Author’s response to reviews

Title: Assessing factors militating against the acceptance and successful implementation of cloud based health center from healthcare professionals’ perspective: A survey of hospitals in Benue state northcentral Nigeria

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THE REPORT OF CORRECTIONS AND RESPONSES BASED ON THE CONCERNS OF THE REVIEWERS

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Manuscript Title: Assessing factors militating against the acceptance and successful implementation of cloud based health center from healthcare professionals' perspective: A survey of hospitals in Benue State, North-Central Nigeria.

General remark: The authors would like to thank the editor and the reviewers who kindly and whole heartedly reviewed the manuscript in a very short time and provided valuable suggestions and comments, which helped us to improve the manuscript.

We have given the comments serious consideration and altered the manuscript according to the suggestions. Below, we address all comments point-by-point, discussing the subsequent modifications.
We hope that the revised manuscript will meet your expectations and we are willing to answer any other questions you might have.

Technical comments

1. Please provide the co-authors email address

We would like to thank for the comment. Email addresses of co-authors have been included on the Title Page.

Reviewer #2

The authors have improved their manuscript; however, some aspects have to be clarified. Below, please find specific comments to the sections of the manuscript (i.e. Background, Methods, Results, Discussion, and References).

We would like to thank the Reviewer for the positive comment.

Background:

1. In the background, statements have to be supported by references.

We would like to thank you for the suggestion. Statements have been supported with new references in the background section.


Kabashiki IR, Moneke NI. The impact of the use of health information and communication technology on health care delivery in Manitoba, Canada. J. Hosp Admin. 2014 Sep 4; 3(6):8.
2. Then, the term "inculcation" should be more reflected (e.g. "adoption" would sound better).

We would like to thank you for the suggestion. The term “Inculcation” has been replaced with the word “adoption” as suggested. (Page 3)

3. The following sentence, "Cloud based health knowledge (CBHK) of CBHP by users, is however necessary for sustainable implementations of cloud-based healthcare solutions", has to be clarified.

We would like to thank for the above mentioned comment.

The statement "Cloud based health knowledge (CBHK) of CBHP by users, is however necessary for sustainable implementations of cloud-based healthcare solutions” has been rephrased and expanded to “It was revealed from previous studies that IT literacy and experience of healthcare service providers have a significant influence on their perception, attitude and intention for the use of a new technology such as e-health technology applications [10], [11]. In accordance, Cloud based health knowledge (CBHK) of CBHP by users, is considered necessary for the sustainability of cloud-based healthcare solutions. It would be easier for the healthcare service providers to use cloud based health care systems if they have a prior knowledge of the systems’ working environment [11]”. (Page 3).

4. The categories of cloud computing services, Software-as-a Service (SaaS), Platform as a Service (PaaS), and Infrastructure as a Service (IaaS) have to be explained to the reader. We would like to thank for the suggestion.

The categories of cloud computing services has been explained to read: “In order to curtail this, developing countries such as Nigeria need to harness the potentials of cloud computing in their health care system by using cloud solutions such as: (1) Software-as-a service (SaaS: the mechanism in which software applications are provided over the internet by service providers), (2) Platform as a service (PaaS: the mechanism in which computing solutions stacks and platforms are accessed by IT managers, developers or users over the internet without having to download any software) and (3) Infrastructure as a service (IaaS: the sharing of computing
resources through a virtualized environment) to bring about reducing cost, service speed and the elimination of inadequate health care workers [13], [18]. (Page 4).

5. Then, the sentence refers to Reference #12 has to be more elaborate, and accessible/available references have to be cited.

We would like to thank you for the comment. The sentence has been elaborated and an accessible reference has also been cited. In order to curtail this, developing countries such as Nigeria need to harness the potentials of cloud computing in their health care system by using cloud solutions such as: (1) Software-as-a service (SaaS: the mechanism in which software applications are provided over the internet by service providers), (2) Platform as a service (PaaS: the mechanism in which computing solutions stacks and platforms are accessed by IT managers, developers or users over the internet without having to download any software) and (3) Infrastructure as a service (IaaS: the sharing of computing resources through a virtualized environment) to bring about reducing cost, service speed and the elimination of inadequate health care workers [13], [18].

(Pages 4).

6. Then, data on internet accessibility and usage in Nigeria should have a reference; in fact, Reference #14 presents figures on Africa, but not on specific countries.

We would like thank you for this suggestion.

The specific reference that discusses the internet usage in Nigeria has been included.

20. Internet users in Nigeria hit 98.3 million.

(Pages 4)

7. Statements made on lines from 95 to 100 have to be supported by references.

We would like to thank for the above mentioned comment.

Statements made on lines 95 -100 has been supported by reference 21.

8. Then, the sentence on lines 103-104 has to be referenced.

The statement on lines 103 and 104 has been referenced as 22.


9. Studies are mentioned but not referenced.

We would like thank for the observation. Studies has been referenced as 24.


10. The different theoretical models have been proposed in the literature have to be briefly explained to the reader [i.e. Theory of Reason Action (TRA), Technology Acceptance Model (TAM 1 and TAM 2), Unified Theory of Acceptance and use of Technology (UTAUT and UTAUT2)]. Then a comparison among them can be introduced (lines 107-110).

We would like to thank for the above mentioned comment.

The different theoretical models has been discussed to read as: “(1) Theory of Reason Action (TRA): this theory explains the connection between behavior and attitudes in the context of human action. Its objective is to predict the intention why a behavior is performed by leveraging on each person’s attitude and beliefs [25]. (2)Technology Acceptance Model (TAM 1 and TAM 2): TAM is one of the well-known information systems theory. It models the factors that influence the users’ decision when introduced to a new technology and their subsequent usage. Over the years, new variables such as integrating barriers and network effects as external factors were added to the TAM model so as to derive a better understanding for users’ intention to use a technology, resulting in TAM 2 [26], [27]. (3) Unified Theory of Acceptance and use of Technology (UTAUT and UTAUT2): is a model employed to assess the level of new technology acceptance by users. Due to some limitations relating to generalization in the original UTAUT,
UTAUT2 was developed and tailored to suit the consumer context [28]. While TRA is a model which is good at the prediction of human behavior [29], TAM is designed to provide a theoretical framework for the factors that influences user’s actions to the usage of information systems [30] and UTAUT is modelled towards user’s motivation to use an information system as well as their future behavior [31]." (Page 5).

11. It appears Reference #21 does not mention cloud and is not specific to Nigeria.

We would like thank for the comment. The reference #21 has been changed to reference #23.


(Page 5).

12. Then, cloud-based health knowledge (CBHK) and Cloud-Based Health Systems (CBHS) should be defined and explained in the background.

We would like to thank for this suggestion.

The term cloud based health knowledge and cloud based health system have been explained in the background section. The sentence reads:

“It was revealed from previous studies that IT literacy and experience of healthcare service providers have a significant influence on their perception, attitude and intention for the use of a new technology such as e-health technology applications [10], [11]. In accordance, Cloud based health knowledge (CBHK) of CBHP by users, is considered necessary for the sustainability of cloud-based healthcare solutions. It would be easier for the healthcare service providers to use cloud based health care systems if they have a prior knowledge of the systems’ working environment [11]." (Page 3).

13. On line 117, the expression "cloud-based health systems" has been introduced, but its meaning has not been explained to the reader. It has to be clarified whether it refers to a specific health information system (as referred to reference #66 - medical laboratory portals) or something more extensive (e.g. as referred to reference #69 - eHealth programmes). I was wondering if some explanation could be added, starting from giving a shared definition of "Health system" (e.g. from the World Health
Organization - WHO) and then adding the meaning of "cloud-based health systems", according to the authors' perspective.

We would like to thank for the comment.

More clarification has been added to the concept of cloud based health system. The sentence reads: “It was revealed from previous studies that IT literacy and experience of healthcare service providers have a significant influence on their perception, attitude and intention for the use of a new technology such as e-health technology applications [10], [11]. In accordance, Cloud based health knowledge (CBHK) of CBHP by users, is considered necessary for the sustainability of cloud-based healthcare solutions. It would be easier for the healthcare service providers to use cloud based health care systems if they have a prior knowledge of the systems’ working environment [11].

The World Health Organization (WHO) [12] noted that, a robust healthcare system is one which provide adequate healthcare services to meet the health needs of people in a certain geographical location whenever needed. With this understanding, the term cloud based health system refers to all computing mechanisms such as infrastructure, software and hardware used by healthcare service providers to deliver healthcare services like Software as a Service (SaaS), Infrastructure as a Service (IaaS) and Platform as a Service (PaaS) [13].” (Page 3).

14. The sentence on lines 129-131 has to be supported by references.

We would like to thank for the comment. This sentence has been rephrased as:

“In addition, it is a crucial research objective to realize the effect of cloud based health knowledge (CBHK) as a major influence on the adoption and usage of cloud based health systems (CBHS) by healthcare professionals.” (Page 6).

15. Then, the "proposed system" should be included in the objectives of the study and in the research questions.

We would like to thank for the suggestion.

The “Proposed system” has been included in the research objectives as:

“To this end, this study primarily aims to assess the factors affecting the acceptance of cloud-based health systems by healthcare professionals in Nigeria. In addition, a Cloud Based Health Center is proposed for remote care and prompt access to health care needs for the future use.” Therefore, the proposed model is not included in the research questions. (Page 6)
16. The sentence on line 144-146 has to be more elaborate and supported by references. We would like to thank for the comment. In accordance, the sentence on lines 144 – 146 has been elaborated and appropriate reference is used as:

“Health institutions were using the manual information processing and filing cabinet storages before the use of information technologies in healthcare delivery which leads to loss of patients’ data and even unnecessary waste of time in looking for a patient record [36]. It should also be noted that since the hospitals are not on the same platforms or using information sharing, referral is found to be very difficult once a patient is asked to go to another health institution. Hence, the use of cloud computing in healthcare could resolve all these issues such that access to patients’ records is not hindered by geographical location [37].”

(Page 7).


17. Performance expectancy (PE), social influence (SI), self-efficacy (SE), perceived usefulness (PU), and perceived ease of use (PEOU) have to be explained to the reader. We would like to thank for the comment. We have made the following changes as indicated below in Page 7.

“There are several studies in the literature in which the acceptance and intention to use a cloud based healthcare technology solutions have been investigated [38], [39], [40]. On the other hand, medical doctors’ intention to use a clinical decision support system is studied in [41] while performance expectancy (PE), social influence (SI) and self-efficacy (SE) were realized as significant factors. PE can be defined as “the degree to which the user expects that using the system will help him or her to attain gains in job performance” [31]. On the other hand, SI can be defined as “the degree to which an individual perceives that important others believe he or she should use the new system” while SE can be defined as “the degree to which an individual skills are required to use the new system” [31]. Integrated TAM and UTAUT based research study in conducted in [42] in order to determine the level of e-health applications among German healthcare professionals. It was revealed from the study that both perceived usefulness (PU) and perceived ease of use (PEOU) have a positive influence on their intention to use the technology. PU is defined as the conviction and opinion of an individual that the use of a certain technology will increase their performance with better productivity. On the other hand, PEOU is defined as
an individual belief that the use of a certain technology would free of effort [42]. Studies have shown that healthcare professionals’ acceptance of cloud based technologies differs when compared to healthcare consumers in the sense that their acceptance is dependent on the perceived usefulness of the technology rather than its ease of use [43].”

18. Then, the following sentence (lines 160-164), "For instance, TAM is used in [33] to determine the intentions of hospital directors, nurses and other hospital physicians to use a healthcare system" has to be more explained, cloud based information systems are not the subject of research in [33]. Then please notice that a "healthcare system" is different from a "health information system" (see comment above, "On line 117 …").

We would like to thank for the comment. The sentence has been rephrased and the reference has also been changed. The new sentence reads:

“Some studies have investigated the attitude of doctors, nurses, lab technicians and other stakeholders as regard the acceptance of cloud based technologies (CBT) using either TAM or UTAUT. For instance, TAM is used in [44] to determine the factors which aid the acceptance of healthcare cloud computing technologies by healthcare professionals in Klang Valleys, Malaysia.”


19. It appears References #27, #28, and #34 do not investigate on cloud systems. As a consequence, "Table 1: Summary of cloud computing acceptance" has to be revised.

We would like to thank you the observation. Table 1 has been revised and the references #27, #28 and #34, has been changed to #38, #39 and #45.


20. It appears Figure 1 is from an external source and it is copyrighted material. Please, follow the author instructions about copyrighted material. We would like to thank for the comment on the Figure 1. Figure 1 has been redrawn by the authors and necessary changes made in the text in Page 8.

21. The Cloud Based Health Center (CBHC) appears to be a result of a study, but it has been included in the Background section. We would like to thank for the suggestion. The “Proposed system” has been included in the research objectives as:

“To this end, this study primarily aims to assess the factors affecting the acceptance of cloud-based health systems by healthcare professionals in Nigeria. In addition, a Cloud Based Health Center is proposed for remote care and prompt access to health care needs for the future use.” Therefore, the proposed model is not included in the research questions. (Page 6)

22. In the description of the CBCH, in line 213, the word "sync" is informal and has to be reconsidered. We would like to thank for observation. The word “Sync” has been replaced with the word “Synchronization”. The sentence now reads:

“In addition to the firewalls, an APACHE web server is used as a security measure to monitor the activities in the system providing a secured, efficient and extensible server with HTTP services in synchronization with recent HTTP standards”. (Page 9)
23. In Figure 2, Cloud Based Health Center (CBHC), it appears an automatic diagnosis of the patient is performed according to data entered by the patient. The legal basis of the possibility of an automatic diagnosis in Nigeria has to be explained.

We would like to thank for the comment. The legal basis for automatic diagnosis in Nigeria has been included to read:

“The Nigerian National Health Act (2014) [50], offers a legal framework that regulates the administration and expansion of the National Health System and also, set criteria for the adequate delivery of health care services in the country. Under this Act, health technologies and institutions are categorized based on their functions to the national health care system. The type or level of health services are categorized with respect to the offered service type as well as the need to structure healthcare service delivery in line with national framework standards.” (Page 9 and 10)

24. In addition, the concept of "satisfaction of the patient" about the results of the diagnosis has to be more explained.

The concept of “satisfaction” has been clarified. The sentence reads:

“After registering to the system, username and temporary password are generated which can also be changed in the future. Users could have the chance to view their medical results, enter the symptoms of a disease they are feeling in order to get a diagnosis. They can also book an appointment with a doctor in cases where a patient feels that the inputted symptoms is not adequate enough for accurate system diagnosis. It should be noted that the patients cloud log-in to their accounts by using their internet enabled devices, such as mobile phones, tablets, computers etc. ” (Page 9).

25. The sentence on lines 215-218, says "Cloud Based Health Center is developed as a result of the relevant research studies and also to provide solutions to the research questions: taking into consideration the necessity of its benefits to healthcare professionals. The relevance of our proposed system to healthcare professionals' acceptance and use of CBHC is evident in that it addresses the issues mentioned earlier." It appears it has to be mitigated as the use of CBHC is not investigated in a study.

We would like to thank for the comment. The sentence on lines 215 -218 has been changed to read:
“Cloud Based Health Center is developed in order to provide solutions to the issues, such as shortage of healthcare professionals and facilities as well as excessive pressure on healthcare professional. The proposed model could be used in the future to be of benefit to both healthcare professionals and consumers.” (Page 10)

26. It appears "Data Security" is not mentioned in reference #45. I was wondering if the right references are #48 and #53, as specified in Table 2.

We would like to thank you for the consideration. The reference #45 has now been changed to reference #57


27. Then, as for the "Information Sharing" determinant some additional explanations should be added. It appears it affects the behavior of users in a negative way. However, sharing healthcare data of patients among healthcare professionals could help in defining patient conditions with a greater amount of data and information.

We would like to thank you for the above mentioned comment. Additional explanation and reference has been added. The sentence now reads:

“Cloud based health platforms provide remote accessibility to the required data and information of patients. In accordance, information sharing, which can occur either internally or externally is a very important construct to be considered. The free flow of information, within cloud based health platforms, inherits efficient use of resources both to service providers and stakeholders [58]. Use of the shared information enhances the behavior of some users since healthcare professionals could have the chance to proffer the right solutions with regard to the patients’ particular condition [59].” (Page 12).

Methods:

28. Table 3 presents the "characteristics of surveyed health institutions". It appears the doctors working at Mount Zion, Saint Monica, and Nazareth Hospital could be
identified, as they are the only doctors participating in the research from those hospitals.

We would like to thank for the comment. In accordance, Table 3 has been modified as suggested in order to preserve the identities of the doctors. We have used alphabets (A - I) instead to represent the visited hospitals. (Page 24)

29. In "Data analysis" section, the following sentence (lines 335-336) "LISREL has been found to be user friendly; coupled with the fact that it does not require conditioning" should be clarified. The "conditioning" concept for software has to be explained to the reader.

We would like to thank for the suggestion. The sentence has been rephrased to read:

“In LISREL, the scales of the observed data is automatically regulated by limiting the loading to one in which there is no need to draw unique factors representing measurement error for each of the observed data.” (Page 14).

Results:

30. The details on the analyses have to be anticipated in the Methods section (e.g. the usage of the criterion of Fornell-Larcker, the intra-class correlation coefficients (ICC), the methods to test the hypothesis and the validation of model).

We would like to thank for the comment. The details of the analysis has been included in the “Method section” under the subsection “data analysis”. The statement reads:

Composite Reliability (CR), Convergent Validity (Average Variance Extracted - AVE) and correlation coefficient (Fornell-Larcker-Criterion and Intra-class coefficients) analyses were used for the measurement of reliability indices. In addition, path coefficient (β) and associated t- value was used for the analysis of the structural model. Finally, Chi Square value was utilized for the general assessment of the model fit. (Page 114).

31. Please, notice there is a missing "r" on line 382, in Larcker name.

Thank you for this observation. The missing “r” on line 382 in Lacker name has been added. It is now written as Fornell-Larcker-Criterion. (Page 16)
Discussion:

32. The question on line 470, "3 - How can Nigeria and other developing countries adopt and use the CBHC?" has been answered for Nigeria only (Benue State), as there were not participants from outside Nigeria. In addition, the question has to be also rephrased on line 124.

We would like to thank for the above mentioned comment. The question on line 470 and 124 has been rephrased from “How can Nigeria and other developing countries adopt and use the CBHC?” to “How can Nigeria adopt and use the CBHC?” (Page 6 and 19).

Reference:

33. Please revise the references. There is missing information.

All the missing information in the references has been corrected.

34. In addition, in the text the numbers of citation should be revised as well, to see if they are

Thank you for the comment. All numbers of citations in the text have been revised since additional citations (#1, #11, #12, #13, #18, #19, #21, #22, #23, #24, #34, #48 and #57) were added.

35. Reference #7: Volume number and page numbers are missing.

Thank you for this observation. The volume number and page number of reference #7 (now #8) has been added.


36. Reference #10: Publication year is missing.
Thank you for this observation. The reference #10 (now 15) has been updated to include the publication year.


37. Reference #11: Publication year is missing.

Thank you for this observation. The reference #11 (now 17) has been updated to include the publication year.


(Page 32).

38. Reference #12: It appears the link does not work, as it points to a "Not found page".

Thank you for this observation. The link has been updated. It is now #18


(Page 32).

39. Reference #14: it appears it is not about Nigeria as main topic.

Thank you for the comment. Reference #14 has been changed to reference #20


(Page 32)

40. Reference #22: Journal name, volume, issue and page numbers are missing.
Thank you for this observation. The reference has been updated. It is now reference #10


(Page 31).

41. Reference #24: Volume, issue and page numbers are missing

Thank you for this observation. The volume number, issue and page number has been updated. It is now #34


(Page 33).

42. It appears the reference to a paper on "monitoring of patients with artificial hearts" is missing.

Thank you for this observation. The reference to "monitoring of patients with artificial hearts" has been included as reference #16.


(Page 4 and 32).

Figure 2 and Table 3:

43. It appears Figure 2 is from an external source (reference #22). I was wondering if referencing it is enough to meet the policies of the journal on copyrighted material. #22.

Thank you very much for this comment. However, Figure 2 is the proposed CBHC. This diagram was drawn by the authors and not extracted from an external source.

44. Then, Table 3 presents the "characteristics of surveyed health institutions". It appears the doctors working at Mount Zion, Saint Monica, and Nazareth Hospital could be identified, as they are the only doctors participating in the research from those hospitals. I was wondering if the table should be modified to preserve the identity of those doctors.

We would like to thank for the suggestion. Table 3 has been modified as suggested in order to preserve the identities of the doctors. We have used alphabets (A - I) instead to represent the hospitals visited. (Page 24).

Reviewer #3

Congratulations for your corrections! I think your paper could be published.

We would like to thank for all previous comments and your recommendation.