PEER REVIEW HISTORY

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ARTICLE DETAILS

TITLE (PROVISIONAL)	Global eHealth Capacity: Secondary Analysis of WHO data on eHealth and Implications for Kidney Care Delivery in Low Resource Settings.
AUTHORS	Okpechi, Ikechi G; Muneer, Shezel; Ye, Feng; Zaidi, Deenaz; Ghimire, Anukul; Tinwala, Mohammed; Saad, Syed; Osman, Mohamed; Lunyera, Joseph; Tonelli, Marcello; Caskey, Fergus; George, Cindy; Kengne, AP; Malik, Charu; Damster, Sandrine; Levin, Adeera; Johnson, David; Jha, Vivekanand; Bello, A

VERSION 1 – REVIEW

REVIEWER	Pape, Lars University Hospital Essen, Pediatrics II
REVIEW RETURNED	23-Aug-2021

GENERAL COMMENTS	This is a very nice manuscript on the development of electronic health wordwide and it's impact for nephrology. I have only one important point: The WHO survey is from 2015 and therefore quite old. I would think that in the last years, especially based on the COVID19-pandemic, eHealts solutions have been developed quite fast. Therefore this fact should stated and discusses as an important limitations. I would suggest to also discuss the impact of the COVID19-pandemic on eHealth in Nephrology.

REVIEWER	Dawson, Jessica The University of Sydney
REVIEW RETURNED	09-Nov-2021

| GENERAL COMMENTS | This is an interesting topic and provides valuable insights into the use of eHealth. There are many figures that could use enhancing - including colour schemes to more obviously differentiate groups. some comments for the authors to consider.

1. there are many abbreviations which can be hard to keep up with. if the word count allows some of these abbreviations should be written in full to improve readability i.e. "health information system" rather than HIS, particularly for abbreviations that are not used frequently.
2. I don't understand how there is >100% of a population with mobile subscriptions, does these mean that people have more than 1 subscription?
3. Page 9, line 28-35: ICT development index - could this be outlined, i.e. what does this scoring mean?? what is the scoring scale? what is a low score, what is a high score? |
|---|---|

4. page 10, mHealth section: I find this very confusing. can you put in some examples of what a toll-free emergency mHealth intervention would be?? can you include some examples of what a mHealth service for treatment adherence would be? given the method of data collection i find it hard to believe that this could be comprehensively captured by one group of experts in each country as many clinic / hospital based systems may exist.

5. page 10, telehealth section: please provide some examples of what these would be. are these hospital based systems? or are these national systems? does telehealth include telephone consultations or only those with video for example? similar concern to mhealth with clinic/hospital systems not being collected adequately

6. page 12, big data: some additional explanation - for example: "NE Asia region had the highest proportion of policies in the health sector, whilst xx had the least"

7. Page 14, line 5: remove "however" at the end of the sentence.

8. some terminology has not been explained sufficiently - in the tables "intermediate", "local or peripheral level" have not been explained. this should be outlined in methods or in a table key.

9. whilst touched on in limitations i think there needs to be a bigger emphasis on the fact that this type of survey could not possibly capture all the clinic or hospital level ehealth strategies that exist. this data would grossly underestimate actual use of eHealth strategies. Does this data intend on also including primary care i.e. general practitioner clinics?

10. are there any current strategies that are being used that could be applicable to low-income countries or that could be enhanced to be applicable? I think there is room for more specific interventions/strategies that the authors may be able to provide.

REVIEWER	Shen, Hongxia Leiden University Medical Center, Department of Public Health and Primary Care
REVIEW RETURNED	16-Nov-2021

GENERAL COMMENTS	Thank you for the opportunity to review this manuscript, Global Status of Infrastructure and Opportunities for eHealth: Implications for Kidney Care Delivery in Low income and Lower-Middle-Income Countries. This manuscript describes the status and penetration of eHealth use across International Society of Nephrology (ISN) regions using data from the WHO global survey on eHealth. Also, authors identified gaps in availability of eHealth services in several ISN regions. Please refer to remarks below: [Abstract] Remark 1-Page 3, line 7, The structured abstract states 'describe the regional status of digital services for kidney care across eight eHealth themes.' I think that the term "regional status" is a bit unclear here. I would suggest revising this sentence so that it states the objective of the study more clearly, such as 'the use of eHealth in support of health coverage'. Remark 2-Page 3, line 22, In the abstract, the authors summarized Outcome measures into 'The availability of digital services and governance frameworks for kidney care across ISN regions.' Could the authors specify on which themes mentioned in the objective belonged to 'availability of digital services' or 'governance frameworks for kidney care'?

Remark 3-Please choose the use of 'digital services' or 'eHealth services' and keep it consistently throughout the manuscript.

[Introduction]
Remark 4-A previous report has documented the results of the third global survey on eHealth conducted by the WHO Global Observatory for eHealth (GOe). The unique contribution/necessity of the present manuscript is not clearly stated and it is not apparent how this manuscript expands upon those that have already been done, particularly why it is important to reanalyze data across ISN regions, and how it is related to implications for kidney care across ISN regions.

Remark 5-Page 5, lines 47-50, Please provide some additional detail on the sentence '…a systematic review of 43 studies that included 6,617 participants and evaluated the impact of an eHealth intervention in people with CKD did not find sufficient value…'
What does the 'sufficient value' mean?

Remark 6-Since data from the WHO global survey on eHealth was mainly used in this study, it would be a good idea to include some information about this survey and related results as well, such as the aim, setting, locations, and relevant dates, and data collection. Also, may be adding the rationale of using the data from WHO global survey on eHealth.

Remark 7-Page 5, line 49, Please write the 'CKD' out when using its abbreviation at the first time.

[Methods]
Remark 8-Please specify the study design in the methods section

Remark 9-Page 6, lines 27-28, Please provide the definition of 'eHealth foundation' and related reference.

Remark 10-Page 7, lines 57-59, Please provide some additional details about methods section. How was the web-based tool, (LimeSurvey -https://www.limesurvey.org/en/) used for online form creation, data collection and management? Maybe add some examples of the items of survey? Also, how many national experts in eHealth participated in the survey?

Remark 11-As in the results, data from World Bank and Internet World Stats were used and presented, it would be good to include some information in the methods section on World Bank and Internet World Stats, such as an introduction for World Bank and Internet World Stats, what data they include and what data authors obtained.

Remark 12-In the methods section, authors used 'eLearning', in the results section authors used 'eLearning in health sciences', please keep it consistently

[Discussion]
Remark 13-There are some disconnections between the Results and the Discussion sections in the paper in that (1) some points were mentioned in Discussion yet not brought up in the Results section, or (2) it is difficult to understand how the results lead to certain points in the Discussion section. Below are some examples:

	- Paragraph 2 in discussion section: I understand that authors would like to highlight the potential of internet technologies. However, authors mostly focused the challenges of kidney disease care. This is not clear how cellular and internet technologies can be used to cope with these challenges (e.g., the usefulness, feasibility) and how did this connect to the data presented in the Results section?
	- Paragraph 3: More elaboration is needed on the usefulness and advantages of mHealth, thereby supporting the statement '…mHealth may be potentially useful for supporting case finding for CKD,48 CKD-specific education to improve awareness.'
	- Paragraph 4: I agree with authors that framing legal governance for eHealth is important for eHealth implementation. Could authors state a bit more on how to guide implementation with considering the 'ethical issues including type and quality of digital technology, doctor-patient relationship, data confidentiality and security, informed consent and patients and families satisfaction with telemedicine services' in framing legal governance for eHealth. Maybe adding some examples?
	- Paragraph 5: Could authors provide more information what measures should be taken to 'ensure successful adoption and implementation of EHR technology including systems usability, interoperability, and adaptability'
	Remark 14-Although the topic of this manuscript is to describe global status of infrastructure and opportunities for eHealth and provide implications for kidney care delivery in Low income and Lower-Middle-Income Countries. Less discussion on the implications for kidney disease care is presented. It is unclear what this study adds to our current understanding of kidney care delivery in Low income and Lower-Middle-Income Countries. It would be useful to add a paragraph in your discussion section that specifically focus on the implications of your findings for kidney disease care.
	Remark 15-English language expression needs improvement throughout the manuscript.

VERSION 1 – AUTHOR RESPONSE

Reviewer: 1
Prof. Lars Pape, University Hospital Essen
Comments to the Author:
This is a very nice manuscript on the development of electronic health worldwide and its impact for nephrology.
I have only one important point:
The WHO survey is from 2015 and therefore quite old. I would think that in the last years, especially based on the COVID19-pandemic, eHealth solutions have been developed quite fast. Therefore, this fact should stated and discusses as an important limitations. I would suggest to also discuss the impact of the COVID19-pandemic on eHealth in Nephrology.

> **Response:** We thank this Reviewer for their generous comments about our paper. We did discuss the impact of COVID-19 and how the pandemic should strengthen use of eHealth services, especially in low resourced settings. However, we agree that the WHO data used is old (2015), however, this has not been superseded by any recent data with global reach on eHealth. We have included this as a limitation of the study and included the following to as part of the limitations:

"These include that the report is old (2015), given that there are no other reports superseding this with a global reach. However, our study has made up for this by the inclusion of newer data from elsewhere showing availability and use of telecommunications services as a proxy for use of eHealth that rely on such services." (Page 17 – marked copy)

Reviewer: 2
Dr. Jessica Dawson, The University of Sydney
Comments to the Author:
This is an interesting topic and provides valuable insights into the use of eHealth. There are many figures that could use enhancing - including colour schemes to more obviously differentiate groups. some comments for the authors to consider.

> **Response:** Thank you for your comments on our paper. We have updated the colour schemes used to improve the quality of the Figures, especially the Supplementary Figures which appeared slightly blurry with the initial colour scheme used.

1. there are many abbreviations which can be hard to keep up with. if the word count allows some of these abbreviations should be written in full to improve readability i.e., "health information system" rather than HIS, particularly for abbreviations that are not used frequently.

> **Response:** Thank you – we have updated some abbreviations, if not used frequently to keep to the word count specified by the journal (e.g., "HIS", and "PDA"). However, other abbreviations (e.g., 'WHO', "ISN", "LICs", etc.) were used frequently and are conventionally used.

2. I don't understand how there is >100% of a population with mobile subscriptions, does these mean that people have more than 1 subscription?

> **Response:** This is correct. Where >100% had mobile phones, this means there are people who have more than one subscription.

3. Page 9, line 28-35: ICT development index - could this be outlined, i.e., what does this scoring mean?? what is the scoring scale? what is a low score, what is a high score?

> **Response:** We have elaborated and explained this in the text as shown below:
>
> *"Data on ICT indices (a composite index of fixed-telephone subscriptions, mobile-cellular telephone subscriptions, international Internet bandwidth per Internet user, households with a computer, and households with Internet access; scored as low as 0 to as high as 100 and presented in unit scores) were obtained……." (Page 8 – marked copy)*

4. page 10, mHealth section: I find this very confusing. can you put in some examples of what a toll-free emergency mHealth intervention would be?? can you include some examples of what a mHealth service for treatment adherence would be? given the method of data collection i find it hard to believe that this could be comprehensively captured by one group of experts in each country as many clinic / hospital-based systems may exist.

> **Response:** Thank you for this comment which helps to improve clarity of the methods. In the methods section, we succinctly defined all themes of eHealth, including mHealth services and provided references that further elaborates on each of these given limitations of word count. However, for mHealth specifically, we have updated the definition to elaborate, specifically about the services mentioned in Table S2 as shown below:
>
> ***mHealth:***[18] *the use of mobile devices, such as mobile phones, patient monitoring devices, Personal Digital Assistants, and wireless devices, for medical and public health practice including free telephone hotlines for emergencies provided by trained personnel and pre-recorded messages (toll-free emergency telephone services), reminder messages provided by health services to patients aimed at achieving medication adherence, reminder messages to patients to make or attend an appointment, etc.. (Page 6-7 – marked copy)*

5

5. page 10, telehealth section: please provide some examples of what these would be. are these hospital-based systems? or are these national systems? does telehealth include telephone consultations or only those with video for example? similar concern to mhealth with clinic/hospital systems not being collected adequately

> **Response:** As for the query on mHealth above, we have also updated the definition of telehealth showing that methods available are synchronous exchanges (e.g., telephone or video link) or asynchronous store and forward (e.g., emails) methods. The general understanding of the place of use of these patient services are in clinics and hospitals while those for e-Learning are at training institutions. Below is a statement updating the definition of telehealth:
>
> *"Telehealth:[18] the delivery of health care services through ICT for the exchange of information in real time (synchronously, e.g., by telephone or video link) or by store-and-forward methods (asynchronously, e.g., by email) for the diagnosis and treatment of diseases and injuries, research and evaluation, and for the continuing education of health professionals where patients and care providers are separated by distance." (Page 7 – marked copy)*

6. page 12, big data: some additional explanation - for example: "NE Asia region had the highest proportion of policies in the health sector, whilst xx had the least"

> **Response:** We have updated this statement as suggested:
>
> *"North-East Asia had the highest proportion of policies in the health sector (75%) while Africa had the least (6%). No data was obtained for North America." (Page 12 – marked copy)*

7. Page 14, line 5: remove "however" at the end of the sentence.

> **Response:** We have removed this.

8. some terminology has not been explained sufficiently - in the tables "intermediate", "local or peripheral level" have not been explained. this should be outlined in methods or in a table key.

> **Response:** We have provided concise definitions of these terms and added them as footnote to Table 2

9. whilst touched on in limitations i think there needs to be a bigger emphasis on the fact that this type of survey could not possibly capture all the clinic or hospital level ehealth strategies that exist. this data would grossly underestimate actual use of eHealth strategies. Does this data intend on also including primary care i.e. general practitioner clinics?

> **Response:** Again, thank you for this comment. We have further updated the limitations section and provided a comment to show possible underestimation of reporting as shown below:
>
> *"Another limitation of this study is the focus on large hospitals and private health institutions as all eHealth capacities and strategies (e.g., primary care level or general practitioner clinics) may not have been adequately captured, thus underestimating its use across countries. However, this data provides a broad scan of the availability of these services across participating countries and regions, therefore useful for monitoring progress and for improving services." (Page 17 – marked copy)*

10. are there any current strategies that are being used that could be applicable to low-income countries or that could be enhanced to be applicable? I think there is room for more specific interventions/strategies that the authors may be able to provide.

> **Response:** Most of the strategies / services outlined are currently available in LICs (e.g., electronic health records systems). However, as we discussed, these services can be improved and increased to benefit patients and health systems I such settings.

Reviewer: 3
Dr. Hongxia Shen, Leiden University Medical Center, Zhengzhou University
Comments to the Author:
Thank you for the opportunity to review this manuscript, Global Status of Infrastructure and Opportunities for eHealth: Implications for Kidney Care Delivery in Low income and Lower-Middle-Income Countries. This manuscript describes the status and penetration of eHealth use across International Society of Nephrology (ISN) regions using data from the WHO global survey on eHealth. Also, authors identified gaps in availability of eHealth services in several ISN regions. Please refer to remarks below:

[Abstract]
Remark 1-Page 3, line 7, The structured abstract states 'describe the regional status of digital services for kidney care across eight eHealth themes.' I think that the term "regional status" is a bit unclear here. I would suggest revising this sentence so that it states the objective of the study more clearly, such as 'the use of eHealth in support of health coverage'.

> **Response:** We used "To describe regional status…." to represent status of these services across ISN regions (as described throughout in the manuscript). However, we have improved the language and changed this as suggested as shown below:
>
> *"To describe the use of eHealth in support of health coverage for kidney care across eight eHealth themes: eHealth foundations, mobile health (mHealth), telehealth, eLearning, electronic health records, legal frameworks for eHealth, social media and big data." (Page 3 – marked copy)*

Remark 2-Page 3, line 22, In the abstract, the authors summarized Outcome measures into 'The availability of digital services and governance frameworks for kidney care across ISN regions.' Could the authors specify on which themes mentioned in the objective belonged to 'availability of digital services' or 'governance frameworks for kidney care'?

> **Response:** Thank you for this comment. We have expanded the outcomes measures in the abstract to clarify tis point as shown below:
>
> *"The availability of digital services (e.g., electronic health records, telehealth, etc.) and governance frameworks (policies) for kidney care across ISN regions." (Page 3 – marked copy)*

Remark 3-Please choose the use of 'digital services' or 'eHealth services' and keep it consistently throughout the manuscript.

> **Response:** Thank you. We have used eHealth services throughout

[Introduction]
Remark 4-A previous report has documented the results of the third global survey on eHealth conducted by the WHO Global Observatory for eHealth (GOe). The unique contribution/necessity of the present manuscript is not clearly stated, and it is not apparent how this manuscript expands upon those that have already been done, particularly why it is important to reanalyze data across ISN regions, and how it is related to implications for kidney care across ISN regions.

> **Response:** The original WHO report on eHealth characterized the availability of these services using the WHO regions. What we have done in this manuscript is to re-appraise the WHO report using the ISN regions, included more recent data (2019 – 2020) on availability of mobile subscriptions and internet usage, and assessed the implications of these for kidney health – what each ISN region can do to improve kidney health using these services and – showing opportunities for use of these services in low- and lower-income regions. Thus, re-analyzing the data by ISN regions makes it more granular and applicable to various populations / communities in the ISN regions. Moreover, as we extensively pointed out the

limitations of this work, e.g., use of 2015 data due to unavailability of superseding data and so forth, we show the scope of applicability and use of this data to promote kidney care.

Remark 5-Page 5, lines 47-50, Please provide some additional detail on the sentence '…a systematic review of 43 studies that included 6,617 participants and evaluated the impact of an eHealth intervention in people with CKD did not find sufficient value…' What does the 'sufficient value' mean?

Response: Thank you for this comment. We have updated this sentence to improve clarity as shown below:

"Furthermore, a systematic review of 43 studies that included 6,617 participants and evaluated the impact of an eHealth intervention in people with CKD did not find statistically significant improvements in the health domains assessed with eHealth in patients with CKD although eHealth was suggested to be useful for dietary sodium intake and fluid management.[12]" (Page 5 – marked copy)

Remark 6-Since data from the WHO global survey on eHealth was mainly used in this study, it would be a good idea to include some information about this survey and related results as well, such as the aim, setting, locations, and relevant dates, and data collection. Also, may be adding the rationale of using the data from WHO global survey on eHealth.

Response: In the methods section, we showed that the survey was carried out in 2015 and included 125 WHO member States and included relevant information on data collection. We have also reflected the aim of the WHO survey in the Introduction as shown below:

"The current manuscript describes the status of eHealth services and eHealth governance across ISN regions, using data from the World Health Organization (WHO) third global survey on eHealth which aimed to survey global eHealth and explore developments in eHealth since the previous survey, and its role in achieving universal health coverage.[18]" (Page 6 – marked copy)

Remark 7-Page 5, line 49, Please write the 'CKD' out when using its abbreviation at the first time.

Response: Thank you. This has been done.

[Methods]
Remark 8-Please specify the study design in the methods section

Response: This has been done as shown below:

"The study, which was designed using a survey method is summarized as follows." (Page 6 – marked copy)

Remark 9-Page 6, lines 27-28, Please provide the definition of 'eHealth foundation' and related reference.

Response: We provided concise definitions and references for each theme in the methods section. (Please see page 6-7 – marked copy)

Remark 10-Page 7, lines 57-59, Please provide some additional details about methods section. How was the web-based tool, (LimeSurvey -https://www.limesurvey.org/en/) used for online form creation, data collection and management? Maybe add some examples of the items of survey? Also, how many national experts in eHealth participated in the survey?

Response: Again, we thank the Reviewer for this comment which is to improve clarity of the methods employed to carry out the survey. Unfortunately, to add most of the detail suggested would significantly increase the word count of this manuscript beyond what is allowable by the journal. We had provided a reference link to the detailed study methodology which can be

accessed online. To include these suggestions would be repetitions of information contained in the WHO manual.

LimeSurvey is an online survey tool (like SurveyMonkey) used for assessing and collecting survey data. We specified this in the methods section.

Remark 11-As in the results, data from World Bank and Internet World Stats were used and presented, it would be good to include some information in the methods section on World Bank and Internet World Stats, such as an introduction for World Bank and Internet World Stats, what data they include and what data authors obtained.

Response: In the methods section, we stated that ICT index data was obtained from the World Bank while more recent internet usage data was obtained from Internet World Stats. Moreover, the legend in Figure 1 clearly shows where each data presented was obtained from.

Remark 12-In the methods section, authors used 'eLearning', in the results section authors used 'eLearning in health sciences', please keep it consistently

Response: We have ensured consistency in usage.

[Discussion]

Remark 13-There are some disconnections between the Results and the Discussion sections in the paper in that (1) some points were mentioned in Discussion yet not brought up in the Results section, or (2) it is difficult to understand how the results lead to certain points in the Discussion section. Below are some examples:

Paragraph 2 in discussion section: I understand that authors would like to highlight the potential of internet technologies. However, authors mostly focused on the challenges of kidney disease care. This is not clear how cellular and internet technologies can be used to cope with these challenges (e.g., the usefulness, feasibility) and how did this connect to the data presented in the Results section?

Response: Again, we thank the Reviewer for this comment. Given that the aim of the study is to assess how these services can be used to improve kidney care, our focus on use of each service was therefore specifically tailored toward kidney disease care. So, throughout the manuscript, we discussed how these services, including cellular and internet technologies can be used to improve care and training.

Paragraph 3: More elaboration is needed on the usefulness and advantages of mHealth, thereby supporting the statement '…mHealth may be potentially useful for supporting case finding for CKD,48 CKD-specific education to improve awareness.'

Response: This statement was made because statements preceding it i.e., about the study in Indonesia, and the findings from our study. Hence, we said "These findings suggest that ……." We do not feel that the statement needs to be elaborated on.

Paragraph 4: I agree with authors that framing legal governance for eHealth is important for eHealth implementation. Could authors state a bit more on how to guide implementation with considering the 'ethical issues including type and quality of digital technology, doctor-patient relationship, data confidentiality and security, informed consent and patients and families satisfaction with telemedicine services' in framing legal governance for eHealth. Maybe adding some examples?

Response: We did provide some considerations (e.g., cost, disability, and data privacy issues) in consideration of ethical issues that relates to legal governance of eHealth.

Paragraph 5: Could authors provide more information what measures should be taken to 'ensure successful adoption and implementation of EHR technology including systems usability, interoperability, and adaptability'

Response: Thank you. We have updated this section as shown below:

"Measures that ensure successful adoption and implementation of EHR technology including systems usability (acceptable and ease of use), interoperability (functional across platforms, e.g., IOS and Android), and adaptability (fitting the technology into local context, e.g., language) need to be considered in terms of local context, individual end-users and advancing technology." (Page 16 – marked copy)

Remark 14-Although the topic of this manuscript is to describe global status of infrastructure and opportunities for eHealth and provide implications for kidney care delivery in Low income and Lower-Middle-Income Countries. Less discussion on the implications for kidney disease care is presented. It is unclear what this study adds to our current understanding of kidney care delivery in Low income and Lower-Middle-Income Countries. It would be useful to add a paragraph in your discussion section that specifically focus on the implications of your findings for kidney disease care.

Response: We did not focus the study to provide granular discussion on management of specific kidney diseases / conditions using eHealth. Rather, we used the data available to provide a broad overview on how these technologies can be utilized for CKD-education, to improve scheduling of appointments and reminders to take medications, for monitoring patients in remote regions, and how they can broadly be applied to mitigate the low workforce available in LICs and LMICs.

Remark 15-English language expression needs improvement throughout the manuscript.

Response: We thank the Reviewer for this comment. We have ensured that English language expressions (grammar) used throughout this manuscript are correct, clear, and consistent.

VERSION 2 – REVIEW

REVIEWER	Shen, Hongxia Leiden University Medical Center, Department of Public Health and Primary Care
REVIEW RETURNED	26-Dec-2021

GENERAL COMMENTS	Thank you for incorporating the comments and suggestions from my prior review. This article makes a necessary contribution to our understanding of the use of eHealth in support of health coverage for kidney care. I have only a few very minor comments on this draft: 1. Please write 'eHealth' out when it was firstly mentioned. It should be 'electronic health (eHealth)'. 2. Page 6, line 10, I think the authors mean 'in eHealth' instead of ''in eHealth health'.

VERSION 2 – AUTHOR RESPONSE

Reviewer: 3

1. Please write 'eHealth' out when it was firstly mentioned. It should be 'electronic health (eHealth)'.

Response: Thank you. We have done this.

2. Page 6, line 10, I think the authors mean 'in eHealth' instead of "in eHealth health'.

Response: Thank you – we have also corrected this.