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Research

User perception and attitude toward electronic medical record system in veterinary practice in Ghana

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User perception and attitude toward electronic medical record system in veterinary practice in Ghana

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Abstract

Introduction: the electronic medical record system (EMR) has proven to be an efficient tool with an effective disease tracking system and offers the ability to record animal health data in real-time. The present study is aimed at investigating the user's perception and attitude towards the adoption and implementation of EMRs in veterinary practice in Ghana. **Methods:** *a cross-sectional survey was adopted through the application of a drop-off/pick-up approach to collect data via the administration of a questionnaire to veterinary physicians, para-veterinary staff, and veterinary students on internship in fourteen (14) veterinary health facilities selected across the Greater Accra region. The selected sites were observed for EMR tools or information technology infrastructure.* **Results:** *a significant proportion (88.7%) of respondents owned a computer or tablet, with 69.0% believing EMR functions would be very important to their work. Most of the respondents (90.0%) agreed that the many functions and benefits of EMRs would greatly improve efficiency and impact the workflow in their practice. Most of the respondents (91.6%) agreed to embrace the implementation of the EMR system in their respective facilities. Over two-thirds (80.3%) of the respondents agreed to devote some time from their heavy work schedules to the EMR training. The attitude of the respondents had a positive significant (p = 0.024, 0.765) relationship with their perception towards adoption of EMRs.* **Conclusion:** *veterinarians, and para-veterinarians, representing 99.5% of the population, have demonstrated a positive perception towards the importance of specific functions of EMR and the impact these technologies will have on their practice.*

Introduction

Historically, the traditional paper-based documentation and filling systems practiced by healthcare providers, which were considered an easy and simple form of record-keeping, could have resulted from a long history of penmanship in their practice in the healthcare delivery sector [1,2]. Paper-based record-keeping practices may stymie efforts to provide clinical decision support and ensure quality medical data management systems for evidence-based healthcare delivery [3,4]. The introduction of computer-based techniques, which include a computerized physician order entry system, a clinical decision support system, a picture archiving and communication system (PACS), a laboratory information system (LIS), etc, has piqued the interest of the medical community, professionals, managers, and policymakers [5,6]. Despite their wide popularity, EMRs have not been fully adopted in many developing countries, including Ghana. Paper-based records are still in use and have not been replaced entirely in these countries. However, due to poor Information and Communication Technologies (ICT) infrastructure, non-existing facilities, a lack of start-up funding, and other challenges, paper-based records have become more essential and the preferred system, undermining the push for electronic adoption in health-care delivery [7,8]. Veterinary officers and para-veterinary staff in the veterinary healthcare industry continue to record data for the monitoring and evaluation of animal diseases and services. Even though patient turnout in veterinary hospitals and clinics has not yet reached overwhelming levels compared to the human healthcare delivery systems, research has suggested how the veterinary profession can better use computer-based systems to improve animal healthcare [9].

The electronic medical record system is intended to maximize the capacity of veterinary medical practitioners to capture clients' medical information and owner contact and billing information [9]. The system also provides the opportunity to create legible and organized recordings and to access clinical information about individual patients with ease [10]. Despite the positive effects of EMR usage in medical practices, the adoption rate of such systems is still low and

meets resistance from physicians [9]. Veterinary practice in Ghana has been gaining ground over the years, particularly with the establishment of Doctor of Veterinary Medicine (DVM) programmes in two top universities in Ghana. Hence, access to veterinary services would be enhanced by widening the clientele base of these veterinary health facilities. Smallholder farmers, and commercial farmers, would have access to veterinary services when computer-based technologies are fully adopted, data generated would be better managed and shared with stakeholders in the industry [11]. The quality and efficiency of patient care will greatly be enhanced when computerized-based technologies are used for data transmission and sharing among stakeholders and relevant institutions for quality healthcare delivery and research. Moreover, the practice of paper-based record-keeping systems in veterinary practice has over the years made it extremely difficult to share veterinary medical data, which could lead to data explosion and difficulty in making meaning out of the existing data due to data incompleteness.

EMRs are thus expected to address issues associated with paper-based records such as inaccuracies, illegibility, incompleteness, expensive storage, difficulty in retrieving needed information, discontinuity of care or duplication of service and issues with fragmented patient information when the information is not shared [12]. The impact of veterinarians' para-veterinarians' perceptions and attitudes on EMR usage, as well as their effect on the implementation of an electronic medical record system in veterinary practice, has yet to be determined. The aim of this study was to determine the attitudes and perceptions of veterinary professionals affecting the adoption and use of electronic medical records in veterinary practice. The study sought to make direct observations about the workflow in various veterinary facilities visited regarding time spent on clients for veterinary care activities from start to end as it occurs unobtrusively.

Methods

Research design

A cross-sectional survey was adopted in this study to examine the perception and attitude of veterinary clinicians and para-veterinarians toward the acceptance and implementation of EMR in veterinary practice. Both quantitative and qualitative research methods were used in this study.

Study sites and population

The study was conducted at selected veterinary facilities in the Greater Accra Region of Ghana. Using the simple random technique of sampling, a total of fourteen (14) veterinary health facilities were identified, selected, and used as the study sites. On separate occasions, these facilities were visited, and qualified veterinary staff were found who were eligible to be enrolled in the study.

Sampling technique and sample size

The study used a purposive sampling technique to obtain data on EMR from respondents at the selected veterinary health facilities. This method was used because the study was looking at active veterinarians, allied health veterinary professionals, and veterinary assistants, as well as clinical-year Doctor of Veterinary Medicine (DVM) students who were practicing veterinary medicine (internship or attachment) at the facilities that were sampled. The Cochran formula [13] was used to calculate sample size (SS) in the study:

$$SS = Z^2 \times (p) \times (1-p)/C^2$$

Z = Confidence Level at 95% = 1.96; P = 50% response = 0.5; C = Confidence Interval set at (+/-) 9% = 0.09.

$$SS = \frac{1.96^2 \times (0.5) \times (1-0.5)}{0.09^2}$$

SS = 83.518 = 84

In this study, a sample size of eighty-four (84) respondents was determined for the various fourteen veterinary health facilities visited across the region. The sample size was determined based on the statistical power analysis to ensure that the study results are representative of the population.

Data collection

Respondents were given a structured, multi-section modified questionnaire on perception and attitude, as proposed by Lakbala and Dindarloo [14]. The questionnaire was pretested to ensure that it was easy to understand and consistent. It covers the staff's demographics, such as gender, age, and specialty. Also, years of practice, access to computers, and some knowledge about computers and their applications were some of the key parameters contained in the questionnaire. It was designed to enable and facilitate the seeking of information regarding computer use in everyday practice.

The paper-based records and electronic medical records systems, as well as data storage and sharing, were sought after using the questionnaire. The use of a five-point Likert scale (from "very important" to "very unimportant") was used to find out how much the respondents knew about how important EMR systems, and their functions were. The respondents were asked questions to ascertain their perceptions and attitudes regarding the implementation of EMRs in their facilities. A Likert scale from "agree" to "no comment" was used to determine the impact of veterinary staff's perceptions and attitudes towards the adoption of the EMR tools.

The questionnaires were sent to veterinary staff after they consented to participate in the survey at their various clinics and hospitals. Two weeks were allowed for all respondents to fully complete the survey questions, and a follow-up visit was made after the stipulated time to collect the questionnaire from participants. To gather more information about staff's perceptions and attitudes towards EMR adoption and implementation, the various study sites visited were critically observed for the presence of ICT tools such as computers, printers, internet connectivity, and so on, which would facilitate the implementation of an electronic medical records system. What is more, an observation was made regarding the general workflow, procedures, and processes as well as the data management systems at the study sites. A scrupulous and unobtrusive observation was made on workflow coordination regarding animal reception, consultation, examination, treatment, and discharge. Attention was paid to the diagnostic laboratory processes and EMR-enabled equipment available at these study sites.

Ethical consideration

The study was conducted in accordance with ethical guidelines, and the data collected was kept confidential. The voluntary participation and written consent ensured that the respondents were aware of their rights and privacy.

Data analysis

The data collected was organized and analysed using GraphPad Prism, Version 7.00 (GraphPad Software, San Diego, CA, USA). The data was presented in tables and graphs. The level of significance was set at $p < 0.05$ (5% significance level), and the confidence interval was set at 95%. Data obtained from direct observation at each study site was collated and organized into tables, and the frequency of events as they occurred at the various study sites was generated. A correlation analysis was performed to identify the relationship between the demographic characteristics of the respondents and their perception and attitude towards EMRs in veterinary practice.

Results

Respondents' response rate

Of the 110 questionnaires distributed, eighty (80) were received, representing a response rate of 72.7%. Of these, nine (9) were incomplete or incorrectly filled out, leaving 71 complete and evaluable questionnaires.

Demographic background of respondents

The demographic characteristics of respondents in the selected facilities are shown in Table 1. Out of the 71 respondents, 54 (76%) were males and 24 (17%) were females. The age distribution in this study indicated that 47 (66.2%) respondents were between the productive ages of 18-30 years, 14 (19.7%) were between 31-40 years, 2 (2.8%) were 41-50 years, and 8 (11.8%) respondents were 50 or older than 50 years.

In terms of profession, 18 (25.4%) respondents were clinicians, 16 (22.5%) were laboratory personnel, 11 (15.5%) were veterinary nurses or assistants, 1 (1.4%) were pharmacy personnel, 3 (4.2%) were data entry clerks, and 22 (31.0%) were student interns. Furthermore, respondents' work experiences revealed that 29 (41%) had worked in the facility for less than a year, 29 (41%) have worked between 1 and 5 years, 6 (8%) have work experience ranging from 6 to 10 years, 2 (3%) have worked between 11 and 15 years, and 5 (7%) have over 16 years of work experience.

Knowledge and application of computer in veterinary practice

In this study, the knowledge and application of computers in veterinary practice were assessed. The findings are displayed in Table 2. A significant number of 63 (88.7%) of the respondents owned a computer or tablet; only 8 (11.3%) of the respondents owned neither a computer nor a tablet (Table 2). Of the total seventy-one respondents, 44 (62%) had formal training in ICT, while 27 (38%) had no training in ICT. A summary

of respondents' (self-rated) skills in the computer application of basic software, such as spreadsheets, Excel, word processors, etc. Only 7 (10.0%) of the respondents rated themselves as "excellent"; 22 (31.0%), 23 (32.3%), and 18 (25.3%) of the respondents who answered rated themselves as "very good", "good," and "average," respectively. Only 1 (1.4%) of respondents indicated deficient knowledge of computer applications, with no skills in basic computer applications. In addition, twenty-four (34%) of the respondents indicated that they used computers frequently for personal purposes alone. Twenty-six respondents (37%) said they often used the computer for personal purposes alone; 15 (21%) revealed that they sometimes used the computer for personal purposes alone; 3 (4%) respondents rarely used the computer for personal purposes; and 3 (4%) respondents never used the computer for personal purposes.

It was observed that eleven (15.5%) of the respondents used computers frequently for professional purposes; 14 (19.7%) admitted that they often used the computer for professional purposes; 29 (40.8%) said they sometimes used the computer for professional purposes; 11 (15.5%) respondents indicated that they rarely used the computer for professional purposes; and 6 (8.5%) conceded they had never used the computer for professional purposes.

The study established information regarding the presence and use of computers for the collection, storage, and sharing of data at the unit or department levels of the facilities visited. As illustrated in Table 2 below, a majority of 30 (42.2%) of the respondents affirmed that computers were available at their various units or departments and that the computers were used for collecting data, storing data, and sharing data with other stakeholders in the veterinary healthcare delivery industry. It is, however, interesting to note that 12 (17%) of the respondents never used the computers available at their various units or departments. Also, 29

(40.8%) of the respondents revealed that there were no computers in their various units.

Use of paper-based records (PBR) and electronic medical records (EMR)

Table 3 below summarizes respondents' views on the use of paper-based record systems and electronic medical records. Information relating to the type of technology used for data backups, data storage, and retrieval systems is also presented herein. Views on ease of use regarding the two medical data management systems and the type of medical record systems the respondents consider faster to complete are also presented. Additionally, information was obtained from respondents regarding how long they had used paper-based records and electronic medical record systems. A sizeable proportion of respondents (94.4%) used paper-based record management systems in their work, as shown in Table 3.

Data about respondents' views on the use of EMR is shown in Table 3 below. Of the 71 veterinary staff contacted, 17 (23.9%) were not familiar at all with the EMR systems; 41 (57.8%) of the respondents had not used the systems even though they had some knowledge about the importance and functions of the EMR systems. Only 8 (11.3%) of the respondents had neither used the EMR system nor been exposed to it. In comparing the speed of the two systems, as displayed in Table 3 below, 31 (43.7%) respondents believed the EMR was faster and much easier to complete, while 3 (4.2%) respondents believed the paper-based record system was faster and easier to complete. Three (4.2%) of the respondents believed both systems were fast, but a considerable proportion of 47.9% of respondents had no idea which of the two systems was faster.

Table 3 also summarizes the various technologies respondents employed to archive backup data in their veterinary facilities. The study showed that a paper-based records system (folder system) was used in the veterinary healthcare facilities visited.

The majority (80.2%) of the respondents used folders for recording veterinary medical information and used the filing systems as backup and storage schemes. Six (8.5%) of the respondents used database replication systems to backup and share data, and eight (11.3%) of the respondents used various paper-based methods, such as book registries, field notes, and record books, for record-keeping. In Table 3, 37 (52.1%) respondents have expressed that data is shared among various units or departments, clients, researchers, and other stakeholders in the veterinary health sector. It is, however, interesting to note that 20 (28.2%) respondents do not share data in their facilities at all, and 14 (19.7%) respondents are not sure whether data is shared or not in their facilities.

Importance of EMR and it functions

Data on respondents' perceptions concerning some of the importance of EMR functions are shown in Table 4. As indicated, 44 (62.0%) respondents believed that the display of patients' demographics and other ancillary clinical data that the EMR offers is very important. Twenty-six (36.6%) respondents rated this function as important, and one (1.4%) respondent perceived this function as slightly important. More than half of the respondents (52.1%) considered the display of radiology images and reports very important.

The display of laboratory results, clinical notes, and reports was considered very important by 55 (77.5%) respondents. As indicated in Table 2 below, the EMR systems' capabilities to allow for the entry of patient information and the display of diagnoses, medications, and other clinically related data were significant to respondents. Most of the respondents (69.0%) considered these functions very important. Additionally, 53.0% of the respondents considered electronic prescriptions, prescription alerts, drug-drug interactions, dose checking, allergy management, and formulary management very important to their veterinary medical practice.

The study showed that 35 (49.3%) respondents perceived preventive health reminders and physician order entry (test and medication orders) functions of the EMR as very important, 30 (42.3%) respondents believed these functions were important, and 6 (5.6%) respondents considered these functions to be slightly important.

Participants in the present study considered the decision support systems (guidelines, expert logic, reminders, and alerts) and other health reminders at the point of care to be very important and slightly important on the Likert scale. Furthermore, 33 (46.5%) respondents believed these functions the EMR offers at the point of care in veterinary medical practice are very important to their practice; 34 (47.9%) respondents believed these functions are important, and 4 (5.6%) respondents rated these functions as the least important to their practice, as shown in Table 4.

Perception and attitude regarding EMR

Table 5 below outlines data concerning respondents' general attitudes and perceptions about EMRs. The findings revealed that a sizeable number of the respondents (90.0%) agreed that the many functions and benefits of EMRs would improve efficiency and impact the workflow in their practice. A substantial number (80.0%) of the respondents agreed that EMRs would improve the quality of care and reduce medical errors. Similarly, a considerable number of the respondents (93.0%) agreed with the expectation that EMRs would improve the quality of their practice (working life) due to the many functions and benefits they offer. Most of the respondents in this study felt that, given the several benefits that the EMRs offer, they believe that those benefits outweigh the initial cost that is involved in the implementation process, as shown in Table 5 below. Forty-four (62.0%) of the respondents agreed that the benefits derived from using EMRs in their various facilities outweighed the cost, and yet they would embrace its implementation.

Even though other participants in this survey surmised that the adoption of EMRs comes with some cost implications, some 16 (22.5%) respondents somewhat agreed with this claim and expressed that its implementation would increase efficiency and gains; 4 (5.6%) respondents disagreed; and 7 (9.5%) respondents declined comments. About one-third of respondents (31.0%) agreed that the EMRs could induce hard work in their various departments; 32 (45.0%) respondents somewhat agreed; but 12 (17.0%) respondents surveyed felt that the EMRs could not induce hard work, though they had several benefits; and 5 (7.0%) respondents refused to comment.

A little over half of the participants in this study believed the security and privacy of their veterinary patients' medical information were of fundamental concern to their practice and therefore felt that EMRs ensured total protection of this medical information. As shown in Table 3 below, 47 (66.2%) respondents agreed that EMRs protect medical data against malicious use; 19 (26.8%) respondents somewhat agreed with this claim; 1 (1.4%) respondent disagreed with this assertion; and 4 (5.6%) respondents declined to comment. Over two-thirds (80.3%) of the respondents agreed to devote some time from their heavy work schedules to the EMRs training, 13 (18.3%) respondents somewhat agreed to be trained on the EMRs tools, and 1 (1.4%) respondent thought that declining to comment on this issue was an option, as shown in Table 3 and Table 4 below. Most of the respondents (91.6%) agreed to embrace the implementation of the EMR system in their respective facilities; 4 (5.6%) of the respondents somewhat agreed and expressed their willingness to use the EMR tools.

Relationship between respondents' demography, perception, and attitudes towards EMRs

Findings on the relatedness of the demographic characteristics of the respondents to their perceptions and attitudes towards EMR usage in veterinary practice are displayed in Table 6 below.

The findings indicate that the attitude of the respondents had a positive significant (p = 0.024, 0.765) relationship with their perception of EMRs. Considering the demography of the respondents, the age of the respondents had a negative significant (p = 0.001, -0.899) relationship with their perception of EMRs. The profession of the respondents had a positive significant (p = 0.000, 0.938) relationship with the perception of the usage of EMRs in veterinary practice. The respondents' work experience had a positive significant (p = 0.000, 0.967) relationship with their perception of the use of EMRs in veterinary practice. Furthermore, the age of the respondents had a negative significant (p = 0.000, -0.845) relationship with their attitude towards EMR usage in veterinary practice. The profession of the respondents had a positive significant (p = 0.003, 0.932) relationship with their attitude towards the use of EMRs in veterinary practice. The work experience of the respondents had a positive significant (p = 0.000, 0.889) relationship with their attitude towards the usage of EMRs in veterinary practice.

Workflow in the veterinary practice of surveyed sites

Out of the fourteen veterinary facilities visited, only seven facilities were directly observed for a repeatable pattern of veterinary care activities (workflow) uninterruptedly. The direct observational study suggested that only one facility recorded an increase in time spent retrieving a patient's information (21-40 minutes). The rest of the surveyed sites spent 0-20 minutes retrieving patients' data. All the facilities spent the same length of time (21-40 minutes) recording patients' information as shown in Table 7. The schematic flow diagram presented in Figure 1 depicts the clinical procedures from case registration to departure.

Discussion

In a resource-constrained country like Ghana, there may be several barriers to the adoption and implementation of EMR in veterinary practice. In this survey, data collected data on the attitudes and perceptions of veterinary practitioners concerning the adoption and subsequent use of EMR. The Greater Accra region was selected for this study based on the vibrancy of the veterinary practices and veterinary-related activities, with well-established facilities aside from the Ashanti region, compared to other regions in Ghana. Most of the respondents in this study (80.2%) used folders for recording veterinary medical information and used the filing systems as backup and storage schemes.

Only 8.5% of the respondents used database replication systems to back-up and share data. This contradicts the findings of Krone *et al.* [9] who reported that a large proportion of randomly selected independent small animal veterinary medical practices in Massachusetts were found to use electronic veterinary medical records systems (EVMRs) alone or in combination with paper records, whereas 19.5% of practices operated with paper records only. This difference in outcome could be attributed to the differences in the geographical setting where the study was conducted. The study was conducted in the USA, which is a developed country as compared to Ghana.

In this study, 42.2% of the respondents affirmed that computers were available at their various units/departments and were used for data collection, data storage, and sharing of data with other stakeholders in the veterinary healthcare delivery industry. It was also observed that 57.8% of the respondents had never used the EMR systems, even though they had some knowledge about the importance and functions of the EMR systems. In addition to the findings of this study, 31 (43.7%) respondents believed the EMR is faster and much easier to complete, while 3 (4.2%)

respondents believed the paper-based record system is faster and easier to complete.

Respondents' knowledge about the functions of EMR technology and the importance of computers in veterinary practice could relate to the fact that most of the respondents (61, or 85.9%) were between the ages of 18-40 years, who are very much exposed to computers and other digital technological devices that have become ubiquitous these days. Respondents' perception regarding the efficiency and effectiveness of EMR technology for quality improvement in veterinary practice was good, as compared to the paper-based record system that they are currently using, even though respondents had a positive perception of EMR functions and benefits for quality improvement in their practice. It was observed that computers that were available at some of these veterinary facilities lacked the appropriate EMR software. Some facilities, however, do not even have these computers and other ICT technology tools at all, which were notable barriers to implementation.

The perception of the respondents to the EMR systems in our study included providing general functionalities including health information and data, results management, order management, decision support, electronic communication and connectivity, patient support, administrative processes, and reporting and population health. This agrees with the findings of Krone *et al.* [9]. Rothman *et al.* [15] suggest some gains derived from full implementation of electronic medical records concerning cost containment, reduction in medical errors, as well as improvement in compliance by using real-time data. The report further presented an improvement in workflow in utilizing patient data more conveniently and adequately through clinical decision support systems to enhance health care delivery.

The findings of this study further established that respondents' general attitudes, beliefs, and perceptions suggested overall support for EMRs, as most of the veterinary staff surveyed (i.e.,

93.1%) would embrace the implementation of EMR in their practice. The success of an electronic veterinary medical record system is highly dependent on the provision of the necessary ICT infrastructure by directors or administrators of these facilities to facilitate adoption and utilization. The end-user's knowledge and understanding of EMR in this instance would become the basis for developing targeted training programmes to demonstrate the benefits of EMRs and further enhance veterinary staff's perception of EMRs.

Workflow coordination observed had a direct impact on patients' turnaround times as clients had to wait a bit longer for simple care such as deworming or vaccination, a situation that was observed as a common phenomenon at the various veterinary facilities visited. It was observed that all the veterinary facilities visited spent almost the same period (41-60) minutes on patient consultations, treatment, and other clinically relevant processes without laboratory procedures. The data input format observed was paper-based, such as registers and folders, which might be time-consuming and error-prone. However, as technology has advanced, electronic data input systems have been developed to speed up the clinical procedure and remove errors. These technologies also allow for faster and more accurate data entry as well as easier access to previously saved data. An optimized workflow in veterinary practice would be achieved by the adoption of EMRs to help minimize clients' wait time, improve efficiency and appointment scheduling, and ensure continuity in veterinary health care provision.

Conclusion

Based on the outcome of this study, 99.5% of veterinarians and para-veterinarians have demonstrated a positive perception and attitude about the importance of specific functions of EMR and the impact these technologies will have on their practice. In view of this, the training of

veterinary officers and para-vets on a tailor-made electronic medical records system. A great deal of effort with investment should be directed towards the development and use of EMRs by stakeholders in the veterinary medical profession. Lastly, the application of EMRs must be an integral part of the training of veterinary medical students to afford them early exposure to the application of the software.

What is known about this topic

- *The quality and efficiency of patient care will greatly be enhanced when computerized-based technologies are used for data transmission and sharing among stakeholders and relevant institutions for quality healthcare delivery and research;*
- *The positive effects of EMR usage in medical practices, the adoption rate of such systems is still low and meets resistance from physicians;*
- *Veterinary practice in Ghana has been gaining ground over the years with little on data sharing.*

What this study adds

- *Most veterinarians and para-veterinarians in Ghana demonstrated a positive perception and attitude about the importance of specific functions of EMR and the impact on practice;*
- *A great deal of effort with investment should be directed towards the development and use of EMRs by stakeholders in the veterinary medical profession;*
- *The application of EMRs must be an integral part of the training of veterinary medical students to afford them early exposure to the application of the software.*

Competing interests

The authors declare no competing interests.

Authors' contributions

Conceptualization of the study, design and data collection was performed by Mustapha Abubakar Ahmed. Data cleaning, statistical analysis, and writing of original manuscript was conducted by Mustapha Abubakar Ahmed and Derrick Adu Asare. Manuscript review and editing was conducted by Hope Richard Otsyina, Sherry Ama Mawuko Johnson, Benjamin Obukowho Emikpe and Salisu Shaban. All authors have read and agreed to the final manuscript.

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Tables and figures

Table 1: demographic profile of respondents

Table 2: respondents' knowledge and application of computer in veterinary practice

Table 3: respondents' usage of paper-based records and electronic medical records

Table 4: respondents' perceptions about the importance of EMR functions

Table 5: respondents' perceptions and attitudes concerning EMR

Table 6: correlation between respondents' demography, perception, and attitudes

Table 7: workflow, data format and time spent on patients as observed

Figure 1: schematic flow coordination diagram of veterinary care delivery processes from case registration to client departure as observed at various veterinary facilities

References

1. Smith CA, Haque SN. Paper versus electronic documentation in complex chronic illness: a comparison. AMIA Annu Symp Proc. 2006;2006: 734-8. **PubMed| Google Scholar**

2. Akhu-Zaheya L, Al-Maaitah R, Bany Hani S. Quality of nursing documentation: Paper-based health records versus electronic-based health records. J Clin Nurs. 2018 Feb;27(3-4): e578-e589. **PubMed| Google Scholar**

3. Collins SA, Cato K, Albers D, Scott K, Stetson PD, Bakken S, *et al*. Relationship between nursing documentation and patients' mortality. Am J Crit Care. 2013 Jul;22(4): 306-13. **PubMed| Google Scholar**

4. Choun DL, Petre A. Digital health and patient data: Empowering patients in the healthcare ecosystem. CRC Press; 2022 Aug 3. **Google Scholar**

5. Elshayib M, Pawola L. Computerized provider order entry-related medication errors among hospitalized patients: An integrative review. Health Informatics J. 2020 Dec;26(4): 2834-2859. **PubMed| Google Scholar**

6. Zaabar B, Cheikhrouhou O, Jamil F, Ammi M, Abid M. HealthBlock: a secure blockchain-based healthcare data management system. Computer Networks. 2021 Dec 9;200: 108500. **Google Scholar**

7. Trencher G. Towards the smart city 2.0: Empirical evidence of using smartness as a tool for tackling social challenges. Technological Forecasting and Social Change. 2019 May 1;142: 117-28. **Google Scholar**

8. Kamadjeu RM, Tapang EM, Moluh RN. Designing and implementing an electronic health record system in primary care practice in sub-Saharan Africa: a case study from Cameroon. Inform Prim Care. 2005;13(3): 179-86. **PubMed| Google Scholar**

9. Krone LM, Brown CM, Lindenmayer JM. Survey of electronic veterinary medical record adoption and use by independent small animal veterinary medical practices in Massachusetts. J Am Vet Med Assoc. 2014 Aug 1;245(3): 324-32. **PubMed| Google Scholar**

10. Ajami S, Bagheri-Tadi T. Barriers for Adopting Electronic Health Records (EHRs) by Physicians. Acta Inform Med. 2013;21(2): 129-34. **PubMed| Google Scholar**

11. Neethirajan S. Harnessing the Metaverse for Livestock Welfare: Unleashing Sensor Data and Navigating Ethical Frontiers. 2023. **Google Scholar**

12. Anderson GF, Frogner BK, Johns RA, Reinhardt UE. Health care spending and use of information technology in OECD countries. Health Aff (Millwood). 2006 May-Jun;25(3): 819-31. **PubMed| Google Scholar**

13. Chaokromthong K, Sintao N. Sample size estimation using Yamane and Cochran and Krejcie and Morgan and green formulas and Cohen statistical power analysis by G* Power and comparisions. Apheit International Journal. 2021 Dec 24;10(2): 76-86. **Google Scholar**

14. Lakbala P, Dindarloo K. Physicians' perception and attitude toward electronic medical record. Springerplus. 2014 Feb 3;3: 63. **PubMed| Google Scholar**

15. Rothman B, Leonard JC, Vigoda MM. Future of electronic health records: implications for decision support. Mt Sinai J Med. 2012 Nov-Dec;79(6): 757-68. **PubMed| Google Scholar**

Table 1: demographic profile of respondents

Characteristic	Categories	Frequency (n)	Percentage (%)
Gender	Male	54	76
	Female	17	24
Age (Years)	18-30	47	66.2
	31-40	14	19.7
	41-50	2	2.8
	Above 50	8	11.3
Profession	Clinician	18	25.4
	Laboratory Staff	16	22.5
	Pharmacy Staff	1	1.4
	Vet Nurse/ Assistant	11	15.5
	Data Entry Clerks	3	4.2
	Clinical Year Student	22	31
Work experience	Less than 1 year	29	41
	1-5 years	29	41
	6-10 years	6	8
	11-15 years	2	3
	Above 16 years	5	7
Values are presented in frequencies (n) and percentages (%)			

Table 2: respondents' knowledge and application of computer in veterinary practice

Query	Response	Frequency (n)	Percentage (%)
Ownership of personal computers	No	8	11.3
	Yes	63	88.7
Had formal ICT training	No	27	38.0
	Yes	44	62.0
Self-rated skills in basic computer applications	Average	18	25.4
	Excellent	7	9.9
	Good	23	32.4
	Poor	1	1.4
	Very good	22	31.0
Usage of computer for personal purposes only	Frequently	24	33.8
	Never	3	4.2
	Often	26	36.6
	Rarely	3	4.2
	Sometimes	15	21.1
Use of computer for professional purposes only	Frequently	11	15.5
	Never	6	8.5
	Often	14	19.7
	Rarely	11	15.5
	Sometimes	29	40.8
Use of computers in my unit for data collection, storage and sharing	Not at all	29	40.8
	No	12	16.9
	Yes	30	42.3

Table 3: respondents' usage of paper-based records and electronic medical records

Question	Response	Frequency (n)	Percentage (%)
Usage of paper-based records	No	3	4.2
	Not at all	1	1.4
	Yes	67	94.4
Usage of EMR tools	No	63	88.7
	Yes	8	11.3
Record system which is faster and easier to use	Both	3	4.2
	EMR	31	43.7
	No idea	34	47.9
Technology used for data backup	Paper	3	4.2
	Filing folders	57	80.3
	Database reps	6	8.5
	Others	8	11.2
Sharing of data in workplace	No	20	28.2
	Not sure	14	19.7
	Yes	37	52.1

Table 4: respondents' perceptions about the importance of EMR functions

EMR functions	VI	I	SI	NI	VU
Display of patients' demographics and other clinical data	44(62.0%)	26(36.6%)	1(1.4%)	0	0
Display of radiology reports and radiology images	37(52.1%)	31(43.7%)	3(4.2%)	0	0
Display of lab results, clinical notes, and reports	55(77.5%)	16(22.5%)	0	0	0
Allow for entry of patient information, display of diagnoses and medication	49(69.0%)	20(28.0%)	2(3.0%)	0	0
Electronic prescription, prescription alerts drug-drug allergy, dose checking and formulary management	38(53.0%)	27(38.0%)	4(6.0%)	2(3.0%)	0
Physician order entry and preventive health	35(49.3%)	30(42.3%)	6(8.4%)	0	0
Decision support systems and preventive health reminders	33(46.5%)	34(47.9%)	4(5.6%)	0	0
VI- Very important, I- Important, SI- Slightly important, NI-Not important, VU-Very unimportant					

Table 5: respondents' perceptions and attitudes concerning EMR

Attitude/beliefs towards EMR	A	SA	D	NC	Mean Response & SD
EMR improves efficiency and impacts on workflow	64 (90.0%)	5 (7.0%)	0	2 (3.0%)	1.42 ± 0.843
EMR improves the quality of care and reduces medical error	57 (80.0%)	12 17.0%)	0	2 (3.0%)	1.72 ± 1.534
EMR improves quality of your practice	66 (93.0%)	3 (4.0%)	0	2 (3.0%)	1.32 ± 1.284
EMR increases practice productivity	43 (60.6%)	21 29.6%)	2 (2.8%)	5 (7.0%)	1.92 ± 1.376
EMR benefits outweigh start-up cost	44 (62.0%)	16 22.5%)	4 (5.6%)	7 (9.9%)	1.88 ± 1.074
EMR induces hard work	22 (31.0%)	32 (45.0%)	12 (17.0%)	5 (7.0%)	2.01 ± 1.125
EMR ensures security and privacy of clients' medical data	47 (66.2%)	19 26.8%)	1 (1.4%)	4 (5.6%)	1.99 ± 1.506
Devoting time for EMR training necessary at all	57 (80.3%)	13 (18.3%)	0	1 (1.4%)	1.69 ± 1.339
Embracing EMR implementation	65 (91.6%)	4 (5.6%)	0	2 (2.8%)	1.38 ± 1.044
Overall attitude/ beliefs towards EMR					± 1.374
A-Agree, SA-Strongly Agree, D- Disagree, NC- No comment, SD- Standard Deviation					

Table 6: correlation between respondents' demography, perception, and attitudes

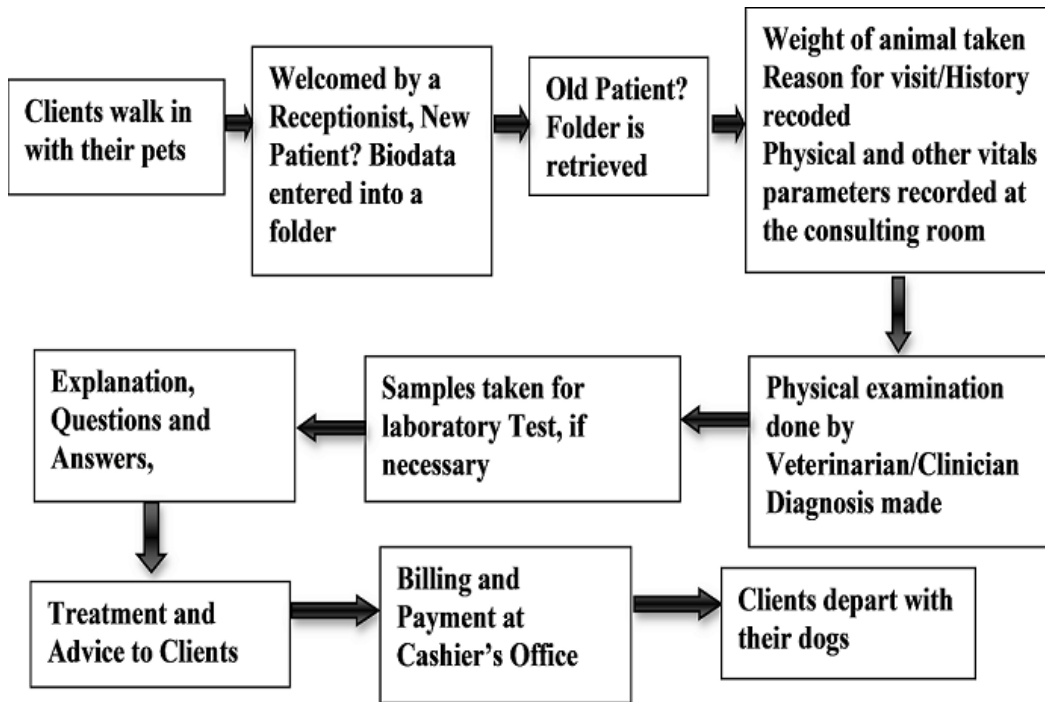|		Perception	Attitude	Gender	Age	Profession	Work experience
Perception	Pearson Correlation	1					
	Sig. (2 tailed)						
Attitude	Pearson Correlation	0.765**	1				
	Sig. (2 tailed)	0.024					
Gender	Pearson Correlation	0.951	0.682	1			
	Sig. (2 tailed)	0.089	0.072				
Age	Pearson Correlation	-0.899**	-0.845**	0.786	1		
	Sig. (2 tailed)	0.001	0.000	0.096			
Profession	Pearson Correlation	0.938**	0.932**	0.714	0.324	1	
	Sig. (2 tailed)	0.000	0.003	0.063	0.156		
Work Experience	Pearson Correlation	0.967**	0.889**	0.620	0.541	0.972	1
	Sig. (2 tailed)	0.000	0.000	0.077	0.065	0.063	
**- Correlation is significant at the 0.01 level (2-tailed)							

Table 7: workflow, data format and time spent on patients as observed					
Veterinary facility	**TRR (min)**	**TPD (min)**	**FDE**	**LCP (min)**	**ATC (min)**
SITE A	0-20	21-40	Paper based	41-60	Over 60
SITE B	0-20	21-40	Paper based	41-60	Over 60
SITE C	0-20	21-40	Paper based	41-60	Over 60
SITE D	0-20	21-40	Paper based	41-60	Over 60
SITE E	21-40	21-40	Paper based	41-60	Over 60
SITE F	0-20	21-40	Paper based	41-60	Over 60
SITE G	0-20	21-40	Paper based	41-60	Over 60
TRR- Time spent for record retrieval, TPD- Time spent for entering patient's data, FDE- Format for data entry, LCP- Length of time caregiver spent on patient, ATC- Average length of time spent at the clinic.					

Figure 1: schematic flow coordination diagram of veterinary care delivery processes from case registration to client departure as observed at various veterinary facilities