

# Enhancing Animal Healthcare through Digital Record Keeping: A Study on Registered Animal Data Management

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## ABSTRACT

Digitalisation has transformed many industries, and this is no different in the animal healthcare sector. However, its impact extends equally across veterinarians, veterinarians, and public health, especially when it comes to managing registered animal data as part of digital record-keeping. This review article discusses the significant benefits, challenges and future developments of digital recording in animal healthcare.

This paper details how EHR and data management systems improve the efficiency of animal healthcare practices, whether that is for disease management or providing oversight to meeting regulatory requirements. It also helps to understand how data driven approaches enhance treatment protocols, lower costs and assist in larger research efforts. This paper aims to analyse the above to highlight how significantly valuable digital records are in improving every single animal and the animal healthcare life cycle.

## INTRODUCTION

Animal Healthcare. - Evolution of veterinary care for pets, livestock, wildlife, and exotic species into a more dynamic and scientifically sophisticated industry over the past few decades. The emergence of digital evolution has impacted the process of handling health data. Traditional systems based on paper become inefficient as records are easily lost, poorly communicated to stakeholders, and there is difficulty tracking animal health histories leading to inconsistent care.

Making the switch to digital record-keeping has produced significant improvements in the management of animal health records, which has helped increase decision making speed, accurate diagnostics and efficient operation. Digital record-keeping also provides a centralized record for each animal to access in one place, up to date, which can be available for shared professionals and organizations to collaborate. Date: May 29, 2021 | The world and its sheep are indeed shrinking and getting our head around a whole flock of breeding systems can be challenging. In this review, we discuss some of the advantages and disadvantages of the digital transition on animal healthcare across a period of decades, and we specifically focus on potential areas of impact that digital data management may have on improving quality of life for patients, regulatory compliance, and public health.

## The Evolution of Animal Healthcare Record Keeping Early Approaches to Animal Health Records

Prior to the advancement of digital technology, farms and veterinary practices kept written paper notes on animals, documenting their health, treatment, and physical condition. Veterinarians or caretakers would write information down on paper logs, medical charts and folders, which was time-consuming and missed the opportunity for automation and was vulnerable to human error. These records were mostly scattered across several places, and accessing detailed health history or vital information during emergencies consumed a lot of time.

## The Transition to Digital Systems

Electronic storage of animal health data started with simple electronic databases towards late 20th century. Some early veterinary record-keeping systems were thus very basic — general information such as medical history, vaccination status or treatment history. This was accompanied by ledger systems that enabled more precise and trustworthy record keeping, minimising human error, and increasing accessibility.

But these systems were still isolated in many respects. For over a decade, they were not interoperable with one another or other systems in use, and data sharing and collaboration among professionals, organizations, and regulatory authorities were scarce. The quality of the data often relied on the person entering the data into the system, and many systems provided only basic functionality, with few having advanced analytics capabilities.

## The Emergence of Modern Digital Health Record Systems

The evolution of these processes are particularly interesting to map in recent years when sophisticated digital systems make animal healthcare possible and minutely functional, reliable, and cover a large number of potential treatments, much of which would not have been possible with traditional health records. Modern Digital platforms come with all encompassing features that include:

- **Cloud-based storage:** Facilitating secure, accessible storage and sharing of animal data.
- **Advanced analytics:** Using artificial intelligence (AI) to analyze health trends, predict disease outbreaks, and offer decision support.
- **Mobile integration:** Allowing real-time access to health records via smartphones or tablets, enabling more flexibility for veterinarians in the field.

- **Integration with diagnostic tools:** Allowing seamless sharing of data from laboratory tests, imaging results, and other diagnostic modalities.

Now, seven years later, digital record-keeping is integral to the modern veterinary practice and not only has it improved care to individual animals, it's also helping improve animal welfare, regulatory practices, and research across the board.

## Benefits of Digital Record Keeping in Animal Healthcare

### 1. Improved Data Accuracy and Accessibility

Another notable benefit of digital record-keeping in animal healthcare is the enhancement of data accuracy and accessibility. Digital systems ensure that data is consistently entered, stored securely and can be easily updated: The time and resources needed to keep paper records up to date is far too high. Modern platforms use error-checking algorithms to limit human error in data input, and in fact, many systems require validation and confirmation before critical information can be stored.

Such centralization of records into digital systems guarantee access to accurate and immediate health information — and at any time, by all stakeholders involved: veterinarians, farm managers, animal owners, and regulatory bodies. Having this information readily available is particularly advantageous in emergencies or when animals are moved between clinics or facilities. Furthermore, veterinarians have the whole past data available for tracking patterns to make decisions based on long-term health trends.

### 2. Enhanced Animal Health Monitoring

Animals can be tracked continuously with digital record-keeping. Veterinarians and custodians can monitor vital signs, medical treatment, immunization history, breeding history, etc. with the provision to track detailed data over time. The system is designed to automatically flag animals needing vaccinations, check-ups or overdue for treatments, which helps improve care consistency and lessen missed appointments.

Moreover, it is helpful in prompt diagnosis and early intervention owing our digital systems. For example, if an animal is experiencing recurring symptoms or bilateral chronic illness, data from previously visited exams will have identifying information so the doctor can analyze it more quickly and target more accurately toward treatment. The more advanced versions, including data collected on wearable health monitoring devices (e.g., heart rate, temperature and activity levels), offer even more accurate and immediate health reporting.

### 3. Efficient Communication Across Stakeholders

In the past, communication of information between veterinarians, farmers, animal shelter managers, researchers and animal owners was often ineffective. Information could fall through the cracks, or critical details could be delayed, leading to less than optimal care. Digital record-keeping systems also facilitate streamlined communication and sharing of-relevant health data to a network of professionals and stakeholders, in real time.

For instance, within seconds, veterinarians share the test results, diagnostic images, or treatment recommendations with specialists, regulatory authorities, or other veterinary clinics, without thereof geographical barriers. This enhances coordination and ensures that everyone involved in delivering care to an animal is working with the same, latest information.

### 4. Cost-Effectiveness and Resource Optimization

While the initial investment into a digital record-keeping system may be high, the long-term cost savings are significant. Digital systems can help reduce labor costs by eliminating paperwork, minimizing administrative tasks, and automating appointment scheduling and reminders. Fewer errors also mean fewer expensive mistakes and misdiagnoses, and ultimately more efficient allocation of resources.

Monitoring and managing chronic conditions with digital systems also helps reduce the demand for emergency treatments, saving costs across the board in veterinary practice. Additionally, electronic information allows for better tracking of medications and supplies, ensuring that resources are used more efficiently and effectively.

### 5. Regulatory Compliance and Traceability

Animal health regulations are particularly stringent in livestock agriculture, where maintaining detailed records of vaccinations, disease outbreaks, and animal movements is critical to protecting public health and safety. Every single animal has a full history, completely transparent and extremely easy-to-access, a digital tail [of] traceability and accountability of every single animal. If there is an outbreak or an audit, veterinarians and farmers can quickly generate reports showing an animal's medical history, vaccination status and treatment records. This is especially relevant in international trade.

Before animals can be exported or imported, many countries require evidence of free status for diseases and vaccination histories. This further enables faster movement of animals across borders while ensuring compliance with international health standards, as digital systems help prevent the spread of diseases by keeping records up to date and verifiable.

### 6. Data Integration, Decision Support, and Predictive Analytics

One of the most exciting prospects of 21st-century digital record-keeping is the ability to integrate data from multiple systems. Laboratory results, diagnostic imaging, and health monitoring devices are integrated into a centralized system, providing a holistic view of an animal's health. Then, AI and machine learning algorithms can analyze this integrated data to provide insights and recommendations for care. These could range from early insights into possible health conditions, ideal treatment regimes, or even recommending possible disease outbreaks.

For example, large-scale animal populations such as in livestock farming are particularly well placed to benefit from predictive analytics. AI can analyze historical data to recognize patterns and forecast the development of diseases before they become epidemic, making it possible for preventive action to be taken.

### 7. Advancements in Veterinary Research and Public Health

Digital health records include all the data collected by veterinarians, often including information (known as "metadata") regarding care, diagnosis, and treatment. Researchers can use large sets of aggregated data to identify disease patterns, monitor treatment effectiveness, and analyze the environmental factors affecting animal health. Such data can inform discoveries in veterinary medicine,

paving the way for new vaccines, treatments, and preventive strategies.

Public health benefits are considerable, too. Digital records enable tracking of zoonotic diseases, which can pass between animals and humans, and are key to averting pandemics or public health emergencies. Additionally, expansive datasets have the potential to provide insight into government policies regarding animal welfare, agriculture, and food safety.

## Challenges in Implementing Digital Record-Keeping

### 1. Cost and Investment Barriers

**Time and Resource Intensity** The cost in terms of money for setting up and operating a digital record-keeping system can be large. The high one-time cost — the software, hardware, training and infrastructure — may be a stretch to justify for small veterinary clinics, farms or independent veterinarians. Talk long-term cost-saving, efficiency, and labor is all very well, but the barrier to entry is still a real road block for many practices, in particular rural or low-income areas.

### 2. Data Security and Privacy Concerns

Indeed, the safety and privacy of digital health are a top concern. As sensitive medical data are abstracted and digitally stored and transferred, the risk of cyberattacks or data breaches is increasing. Similar to human healthcare, animal health records must also comply with data protection regulations like the General Data Protection Regulation (GDPR) in Europe, which prevent sensitive data from being misused or accessed by unauthorized parties.

Veterinary clinics and farms need to have strong cybersecurity protocols in place like encryption, firewall and secure cloud. The aforementioned security measures are a vital deterrent to data breaches, securing the privacy of both animals and their owners—be it through access controls, multi-factor authentication, or routine audits.

### 3. Technical Challenges and User Adoption

Digital record-keeping systems are not without challenges, however, including the need for technical know-how for implementation. But of course, training these people on how to fly such systems is also required. It especially is true in rural areas or developing countries where training resources or technical assistance can be scarce when it comes to getting the people connected.

Moreover, there are users who resist on making the shift from paper to digital platforms due to their unfamiliarity of the system, fear of changes and following a learning path. So overcoming this resistance is a challenge in (the use of IT in) the veterinary field, and this can be solved if we can train veterinarians properly, give them support to go through the period where they use digital systems, and in a way who we can show them tangible benefits where that will improve animal healthcare.

### 4. Interoperability and Standardization Issues

And while many digital systems are powerful, their application is often siloed, making it challenging to share data easily between platforms. What this means is that interoperability is essential because without it, veterinary clinics, research institutions, and regulatory authorities cannot access data from different sources, thus thwarting their collective work contribution.

Given the wide range of data types and formats for animal health records across different regions, standardisation

initiatives are being pursued by some regions. Such efforts are critical for the interoperability of systems and the flow of animal health data across borders and institutions.

### 5. Difficulties in Low-resource Settings

This lack of access to technology and the internet, in turn, is a barrier to adoption of digital record-keeping systems in low-resource regions. Data security is a critical issue, especially for veterinarians and farmers located in rural regions may have connectivity problems, use older devices, or lack basic knowledge training.

It falls upon governments, NGOs and industry leaders to collaborate actively to bridge this gap and make sure all stakeholders, no matter where they reside, are able to take advantage of the benefits that digital animal healthcare has to offer.

## Diagram Examples

### 1. Central Node (Theme):

Subcategory: Animal Agriculture and Livestock Management  
This is the core of the diagram, often at the centre.

### 2. Main Branches (Key Components):

Here are the key components you determine and then place around the central node:

#### ➤ Data Collection

- Tools: Wearable sensors, RFID, mobile applications, etc.
- Data Types: Health records, vaccines, medications, mating history.

#### ➤ Data Storage

- Tech Stack: Cloud Storage, Secure Databases
- Advantages: Secure and easy data storage, backup system.

#### ➤ Data Integration

- Integration between systems: Veterinary records, metadata, production management tools, and research databases.

#### ➤ Data Analysis

- Tools: AI, Machine Learning, Predictive Analytics
- USE CASES: Disease prediction, health monitoring, behavioral analysis

#### ➤ Decision Support

- Outputs: They are alerts, health status reports, treatment recommendations and prevention strategies.

#### ➤ Stakeholder Collaboration

- Involved: Veterinarians, animal owners, farm managers, regulatory bodies.

### 3. Outcome/Results (Outer Layer):

**Write the benefits on the outside of the diagram:**

- Improved Healthcare Outcomes
- Early Disease Detection
- Better Animal Welfare
- Operational Efficiency
- Data-Driven insights for Treatment & Prevention

### 4. Flow Connections:

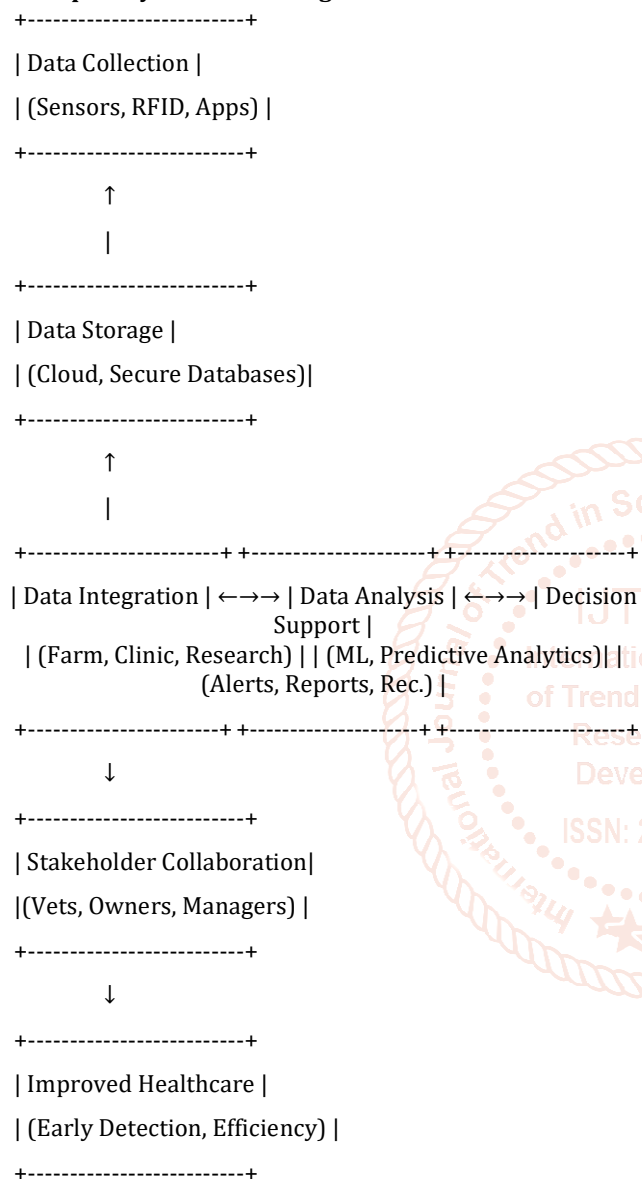
**Use arrows to show how each element influences the others or interconnects in some way:**

- Data Collection → Data Storage → Data Integration → Data Analysis → Decision Support → Improved Healthcare Outcomes

**5. Final Design:**

- Place the central theme "Digital Record Keeping" in the middle.
- Surround it with the key components and their associated sub-elements.
- Use arrows to show the process flow and relationships.
- The outer circle can have the outcomes listed.

**Example Layout for the Diagram:**



**Future Directions in Animal Data Management**

With the development of digital technologies, many opportunities are emerging for better data handling, which would improve animal health.

**1. Artificial Intelligence and Machine Learning**

The use of AI and machine learning can dramatically improve decision-making in veterinary practice. AI can provide predictive insights regarding animal health trends, optimize treatment protocols, and aid in preventing disease outbreaks by analyzing large data sets. Down the line, veterinarians could use AI diagnostic tools to achieve faster, more accurate diagnoses based on patterns that exist in animal health records and outside data.

**2. Blockchain for Data Security and Transparency**

Blockchain technology is gaining popularity as a data management solution due to its security and transparency. Blockchain can offer a decentralized, unchangeable record of an animal's medical history, making it impossible to tamper with the data and thus affording a high level of security. It could be especially valuable for tracking the movement and treatment of livestock animals in production and international trade with greater robustness of traceability.

**3. Universal Standards for Interoperability**

The global standard is critical for digital record keeping systems to reach their full potential. Establishing universal standards for animal health data formats, privacy, and interoperability is important to ensure different systems can seamlessly communicate with one another. It would make possible for veterinarians, researchers, and regulatory authorities to share data, which in turn, significantly increases the efficiency and quality of animal health around the globe.

**4. Mobile and Remote Access**

Mobile device and smartphone use in veterinary practice are growing, and with such growth comes exciting opportunities for accessing animal health records from afar. Veterinarian-specific applications can also be found for mobile devices that let them access health records, communicate with clients and share data with colleagues on the go, increasing access to care in rural or underserved areas.

**Conclusion**

The digitalization of record-keeping, however, has significantly changed the landscape of animal healthcare, offering veterinarians, farmers, and researchers various tools to optimize the management of animal health in a more efficient and effective manner.

While implementation hurdles include high costs, data security concerns, and resistance to change, the potential benefits of digital systems in animal healthcare are tremendous. With the evolution of technology, digital record-keeping will further integrate with the animal health ecosystem, optimizing care, reducing costs and improving outcomes for all animals across the globe.

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