

Field studies in practice - pros & cons

实地研究实践-利弊

Can we trust our field data to guide decisions in swine health & production?

我们能否依赖现场数据来指导猪的健康与生产决策?

Heiko Nathues

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20. OCT 2025

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Case Example 1 案例1

Heliyon 7 (2021) e06714



Contents lists available at ScienceDirect

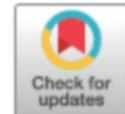
Heliyon

journal homepage: www.cell.com/heliyon



Case report

Reduction of *Salmonella* prevalence at slaughter in *Lawsonia intracellularis* co-infected swine herds by Enterisol[®] Ileitis vaccination



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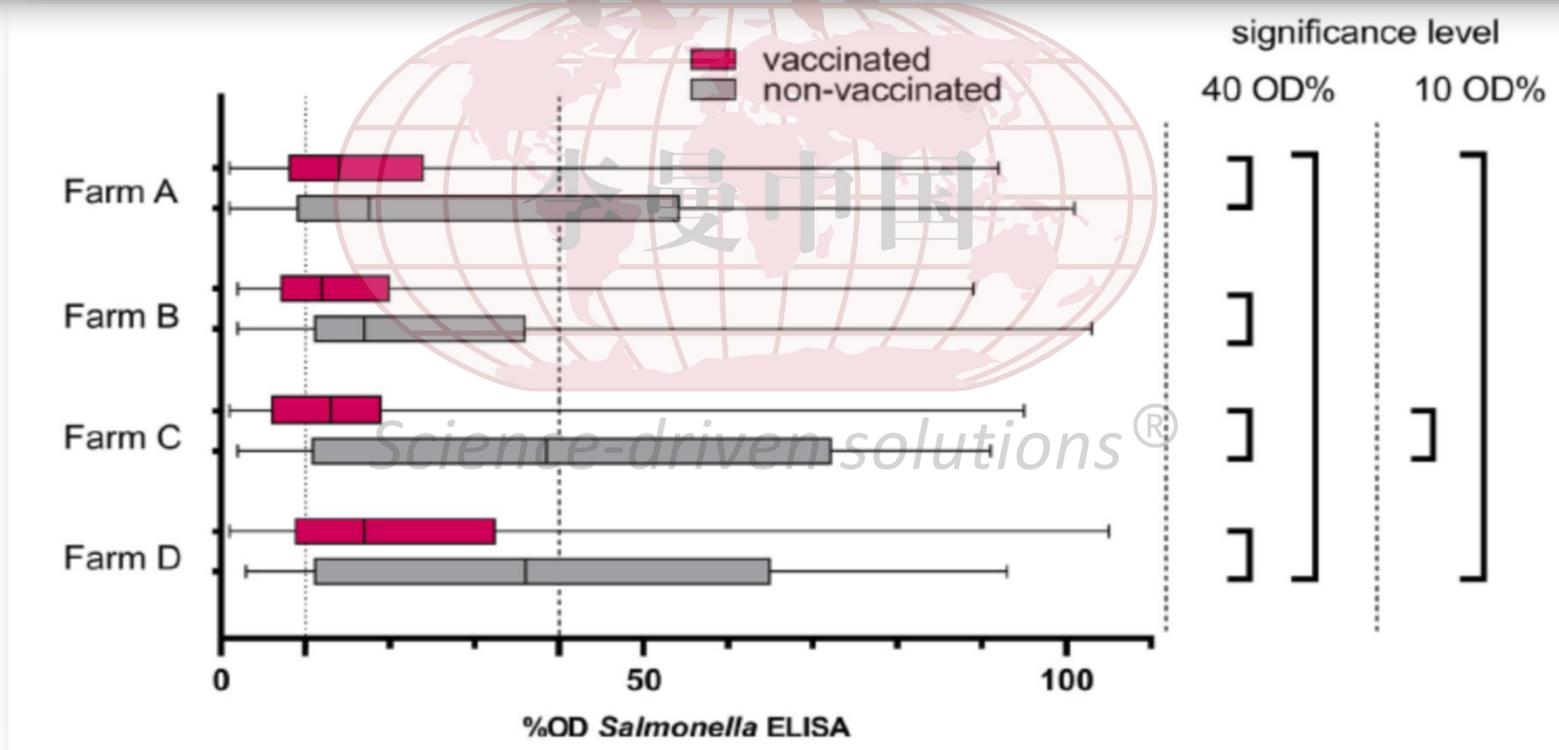
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Table 3. Production data.

| Farm | Treatment group | N | ADWG (g/day) | Fattening (days) | Feed conversion (kg/kg) | Mortality (%) |
|------|-----------------|----|--------------|------------------|-------------------------|---------------|
| All | Vaccination | 16 | 809.2 | 117.2 | 2.83 | 1.36 |
| | Non-vaccination | 9 | 790.9 | 119 | 2.83 | 1.66 |
| | <i>P</i> | | 0.1513 | 0.3378 | 0.9537 | 0.1757 |

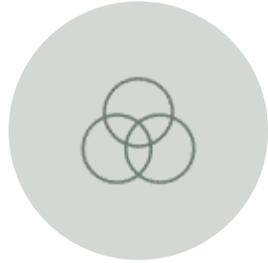
N, number of batches; ADWG, average daily weight gain.

In conclusion, this study demonstrated that vaccination with Enterisol[®] Ileitis significantly reduces the seroprevalence of *Salmonella* in herds co-infected with *L. intracellularis* and *Salmonella* spp. compared to non-vaccinated animals at time of slaughter.



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Why Scientific Integrity is compromised 为什么科学诚信受到损害



No contemporaneous control group (historical batches used)

1无同期对照组（使用历史批次）



No randomization or blinding

无随机或盲法



No diagnostic confirmation of infection status
未确诊感染状态



Serology-only outcome (no pathogen detection)

仅血清学结果（未检出病原体）



Weak statistical analysis
统计分析不充分



Commercial conflict of interest
商业利益冲突

Why Journal Integrity is compromised 为什么期刊的完整性受到损害



Delisted from Web of Science in 2024

2024年从科学网除名



Reasons: 李曼中国

原因

Excessive growth in manuscript volume
手稿数量增长过快
Lowered peer-review thresholds
降低同行评审门槛
Prioritization of quantity over quality
数量优先于质量



Implication: Published studies may not meet baseline scientific standards

含义：已发表的研究可能不符合基本科学标准

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Definition of field studies in veterinary medicine
兽医学实地研究的定义



Importance in porcine health management
在猪健康管理中的重要性



Real-world challenges
现实世界的挑战

Science-driven solutions[®]

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Definition of field studies in veterinary medicine 兽医学实地研究的定义



Definition of field studies in practice

实地研究的定义

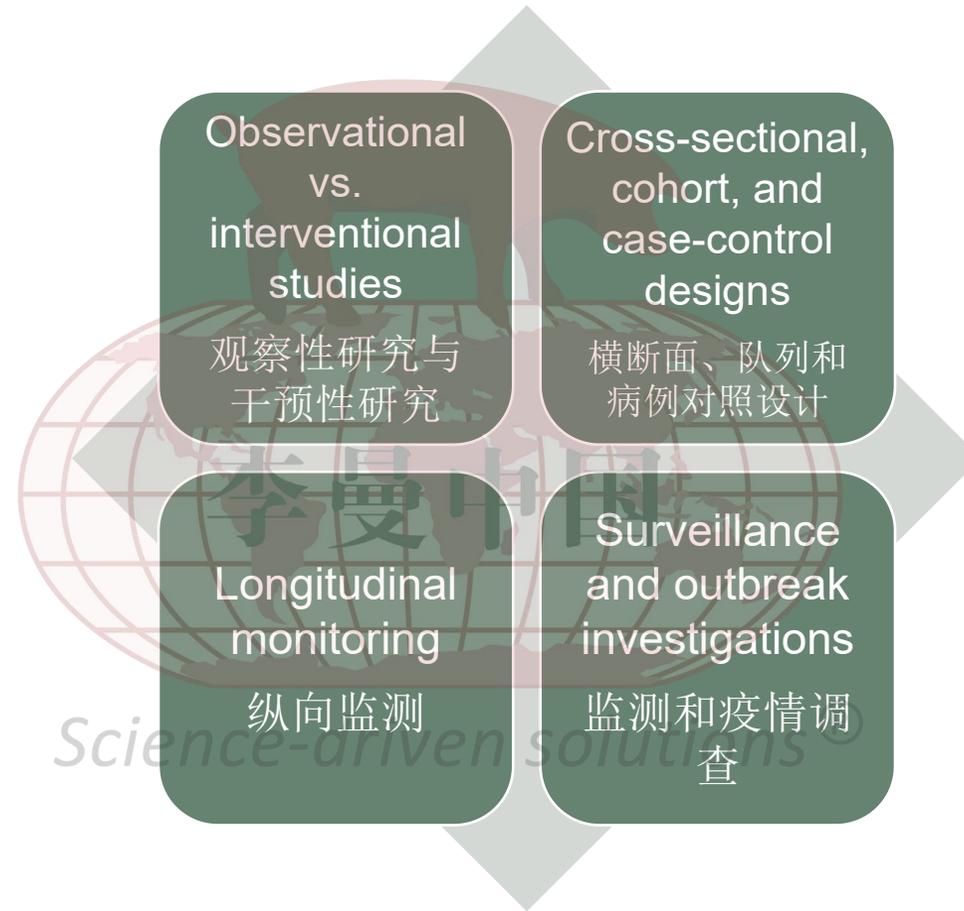
Systematic investigations conducted under commercial or farm-like conditions to evaluate health-related outcomes, disease dynamics, or intervention effects in pigs. These studies are performed outside of controlled laboratory environments and aim to reflect the complexity, variability, and practical constraints of real-world swine production systems.

在商业或农场样条件下进行的系统性调查，以评估猪的健康相关结果、疾病动态或干预效果。这些研究是在受控实验室环境之外进行的，旨在反映真实世界猪生产系统的复杂性、可变性和实际限制。

Key Attributes: 关键属性:

- **Conducted on working farms or production units, often with minimal disruption to routine operations.**
在工作农场或生产单位进行，通常对日常操作的干扰最小。
- Designed to generate practically applicable insights, often with direct relevance to veterinarians & producers.
旨在提供实用的见解，通常与兽医和生产者直接相关。
- Typically involve heterogeneous populations, environmental variability, and multifactorial influences.
通常涉及异质性种群、环境变异性以及多因素影响。
- Require careful attention to study design, diagnostics, and confounding control to ensure scientific validity.
需要仔细关注研究设计、诊断和混杂控制，以确保科学有效性。
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Types of Field Studies 实地研究类型



Observational Studies

观察性研究

1. Non-Interventional Design 1. 非介入性设计

- Researchers observe existing practices, conditions, or outcomes without assigning treatments or altering farm protocols. 研究人员观察现有的实践、条件或结果，而不进行处理或改变农场规程。
- This allows for naturalistic data collection but limits causal inference. 这允许自然数据收集，但限制了因果推断。

2. Real-World Relevance 2. 现实相关性

- Conducted under commercial farm conditions, reflecting the complexity of actual production systems.
- 在商业农场条件下进行，反映了实际生产系统的复杂性。
- Findings are highly applicable to practitioners, though often context-specific.
- 研究结果对从业者非常适用，尽管通常是特定于上下文的。

3. Exposure-Based Grouping 3. 基于暴露的分组

- Animals are grouped based on naturally occurring exposures (e.g. vaccination status, housing type, feed regimen). 根据自然暴露（例如疫苗接种状态、饲养类型、饲料方案）对动物进行分组。
- No randomization—groups may differ in multiple uncontrolled ways, introducing confounding.
- 没有随机分组-组间可能存在多种不受控的差异，从而引入混杂因素。

Observational Studies 观察性研究

🔍 4. Retrospective or Prospective Data Collection 4. 回顾性或前瞻性数据采集

- - Can be retrospective (using farm records, slaughter data) or prospective (monitoring cohorts over time). - 可以是回顾性的（使用农场记录、屠宰数据）或前瞻性的（随时间监测队列）。
- - Data quality depends heavily on record accuracy and consistency. - 数据质量很大程度上取决于记录的准确性和一致性。

⚠️ 5. Limited Control Over Confounders 5. 对混杂因素的控制有限

- Environmental, genetic, managerial, and health-related variables are often uncontrolled.
- 环境、遗传、管理和健康相关的变量通常不受控制。
- Requires careful statistical adjustment (e.g. multivariable models) to avoid misleading associations.
- 需要仔细的统计学调整（例如多变量模型）以避免误导性关联。

These studies are invaluable for hypothesis generation, benchmarking, and identifying risk factors - but they must be interpreted with caution.

这些研究对于假设的产生、基准和识别风险因素都是无价的，但必须谨慎地加以解释。

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Interventional Studies 介入性研究

-  1. Controlled Intervention 1.对照干预
 - Researchers actively introduce a treatment (e.g. vaccine, feed additive, management change).
 - 研究人员积极引入一种治疗（例如疫苗、饲料添加剂、管理改变）。
 - The intervention is standardized across groups to isolate its effect. 在各组中对干预措施进行标准化，以隔离其影响。
 - This is the defining feature that separates interventional studies from observational ones. 这是区分干预性研究和观察性研究的决定性特征。
-  2. Concurrent Control Group 2.同时对照组
 - A non-treated or differently treated group is monitored alongside the intervention group. 在干预组的同时，对未治疗或不同治疗的组进行监测。
 - Controls must be contemporaneous to avoid seasonal or management confounding. 控制措施必须是同期的，以避免季节性 or 管理混淆。
 - Ideally randomized to ensure comparability. 理想情况下，进行随机化以确保可比性。
-  3. Baseline Diagnostics and Monitoring 3.基线诊断和监测
 - Infection status, health metrics, or performance indicators are measured before the intervention. 在干预前，测量感染状况、健康指标或性能指标。
 - Follow-up diagnostics (e.g. PCR, serology, clinical scoring) are used to track outcomes. 跟踪诊断（例如PCR、血清学、临床评分）用于跟踪结果。
 - Ensures that observed effects are attributable to the intervention. 确保观察到的效果可归因于干预措施。

Interventional Studies 介入性研究

4. Randomization and Blinding 4.随机化和盲法

- Animals or pens are randomly assigned to treatment groups. 将动物或围栏随机分配至治疗组。
- Blinding (where feasible) reduces bias in outcome assessment and data handling. 设盲评组（如可行）可降低结局评估和数据处理中的偏倚。
- Essential for internal validity, especially when subjective measures are involved. 对内部有效性至关重要，特别是在涉及主观测量时。

5. Ethical Oversight and Protocol Adherence 5.伦理监督和方案依从性

- Study protocols are reviewed by veterinary ethics boards or institutional committees. 研究方案由兽医伦理委员会或机构委员会审查。
- Animal welfare, data integrity, and transparency are prioritized. 动物福利、数据完整性和透明度是优先考虑的。
- Conducted under GLP or GVP standards when used for regulatory purposes. 如用于监管目的，按照GLP或GVP标准进行。

These characteristics ensure that interventional studies produce causally interpretable, reproducible, and ethically sound results - even under the messy realities of commercial pig production.

这些特征确保了干预性研究产生因果可解释、可重复和伦理上合理的结果——即使是在商业猪生产的混乱现实中。

• Cross-Sectional Study 交叉选择研究

Snapshot in time: assesses exposure and outcome simultaneously
时间点快照：同时评估暴露量和结局

Useful for estimating **prevalence** of disease or conditions 可用于估计疾病或病症的患病率

Cannot determine causality - only associations
无法确定因果关系-仅存在相关性

Example: Measuring seropositivity for PRRSV across farms during one season 示例：在一个季节内测量不同农场的PRRS血清阳性率

Cohort Study 队列研究

Follows a group over time based on exposure status 根据暴露状态随时间跟踪一个组

Can be **prospective** (forward-looking) or **retrospective** (using past records) 可以是前瞻性的（具有前瞻性），也可以是回顾性的（使用过去的记录）

Measures **incidence** and can suggest causal relationships 衡量发生率并可提示因果关系

Example: Tracking vaccinated vs. unvaccinated pigs for Lawsonia over a production cycle 示例：在生产周期内追踪接种疫苗与未接种疫苗猪的胞内劳森菌情况

Case-Control Study 病例对照研究

Starts with outcome (cases) and compares past exposures to controls 从结局（病例）开始，将既往暴露量与对照组进行比较

Efficient for **rare diseases** or outcomes 对罕见疾病或结局有效

Prone to recall and selection bias if not carefully designed 如果不仔细设计，容易出现回忆偏倚和选择偏倚

Example: Comparing feed history of pigs with gastric ulcers vs. healthy pigs 示例：比较患有胃溃疡的猪与健康猪的采食历史

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Importance in Porcine Health Management 在猪健康管理中的重要性

*«Better Field Studies
= Better Decisions
= Healthier Pigs»*

“更好的实地研究
=更佳决策
=更健康的猪»

Advantages of Field Studies 实地研究的优势

Real-world applicability of findings 研究结果的实际适用性

Access to large and diverse populations 接触众多不同群体

Opportunity to study natural disease dynamics 研究自然疾病动态的机会

Cost-effectiveness compared to lab studies 与实验室研究相比的成本-效益

Stakeholder engagement and relevance 利益相关方参与和相关性

Challenges and Limitations 挑战和局限

Lack of control over confounding variables 缺乏对混杂变量的控制

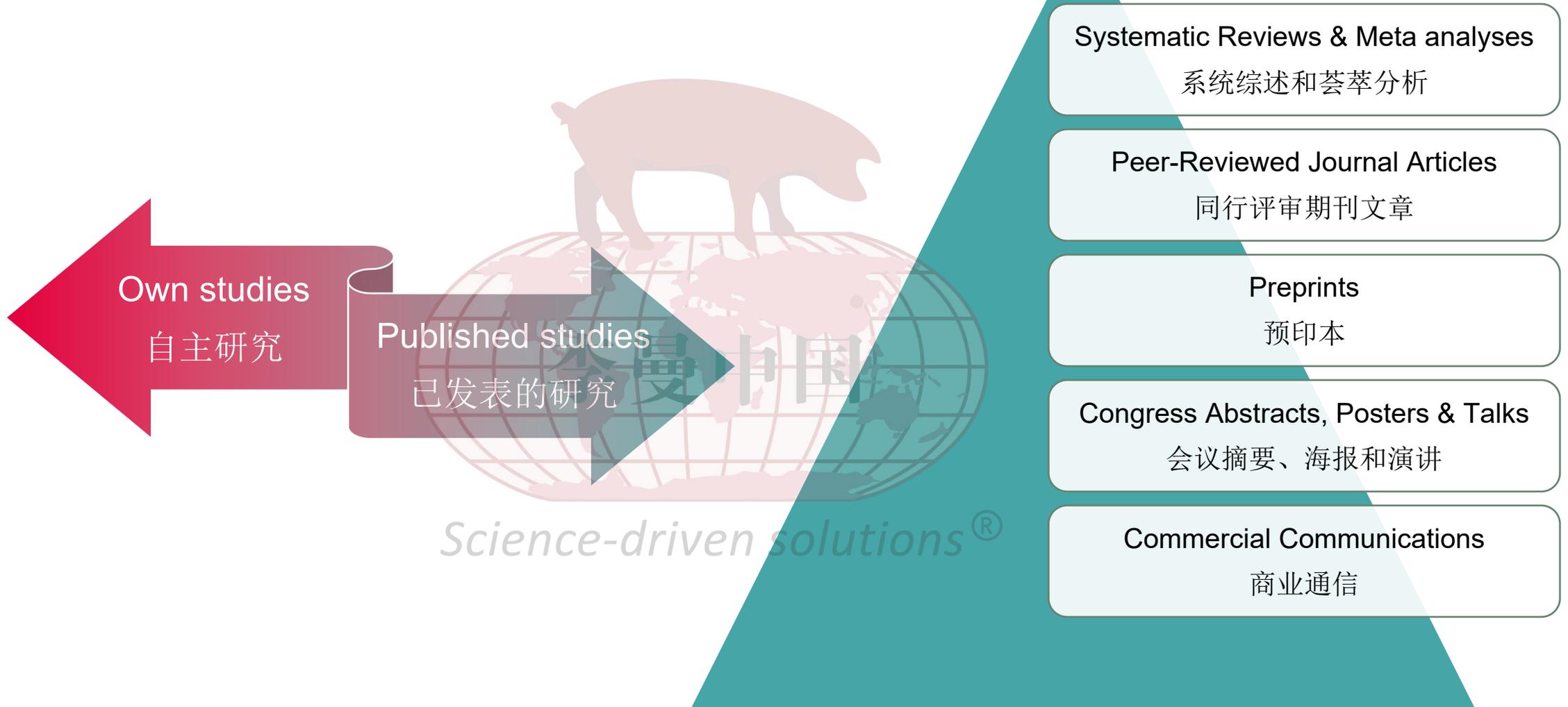
Variability in farm management practices 农场管理做法的差异

Data quality and completeness issues 数据质量和完整性问题

Ethical and logistical constraints 伦理和后勤限制

Difficulty in standardizing protocols 难以标准化协议

'Value' of Field Studies 实地考察的“价值”



Number of published Field Studies in PHM

PHM中已发表的实地研究数量

| Database | Estimated numbers | Notes |
|----------|-------------------|--|
| PubMed | 2'500-3'000 | Includes observational and interventional studies in swine health, epidemiology, and production systems 包括猪健康、流行病学和生产系统方面的观察性和干预性研究 |
| Scopus | 3'000-4'500 | Broader coverage including agricultural and veterinary journals not indexed in PubMed 更广泛的覆盖范围，包括未被PubMed索引的农业和兽医学期刊 |

These numbers reflect studies that:

这些数字反映了以下研究：

- Were conducted under real-world farm conditions (not lab-based)
-在真实农场条件下进行（非实验室）
- Focused on disease surveillance, intervention trials, herd health monitoring, or production outcomes
-重点关注疾病监测、干预试验、畜群健康监测或生产结果
- Were published in peer-reviewed journals between 2000 and 2025
-于2000年至2025年在同行评审期刊上发表

Number of GLP/GVP compliant Field Studies

符合GLP/GVP标准的现场研究数量

| Guideline | Estimated numbers | Notes |
|-----------|-------------------|---|
| GLP | 150-300 | <p>Mostly related to pharmaceutical or vaccine trials, toxicology, and residue studies. Conducted under strict regulatory oversight</p> <p>主要与药物或疫苗试验、毒理学和残留研究相关，且在严格监管下开展</p> |
| GVP | 200-400 | <p>Includes clinical trials and herd-level interventions with veterinary oversight, often for product validation or post-market surveillance</p> <p>包括在兽医监督下开展的临床试验和群体水平干预措施，通常用于产品验证或上市后监测</p> |

These numbers are approximate and based on:

这些数字是近似值，其依据为：

- Known publication trends in regulatory veterinary journals
- 已知的监管兽医学期刊出版趋势
- Industry-sponsored studies submitted for product approval (e.g., EMA, FDA, or CMA)
- 为产品批准提交的行业申办研究（例如EMA、FDA或CMA）
- The fact that many GLP/GVP studies are not published in open-access journals but instead submitted as confidential regulatory dossiers
- 许多GLP/GVP研究未在开放获取期刊中发表，而是作为机密监管档案提交

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Real-world challenges 现实世界的挑战



Case Example 2 案例2

Cvjetković et al. *Porcine Health Management* (2018) 4:19
<https://doi.org/10.1186/s40813-018-0092-7>

Porcine Health Management

RESEARCH

Open Access



Clinical efficacy of two vaccination strategies against *Mycoplasma hyopneumoniae* in a pig herd suffering from respiratory disease

Vojislav Cvjetković¹, Sabine Sipos², Imre Szabó³ and Wolfgang Sipos^{4*} 

Science-driven solutions®

Abstract 摘要

Background: A randomised field trial was conducted on an Austrian farrow-to-finish farm for one year to compare the efficacy of two commercial *Mycoplasma hyopneumoniae* vaccines. 585 piglets either received the one-shot formulation in group 1 (Hyogen[®], 23.9 days of age) or a two-shot vaccine (Stellamune[®] Mycoplasma, 4.3 and 24.0 days of age) in group 2. Assessment of vaccine efficacy was evaluated by regression analyses through cough monitoring from nursery to slaughter, average daily weight gain from inclusion to slaughter, antibiotic treatment rate (ATR), mortality rate, and lung lesion scoring at slaughter.

背景：在奥地利一个从母猪分娩到产犊的养殖场中开展了一项为期一年的随机田间试验，以比较两种市售猪肺炎支原体疫苗的效力。第1组的585头仔猪接受单次疫苗（Hyogen[®]，23.9日龄），第2组的585头仔猪接受双剂量疫苗（Stellamune[®] Mycoplasma，4.3和24.0日龄）。通过从育成期到屠宰期的咳嗽监测、从保育到屠宰的平均日增重、抗生素治疗率（ATR）、死亡率和屠宰时肺部病变评分进行回归分析，对疫苗有效性进行了评估。

Results: In general, coughing was more frequent during late nursery and finishing. No significant differences were found in the coughing index (0.02 vs 0.03) and mean average daily weight gain (560 vs 550 g) between the two groups. ATR was higher in group 2 (3.8 vs 9.6%). At the slaughterhouse check, significant differences in the prevalence of bronchopneumonia (62.9 vs 71.2%) could be found. Extension of lung lesions was also significantly lower in group 1 in terms of enzootic pneumonia (EP) values ($p = 0.000$, $z = -4.269$). There were no significant differences in the rate of scarred lungs (20.0 vs 24.0%) or those affected by dorsocaudal pleurisy (36.8 vs 34.3%).

结果：一般而言，咳嗽在保育后期和分娩期间更频繁。两组的咳嗽指数（0.02 vs 0.03）和平均日增重（560 vs 550 g）无显著差异。第2组的ATR值较高（3.8%对比9.6%）。屠宰场检查显示，支气管肺炎患病率存在显著差异（62.9%对比71.2%）。就地方性肺炎（EP）指标而言，第1组肺部病变的扩展程度也明显更低（ $p = 0.000$ ， $z = -4.269$ ）。在肺部瘢痕形成率（20.0%对比24.0%）和背尾侧胸膜炎发生率（36.8%对比34.3%）方面，两组间未发现显著差异。

Conclusions: This trial demonstrated that Hyogen[®] was superior to Stellamune[®] Mycoplasma in reducing (I) the prevalence of bronchopneumonic lungs and those affected by cranioventral pleurisy, (II) the extension and severity of EP-like lung lesions, and (III) the rate of antibioticly treated animals against respiratory disease.

结论：本试验表明，与Stellamune[®] Mycoplasma相比，Hyogen[®]可更有效地降低(II)支气管肺炎肺和颅胸膜炎受累的患病率，(II)类EP肺部病变的扩展和严重程度，以及(III)接受抗生素治疗动物的呼吸道疾病发生率。

u^b Major Concerns 主要的关注

- **No untreated control group:** Limits ability to assess baseline disease impact and vaccine efficacy.
• 无未经处理的对照组：限制了评估基线疾病影响和疫苗有效性的能力。
- **Small sample size:** Reduces statistical power and generalizability of findings.
• 小样本量：降低了统计学效力和结果的普适性。
- **Single farm setting:** Results may not be applicable to other production systems or environments.
• 单一农场设置：结果可能不适用于其他生产系统或环境。
- **Lack of blinding:** Potential for observer bias in clinical assessments and lesion scoring.
• 缺乏盲法：临床评估和病变评分中存在观察者偏倚的可能性。
- **Limited outcome measures:** Focused mainly on coughing index and lung lesions; no serological or microbiological data.
• 有限的结局指标：主要集中在咳嗽指数和肺部病变；没有血清学或微生物学数据。
- **No standardized scoring system for lesions:** Reduces comparability with other studies using validated scoring methods.
• 没有针对病变的标准化评分系统：降低了与其他使用经确认评分方法的研究的可比性。
- **Potential confounding factors not controlled:** Environmental, management, or co-infection variables may have influenced results.
• 未控制的潜在混杂因素：环境、管理或合并感染变量可能影响结果。

Case Example 3 案例3



The image shows the cover of a research article from the journal 'Frontiers in Veterinary Science'. The title is 'Vaccination versus antimicrobials to prevent Porcine Proliferative Enteropathy: associated costs and effects on piglets' growth, health, and serological performance'. The authors listed are Marco Aurélio Gallina^{1,2}, Monike Willemin Quirino¹, Rafael Frandoloso^{3,4}, Yuso Henrique Tutida⁵, Adriano Norenberg⁵, Arlei Coldebella⁶, Ivan Bianchi¹ and Jalusa Deon Kich^{1,6*}. The article was published on 24 February 2025. The cover features a pig silhouette and a globe watermark.

frontiers | Frontiers in Veterinary Science

TYPE Original Research
PUBLISHED 24 February 2025
DOI 10.3389/fvets.2025.1538206

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Vaccination versus antimicrobials
to prevent Porcine Proliferative
Enteropathy: associated costs
and effects on piglets' growth,
health, and serological
performance

Science-driven solutions[®]

Marco Aurélio Gallina^{1,2}, Monike Willemin Quirino¹,
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Adriano Norenberg⁵, Arlei Coldebella⁶, Ivan Bianchi¹ and
Jalusa Deon Kich^{1,6*}

TABLE 3 Zootechnical performance of piglets in the nursery and growth-finishing phases during the study period.

| Nursery phase | NVMED n = 301 | VMED n = 297 | VNMED n = 302 | p-value |
|--------------------------|----------------------------|----------------------------|----------------------------|---------|
| Starting weight – kg | 8.07 ± 0.02 | 8.07 ± 0.01 | 8.03 ± 0.02 | 0.30 |
| Final weight (37 d) – kg | 22.79 ± 0.26 ^a | 22.70 ± 0.21 ^a | 21.34 ± 0.23 ^b | <0.01 |
| FCR | 1.44 ± 0.02 | 1.46 ± 0.02 | 1.48 ± 0.03 | 0.56 |
| ADG (0–37 d) – g | 387.46 ± 7.13 ^a | 385.04 ± 5.59 ^a | 350.07 ± 5.79 ^b | <0.01 |

| Growth-finishing phase | NVMED n = 287 | VMED n = 284 | VNMED n = 297 | p-value |
|---------------------------|---------------------------|---------------------------|---------------------------|---------|
| Starting weight – kg | 22.79 ± 0.28 ^a | 22.73 ± 0.23 ^a | 21.36 ± 0.25 ^b | <0.01 |
| Final weight (110 d) – kg | 131.83 ± 0.65 | 131.24 ± 0.74 | 131.17 ± 0.67 | 0.75 |
| FCR | 2.33 ± 0.02 | 2.37 ± 0.02 | 2.33 ± 0.02 | 0.23 |
| ADG (0–110 d) – g | 991.25 ± 6.36 | 986.39 ± 6.16 | 998.36 ± 5.40 | 0.37 |

NVMED, Non-vaccinated and medicated group; VMED, Vaccinated and medicated group; VNMED, Vaccinated and non-medicated group; FCR, feed conversion ratio; ADG, average daily gain. Data are presented as means ± standard error of the mean. Significant differences ($p \leq 0.05$) between groups are indicated by different letters among treatments.

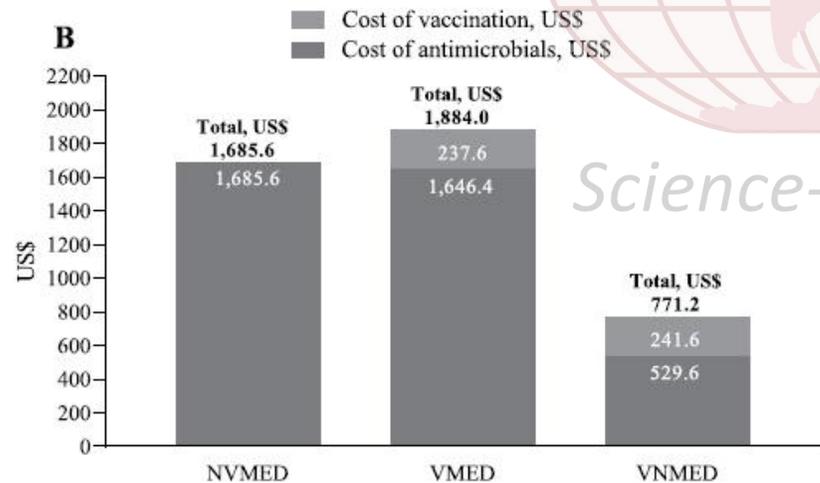
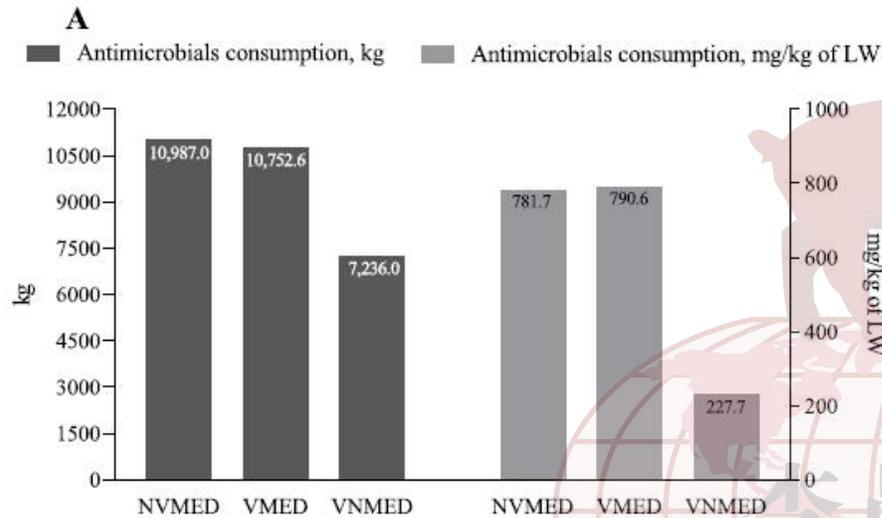
TABLE 4 Clinical performance of piglets in the nursery and growth-finishing phases during the study period.

| Nursery phase | NVMED n = 301 | VMED n = 297 | VNMED n = 302 | p-value |
|---------------------------------|------------------|-----------------|------------------|---------|
| Treated piglets*, % | 6.50 ± 1.06 | 5.17 ± 0.79 | 5.50 ± 0.81 | 0.59 |
| Mortality, % | 0.50 ± 0.22 | 0.83 ± 0.31 | 0.17 ± 0.17 | 0.31 |
| Fallout piglets, %** | 1.67 ± 0.56 | 1.33 ± 0.56 | 0.67 ± 0.49 | 0.29 |
| Mortality of fallout piglets, % | 2.17 ± 0.65 | 2.17 ± 0.65 | 0.83 ± 0.65 | 0.35 |

| Growth-finishing phase | NVMED n = 287 | VMED n = 284 | VNMED n = 297 | p-value |
|---------------------------------|------------------|-----------------|------------------|---------|
| Treated piglets*, % | 0.00 ± 0.00 | 0.25 ± 0.13 | 0.25 ± 0.18 | 1.00 |
| Mortality, % | 0.08 ± 0.08 | 0.67 ± 0.22 | 0.67 ± 0.22 | 0.13 |
| Fallout piglets, %** | 0.25 ± 0.13 | 0.42 ± 0.19 | 0.08 ± 0.08 | 0.30 |
| Mortality of fallout piglets, % | 0.33 ± 0.14 | 1.08 ± 0.36 | 0.75 ± 0.22 | 0.10 |

*With injectable medication. **Piglets that were much lighter than their littermates. NVMED, Non-vaccinated and medicated group; VMED, Vaccinated and medicated group; VNMED, Vaccinated and non-medicated group. Data are presented as means ± standard error of the mean.

Summary



Conclusion

The use of inactivated vaccine against *L. intracellularis* to prevent Porcine Proliferative Enteropathy is an effective strategy to reduce the prophylactic use of antimicrobials. Replacing the drug program with vaccination did not change the zootechnical parameters; however, it significantly reduced the expenses with antimicrobials, increasing the profitability of the operation.

总结

使用灭活的抗胞内劳森菌疫苗来预防猪增生性肠病是一种有效的策略，可以减少抗菌药物的预防性使用。用疫苗替代药物计划不会改变畜牧技术参数；然而，它显著减少了抗菌药物的费用，提高了操作的盈利能力。

Major Concerns 主要关注事项

• Limited Sample Size and Scope 样本量和范围有限

• Although 900 piglets were used, they were all from only three commercial farms in Brazil, which limits the external validity and generalizability of the findings to other production systems, regions, or genetic lines. 虽然使用了900头仔猪，但它们都来自巴西的三个商业农场，这限制了研究结果的外部有效性和推广到其他生产系统、地区或遗传系。

• Lack of a True Negative Control Group 缺乏真正的阴性对照组

• The study did not include a group that was neither vaccinated nor medicated, which would have provided a baseline for evaluating the true efficacy of both interventions independently. 该研究没有包括一个既未接种疫苗也未用药的组，这将为评估两种干预措施的真实有效性提供一个基线。

• Short Duration of Observation 观察持续时间短

• The study focused on the nursery and growth-finishing phases, but long-term effects of vaccination or antimicrobial use (e.g., on carcass quality, microbiota, or resistance development) were not assessed. 该研究重点关注保育和生长完成阶段，但未评估疫苗接种或抗菌剂使用（例如对胴体质量、微生物群或耐药性发展）的长期影响。

• Limited Microbiological and Immunological Data 有限的微生物学和免疫学数据

• Only 4 out of 90 fecal samples tested positive for *L. intracellularis*, and serological data (IgG levels) were used as the main immune marker. There was no assessment of cell-mediated immunity, which is crucial for intracellular pathogens like *L. intracellularis*. 在检测的90份粪便样本中，仅有4份样本对胞内劳森菌呈阳性，血清学数据(IgG水平)被用作主要免疫标志物。未对细胞介导免疫进行评估，而细胞介导免疫对于胞内病原体如胞内劳森菌至关重要。

• Potential Conflict of Interest 潜在利益冲突

• One of the authors is affiliated with MSD Animal Health, the manufacturer of the vaccine used (Porcilis® Ileitis). This raises concerns about bias, especially since no competing interests were explicitly disclosed in the summary. 其中一位作者隶属于MSD Animal Health，即所用疫苗（Porcilis® Ileitis）的生产商。这引起了对偏倚的担忧，特别是因为概要中没有明确披露竞争利益。

**OPEN ACCESS**

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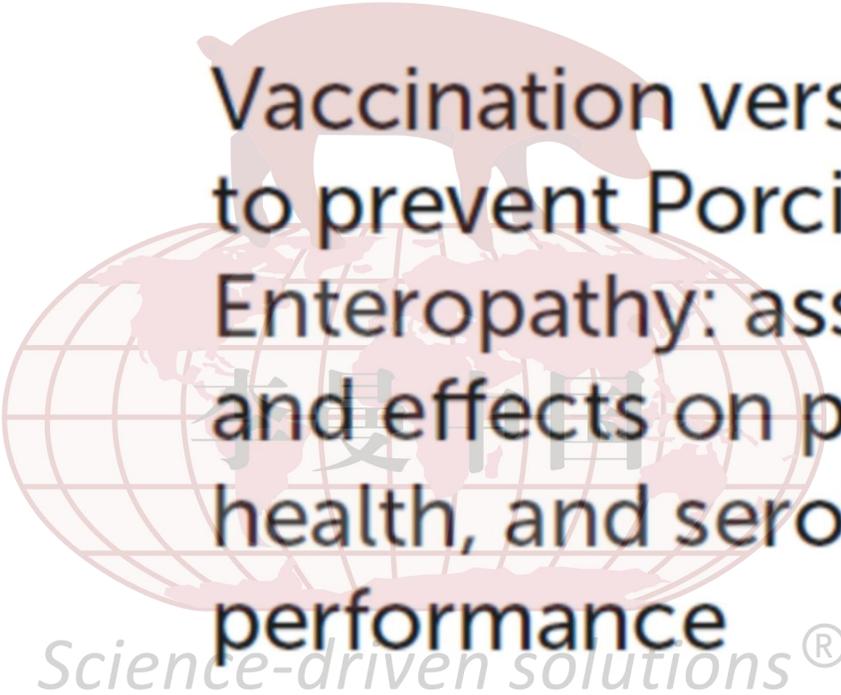
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Vaccination versus antimicrobials to prevent Porcine Proliferative Enteropathy: associated costs and effects on piglets' growth, health, and serological performance[®]

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Jalusa Deon Kich^{1,6*}

u^b

When there is light, there are also shadows 有光就有影

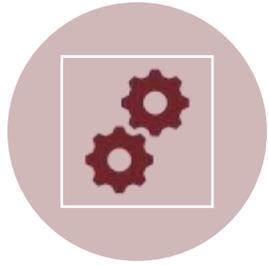


Best Practices for Field Studies

实地研究的最佳实践

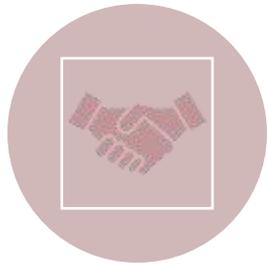
- Clear study design and objectives
明确研究设计和目的
- Stakeholder communication and training
利益相关方沟通和培训
- Robust data collection tools
可靠的数据收集工具
- Ethical approval and informed consent
伦理批准和知情同意
- Contingency planning for field issues
针对现场问题的应急计划

Future Directions 未来方向



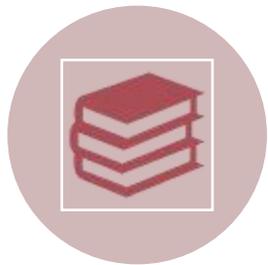
Integration with digital tools (e.g., sensors, apps)

与数字工具集成（例如，传感器、应用程序）



Cross-country collaborations

跨国合作



Policy implications and knowledge translation

政策含义和知识翻译



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Importance of balancing rigor with practicality

平衡严谨性和实用性的重要性



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2. Appropriate Study Design
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4. Concurrent Control Group
5. Baseline Diagnostics
6. Randomization and Blinding
7. Robust Data Collection
8. Confounding Control
9. Appropriate Statistical Analysis
10. Transparency and Ethical Oversight

1. 明确的目标
2. 适当的研究设计
3. 代表性群体
4. 同步控制组
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u^b Thank you for your attention!
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