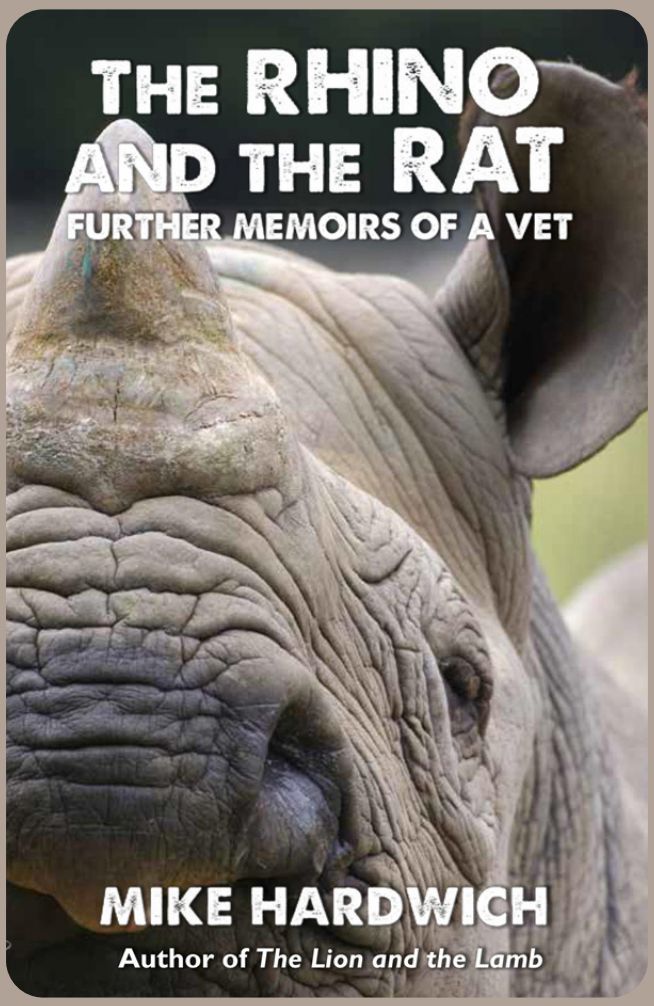
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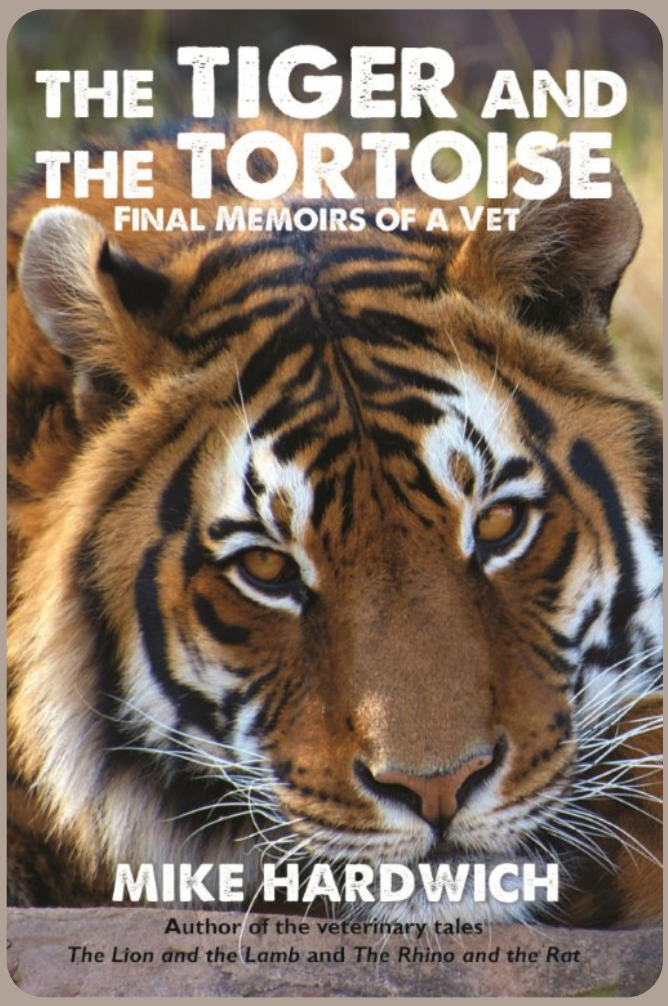
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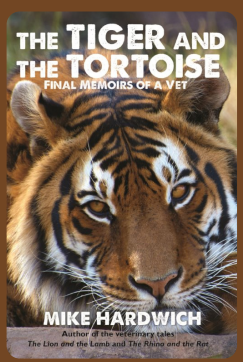




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