PEER REVIEW HISTORY

ARTICLE DETAILS

TITLE (PROVISIONAL)	National health information systems for achieving the Sustainable Development Goals: a cross sectional survey in low- and middle-income countries
AUTHORS	Suthar, Amitabh; Khalifa, Aleya; Joos, Olga; Manders, Eric–Jan; Abdul–Quader, Abu; Amoyaw, Frank; Aoua, Camara; Aynalem, Getahun; Barradas, Danielle; Bello, George; Bonilla, Luis; Cheyip, Mireille; Dalhatu, Ibrahim Tijjani; De Klerk, Michael; Dee, Jacob; Hedje, Judith; Jahun, Ibrahim; Jantaramanee, Supiya; Kamocha, Stanley; Lerebours, Leonel; Lobognon, Legre Roger; Lote, Namarola; Lubala, Léopold; Magazani, Alain; Mdodo, Rennatus; Mgomella, George S.; Monique, Lattah Asseka; Mudenda, Mphatso; Mushi, Jeremiah; Mutenda, Nicholus; Nicoue, Aime; Ngalamulume, Rogers Galaxy; Ndjakani, Yassa; Nguyen, Tuan Anh; Nzelu, Charles Echezona; Ofosu, Anthony Adofo; Pinini, Zukiswa; Ramírez, Edwin; Sebastian, Victor; Simanovong, Bouathong; Son, Ha Thai; Son, Vo Hai; Swaminathan, Mahesh; Sivile, Suilanji; Teeraratkul, Achara; Temu, Poruan; West, Christine; Xaymounvong, Douangchanh; Yamba, Abel; Yoka, Denis; Zhu, Hao; Ransom, Ray L.; Nichols, Erin; Murrill, Christopher S.; Rosen, Daniel; Hladik, Wolfgang

VERSION 1 - REVIEW

REVIEWER	Hannah Leslie Harvard TH Chan School of Public Health, United States of America
REVIEW RETURNED	17-Dec-2018

GENERAL COMMENTS	Dear authors, I appreciate the opportunity to review the manuscript, “National health information systems for achieving the Sustainable Development Goals.’ This work provides a valuable description of health information systems in 15 low- and middle-income countries. The results can be presented more clearly to reflect what the sample does and does not capture, and implications refined accordingly. Please see below for specific areas of concern. Major - The sampling of countries, overall response rate, and within section response rate deserve greater attention and more

	complete presentation to ensure results are not over generalized. Please consider: o Providing some explanation for which countries had CDC offices with HIV and TB staff as background for the initial selection of these countries, potentially describing what portion of LIC and MIC this encompasses or geographic range o Listing all contacted countries, in a map or table, supplemental information if preferred o Noting any differences in respondent / non-respondent countries in terms of geography, income, disease burden as applicable - The decision to exclude non-responses within the survey from the denominator may introduce systematic upward bias into the findings if respondents from countries with less well developed health systems were less likely to answer each question, which seems plausible. I understand that it would be inappropriate to take any formal approach to missing data here, but I would encourage additional efforts to present the results to reflect the gaps in the data. Please consider: o Reporting the % of responding countries out of all 15 as well as out of those with complete information to provide the range of possible outcomes if those countries that did not respond did not have the policies in place vs. if they were similar to those countries that did respond. It may be useful to report on those countries with the least complete / most complete information to help readers understand how missing responses may (or may not) relate to the valid responses. - In light of both points, revisit key messages, abstract, and discussion to specify that results pertain to 15 countries that chose to respond and consider the implications of both the original sample and then the responsive countries. Wording can be a bit broad at times - 'most responding countries' is unclear without further context, and the concluding line 'most countries' goes beyond the actual sample. - Context for health information systems, particularly for health system as a whole. o Would it be possible to provide broader context for health information systems in the introduction, in a few sentences or a box / figure listing the universe of health information systems referred to in line 181? This would be useful before narrowing in on the 3 selected here; a brief justification for these 3 would be helpful as well. o How did the impetus of HIV surveillance influence the topics and form of the questionnaire as reported in the general findings here? Several of the definitions reference HIV in particular in the tool itself, though this is not mentioned in the manuscript. Consideration of whether respondents may have reflected primarily on HIV-specific resources would be helpful o The manuscript is written in terms of health information systems as a whole, but it does not seem that the survey distinguished service-specific HIS. Particularly given the development of parallel HIS for priorities such as HIV and TB, it would have been useful to understand the scope of the case reporting and patient monitoring systems. Any additional insight on the breadth of the systems in place or the further research required to understand the actual scope of systems in use would be helpful. o 'Linkage' could mean a range of things, from interoperable systems with a common ID to totally independent systems that can produce summary information for the same locations and times. There are many challenges in calculating indicators that require distinct information sources for the denominator and numerator

	(like women carrying to term in a region and women receiving appropriate quality of delivery care at a formal health facility); it would be helpful to discuss further what linkage meant in this context or, if no further detail can be provided, what additional details might be sought in the future to better understand the actual use and usability of these systems. Minor - Line 237: “Government counterparts” – in country? - The finding on geographic coverage is not included in the Results text, worth noting since this is featured in discussion - Lines 311 – 312: Reported use of individual level data by MoH respondent does not necessarily indicate accessibility and use for end users.

REVIEWER	Reza Khajouei Kerman University of Medical Sciences, Kerman, Iran
REVIEW RETURNED	05-Jan-2019

GENERAL COMMENTS	This study aimed to determine the state of 3 types of health information systems in low and middle income countries. The word system is a general term that refers to a wide rage of software or applications from a very basic software to very sophisticated software fore the same purpose. What I missed in this study is the determination of the maturity level of included systems. The manuscript should be carefully edited to improve both its scientific content and English. Low response rate in this study is a big concern in this study given that no special attempt was done to resolve this problems for example by substituting non-respondents. Following are my specific comments. Abstract - The information in all sections of the manuscript especially different parts of the Abstract section should be consistent. In the methods of the Abstract data were collected from key informants in 51 centers, while in the results of the Abstract key informants in 15 countries responded to the questionnaire. It is not clear in how many countries these 51 centers are located or key informants in how many countries were contacted. Likewise, "health information systems" in the objective and "electronic systems" in the results. - The conclusions of the Abstract is not clearly aligned with objective of the study. Strengths and limitations of this study - In this section (page 8) conclusions of the study are presented instead of the strengths and limitations of the study. Introduction - I doubt about the categorization of major health information systems in paragraph 2 of the Introduction section. It seems that the large number of health information systems which are used in hospitals and other health care centers are missed in these categories. - Authors should clearly present the gap in the knowledge, what is known and what is unknown about the subject and why it is important to fill this gap, current solutions in the Introduction section.

	Methods: - There is not sufficient information about the development of the data collection tool and methods for confirming its reliability and validity. - The subheadings in the Methods section are not appropriate, e.g. what does "design" stand for in this section. Does it refer to study design? the development of data collection tool? or something else? - In data collection part: How did you select one of the staff from each country, and how sure are your that this staff is representative of others? - It is not clear how many countries are included, and which countries are considered as low- and middle-income. - What are the inclusion and exclusion criteria for recruiting key informants. How did the authors select theses participants? How these participants are representative? - Which sort of data analysis and statistical tests was used? - Do all low and middle income countries have CDC offices? Results - Presentation of information in the Results section is hard to follow. There are too many numbers. The presentation of the information can be improved using a supporting figure or table. The quality of current figures is poor too. - The headings of some columns in tables are not appropriate, e. g. "number" in Table 3. More over the calculations need to be rechecked, for example the calculation of percentage in line 12 should be changed to 100% because the number of responses is 15 and the number of participating countries/key informants is 15. Hence all countries/key informants responded to this question. The same applies for percentage in some other lines such as line 20. The same check should be done on other tables. Discussion - What I miss in this section are the comparison of the findings of this study with the findings of other similar studies, the concrete message and implications of the study.

VERSION 1 – AUTHOR RESPONSE

Reviewer 1, Hannah Leslie (Harvard TH Chan School of Public Health, U.S.A.)

Major

- The sampling of countries, overall response rate, and within section response rate deserve greater attention and more complete presentation to ensure results are not over generalized. Please consider:

o Providing some explanation for which countries had CDC offices with HIV and TB staff as background for the initial selection of these countries, potentially describing what portion of LIC and MIC this encompasses or geographic range

o Listing all contacted countries, in a map or table, supplemental information if preferred

o Noting any differences in respondent / non-respondent countries in terms of geography, income, disease burden as applicable

Authors:

Thank you very much for this suggestion. We have added a supplemental table including the contacted and responding countries. We also added text describing some of the differences in respondents in lines 392-394 of the tracked manuscript.

- The decision to exclude non-responses within the survey from the denominator may introduce systematic upward bias into the findings if respondents from countries with less well developed health systems were less likely to answer each question, which seems plausible. I understand that it would be inappropriate to take any formal approach to missing data here, but I would encourage additional efforts to present the results to reflect the gaps in the data. Please consider:

o Reporting the % of responding countries out of all 15 as well as out of those with complete information to provide the range of possible outcomes if those countries that did not respond did not have the policies in place vs. if they were similar to those countries that did respond. It may be useful to report on those countries with the least complete / most complete information to help readers understand how missing responses may (or may not) relate to the valid responses.

- In light of both points, revisit key messages, abstract, and discussion to specify that results pertain to 15 countries that chose to respond and consider the implications of both the original sample and then the responsive countries. Wording can be a bit broad at times - ‘most responding countries’ is unclear without further context, and the concluding line ‘most countries’ goes beyond the actual sample.

Authors:

Thank you very much for raising this concern. We agree that it is plausible that non-respondents did not respond to questions because they had less developed systems. It may also be plausible that they did not respond to questions because they did not know the answer to the question at the time of filling the survey and would have responded positively had they known the answer. It is difficult to predict which hypothesis is correct and it may vary from country to country. While imputing negative and positive responses for them can explore the range of options, we felt this could introduce measurement bias into the reported estimates. Therefore, we have added text to our limitations on the missing data and mentioning how this could be improved in future surveys in lines 397-401. As suggested, we have also revised our text to ensure we state “most responding countries” rather than “most countries”. Since this was a survey we felt it was appropriate to report the countries that responded and their results. We have also included the non-responding countries as a supporting file (as suggested above).

- Context for health information systems, particularly for health system as a whole.

o Would it be possible to provide broader context for health information systems in the introduction, in a few sentences or a box / figure listing the universe of health information systems referred to in line 181? This would be useful before narrowing in on the 3 selected here; a brief justification for these 3 would be helpful as well.

Authors:

Thank you very much for this suggestion. We have expanded our introductory text on health information systems in lines 188-194.

o How did the impetus of HIV surveillance influence the topics and form of the questionnaire as reported in the general findings here? Several of the definitions reference HIV in particular in the tool itself, though this is not mentioned in the manuscript. Consideration of whether respondents may have reflected primarily on HIV-specific resources would be helpful

Authors:

Thank you very much for raising this concern. This manuscript covered cross-cutting health information systems. There were separate questions related to HIV-specific systems that were influenced by the HIV surveillance lens. We plan to report these results separately in a different manuscript encompassing HIV-specific systems.

o The manuscript is written in terms of health information systems as a whole, but it does not seem that the survey distinguished service-specific HIS. Particularly given the development of parallel HIS for priorities such as HIV and TB, it would have been useful to understand the scope of the case reporting and patient monitoring systems. Any additional insight on the breadth of the systems in place or the further research required to understand the actual scope of systems in use would be helpful.

Authors:

Thank you very much for this suggestion. We did include some questions related to independent HIV systems that we plan to report separately. We have added some text mentioning disease-specific systems in line 344 and indicated the need to examine them further in the context of the transition to social health insurance-based systems in lines 348-350.

o ‘Linkage’ could mean a range of things, from interoperable systems with a common ID to totally independent systems that can produce summary information for the same locations and times. There are many challenges in calculating indicators that require distinct information sources for the denominator and numerator (like women carrying to term in a region and women receiving appropriate quality of delivery care at a formal health facility); it would be helpful to discuss further what linkage meant in this context or, if no further detail can be provided, what additional details might be sought in the future to better understand the actual use and usability of these systems.

Authors:

Thank you very much for raising this concern. We agree and have added this as a limitation in lines 403-404.

Minor

- Line 237: “Government counterparts” – in country?

Authors: Thank you for pointing out this potentially confusing text. We have added the qualification “national” to make clear that these were in country counterparts in line 247.

- The finding on geographic coverage is not included in the Results text, worth noting since this is featured in discussion

Authors:

Thank you very much for raising this oversight. We have added these findings to the results section in lines 285-286 (case reporting), 301-302 (patient monitoring), and 320-322 (CRVS).

- Lines 311 – 312: Reported use of individual level data by MoH respondent does not necessarily indicate accessibility and use for end users.

Authors:

Thank you very much for raising this concern. We have revised the text to indicate that more granular and accessible data may be available for end-users (rather than are becoming) in lines 329-331.

Reviewer 2, Reza Khajouei (Kerman University of Medical Sciences, Iran)

Abstract

- The information in all sections of the manuscript especially different parts of the Abstract section should be consistent. In the methods of the Abstract data were collected from key informants in 51 centers, while in the results of the Abstract key informants in 15 countries responded to the questionnaire. It is not clear in how many countries these 51 centers are located or key informants in how many countries were contacted. Likewise, "health information systems" in the objective and "electronic systems" in the results.

- The conclusions of the Abstract is not clearly aligned with objective of the study.

Authors:

Thank you very much for your review of our article. We take your concerns very seriously and have addressed them point by point in the ensuing pages.

We have now included a supplementary table that includes the contacted and responding countries to clarify the concern above.

We included both paper and electronic based health information systems in this article. The reason we included the word ‘electronic’ in the results is because we had survey questions asking countries whether each of their systems was paper or electronic.

Our objective was to summarise the status of health information systems in this survey. We made comprehensive efforts to document our limitations and hope we also successfully summarised the status of health information systems in the responding countries.

Strengths and limitations of this study

- In this section (page 8) conclusions of the study are presented instead of the strengths and limitations of the study.

Authors:

Thank you very much for raising this concern. We have revised our strengths and weaknesses in lines 159-177 of the tracked manuscript.

Introduction

- I doubt about the categorization of major health information systems in paragraph 2 of the Introduction section. It seems that the large number of health information systems which are used in hospitals and other health care centers are missed in these categories.

Authors:

Thank you very much for raising this point. We have added text describing some more background on health information systems from WHO and why we selected these three systems in lines 188-194.

- Authors should clearly present the gap in the knowledge, what is known and what is unknown about the subject and why it is important to fill this gap, current solutions in the Introduction section.

Authors:

Thank you very much for this suggestion. We have included text that there are limited publications evaluating health information systems in lines 209-211. We have included a reference for one

evaluation completed by WHO Africa regional office as reference 12. Our proposed solution was to carry out a survey to summarise the status (lines 211-212).

Methods:

- There is not sufficient information about the development of the data collection tool and methods for confirming its reliability and validity.

Authors:

Thank you for this suggestion. We have included additional text on the contributors of the survey development team and that it was piloted prior to full implementation in lines 216-221.

- The subheadings in the Methods section are not appropriate, e.g. what does "design" stand for in this section. Does it refer to study design? the development of data collection tool? or something else?

Authors:

Thank you very much for raising this oversight. We have revised the text to indicate survey design in line 215.

- In data collection part: How did you select one of the staff from each country, and how sure are your that this staff is representative of others?

Authors:

Thank you for very much for this query. We have revised the text to indicate that CDC country staff overseeing strategic information covered health information systems, surveillance, and monitoring and evaluation in lines 244-245.

- It is not clear how many countries are included, and which countries are considered as low- and middle-income.

Authors:

Thank you very much for raising this concern. In Table 2 we have included the responding fifteen countries. We have also included their income classification based on World Bank criteria.

- What are the inclusion and exclusion criteria for recruiting key informants. How did the authors select theses participants? How these participants are representative?

Authors:

Thank you very much for this question. In lines 244-248 we specify our criteria for selecting key informants.

- Which sort of data analysis and statistical tests was used?

Authors:

Thank you very much for this question. We summarised our data analysis in lines 254-259. Given that with countries acting as our unit of measure we had limited statistical power, we chose not to conduct statistical tests but rather describe the results of the survey using proportions.

- Do all low and middle income countries have CDC offices?

Authors:

Thank you very much for this question. We specify the full list of contacted and responding countries in the appendix.

Results

- Presentation of information in the Results section is hard to follow. There are too many numbers. The presentation of the information can be improved using a supporting figure or table. The quality of current figures is poor too.

Authors:

Thank you very much for this suggestion. We have used a standardised text to report our results for each of the systems in the narrative and have complementary tables and figures. Our figures were designed in order to meet BMJ Open criteria.

- The headings of some columns in tables are not appropriate, e. g. "number" in Table 3. More over the calculations need to be rechecked, for example the calculation of percentage in line 12 should be changed to 100% because the number of responses is 15 and the number of participating countries/key informants is 15. Hence all countries/key informants responded to this question. The same applies for percentage in some other lines such as line 20. The same check should be done on other tables.

Authors:

Thank you very much for your review of the tables. We rechecked the numbers specified in Table 3 and found that we reported 13 as a numerator, 15 as a denominator, and 87 as the percentage in line 12. We also found that we reported 14 as a numerator, 15 as a denominator, and 93 as the percentage in line 20.

Discussion

- What I miss in this section are the comparison of the findings of this study with the findings of other similar studies, the concrete message and implications of the study.

Authors:

Thank you very much for this suggestion. We have revised the text to indicate that to our knowledge there are no other national assessments of these health information systems. There were many findings of this survey, therefore in the conclusion we have focussed on the key messages around strengths and opportunities for system development and the need to monitor and evaluate this area over time to achieve the SDGs.

VERSION 2 – REVIEW

REVIEWER	Hannah Leslie Harvard TH Chan School of Public Health, United States
REVIEW RETURNED	15-Feb-2019

GENERAL COMMENTS	Dear authors, Thank you for your careful revision of the manuscript following review; I appreciate the efforts made to address editor and

	reviewer concerns. I note below a small number of areas for continued attention, mainly around being explicit in showing the non-response in the abstract, bullets, and figures as well as making the inference appropriate to the study findings. • The strengths and limitations section can be further revised to focus entirely on methods. The first bullet still reflects results rather than a strength or limitation of the methods. The low overall response rate and to a lesser extent the missing values for individual questions are key limitations that are not explicit at the moment. Consider revising bullet four to comment on the generalizability (or lack of) rather than calling for more research, which can be done in the discussion – it may be useful to note the number of low-income vs. middle-income countries of the 15 respondents in this limitation • The issue of non-response to individual items remains a concern. To more rigorously indicate survey non-response, please include numerator and denominator in the results in the abstract, as many of these percentages are based on a subset of the responding countries. Similarly, maps should include all 15 countries in all cases, with a different shading for those that did not respond. • Which results does the final sentence of the Abstract Results section on electronic systems refer to? I am unable to match these figures to specific statements in the Results or Tables – are we to infer them from the maps? If so, please state the same numbers in the Results section referring to the maps for greater clarity. • Please define coverage (referred to as coverage in the results and geographic coverage in the discussion) in the methods section and indicate the justification for the selection of 75% coverage as a threshold. Coverage could be based on population size, number of health facilities (out of all or out of public), number of regions, square kilometers… • My previous concern about disease-specific systems has not been fully addressed – it is not clear from the survey that respondents would be speaking of electronic systems that address an entire health system, platform (primary care), or suite of diseases. Indeed, much of the prior literature suggests that a key concern is the number of overlapping and duplicative health systems (see for instance the work of the Health Data Collaborative mapping HIS in Tanzania [1]) that are each devoted to different diseases or services. If my interpretation of the survey is reasonable, at least a mention should be made that results are indicative only that at least one system exists, and do not speak to the breadth of coverage relative to diseases or interoperability, to avoid overstatement of the findings. Best, Hannah Leslie 1. Health Data Collaborative, Health Data Collaborative Progress Report 2016-2017. 2017, Health Data Collaborative.

VERSION 2 – AUTHOR RESPONSE

Reviewer 1, Hannah Leslie (Harvard TH Chan School of Public Health, U.S.A.)

- The strengths and limitations section can be further revised to focus entirely on methods. The first bullet still reflects results rather than a strength or limitation of the methods. The low overall response rate and to a lesser extent the missing values for individual questions are key limitations that are not explicit at the moment. Consider revising bullet four to comment on the generalizability (or lack of) rather than calling for more research, which can be done in the discussion – it may be useful to note the number of low-income vs. middle-income countries of the 15 respondents in this limitation

Authors:

Thank you very much for this suggestion. We have withdrawn the first bullet changed the fourth bullet to focus on generalisability, and added a fifth bullet discussing the limitation surrounding differences in the number of questions answered by each respondent in lines 172-183:

- "To our knowledge this is the first detailed multi-country assessment of national case reporting, patient monitoring, and vital statistics systems

- Given that this survey was administered electronically, there may have been differences in how respondents interpreted question and answer choices

- Knowledge and experience of respondents may have varied from office to office

- Given that the survey represents 15 countries globally the results may not be globally representative

- Given that survey respondents did not answer all questions, there are differences in the denominator across questions"

- The issue of non-response to individual items remains a concern. To more rigorously indicate survey non-response, please include numerator and denominator in the results in the abstract, as many of these percentages are based on a subset of the responding countries. Similarly, maps should include all 15 countries in all cases, with a different shading for those that did not respond.

Authors:

Thank you very much for this suggestion. We have revised the abstract to include numerators and denominators in lines 143-153:

"Key informants in 15 countries responded to the questionnaire. Several key informants did not answer all questions, leading to different denominators across questions. The Ministry of Health coordinated case reporting, patient monitoring, and CRVS systems in 93% (14/15), 93% (13/14), and 53% (8/15) of responding countries, respectively. Domestic financing supported case reporting, patient monitoring, and CRVS systems in 86% (12/14), 75% (9/12), and 92% (11/12) of responding countries, respectively. The most common uses for system-generated data was to guide programme response in 100% (15/15) of countries for case reporting, to calculate service coverage in 92% (12/13) of countries for patient monitoring, and to estimate the national burden of disease in 83% (10/12) of countries for CRVS. Systems with an electronic component were being used for case reporting, patient monitoring, birth registration, and death registration in 87% (13/15), 92% (11/12), 77% (10/13), and 64% (7/11) of responding countries, respectively."

We have also redrawn figures 1-5 to include a shade for non-responding countries.

• Which results does the final sentence of the Abstract Results section on electronic systems refer to? I am unable to match these figures to specific statements in the Results or Tables – are we to infer them from the maps? If so, please state the same numbers in the Results section referring to the maps for greater clarity.

Authors:

Thank you very much for this suggestion. These data are linked to figures 1-5 and the results section in lines 295-296, 311-312, and 326-329. We have corrected a discrepancy with the electronic CRVS results presented in the abstract and those in the results section.

• Please define coverage (referred to as coverage in the results and geographic coverage in the discussion) in the methods section and indicate the justification for the selection of 75% coverage as a threshold. Coverage could be based on population size, number of health facilities (out of all or out of public), number of regions, square kilometers…

Authors:

Thank you for this suggestion. We did not define coverage in our tool and agree that it could be interpreted in the ways you suggested. We have added this potential difference in interpretation to our limitations section in lines 415-420:

“Moreover, since we conducted this survey electronically, there may have been differences in the way questions were interpreted across different key informants. This could have affected their answer selection. For example, linkage could be interpreted as interoperability across different systems or producing summary information for the same location and time while coverage have used health facilities, regions, or other measures as a denominator. Including more definitions in the survey tool could establish common terminology during future iterations of this survey.”

• My previous concern about disease-specific systems has not been fully addressed – it is not clear from the survey that respondents would be speaking of electronic systems that address an entire health system, platform (primary care), or suite of diseases. Indeed, much of the prior literature suggests that a key concern is the number of overlapping and duplicative health systems (see for instance the work of the Health Data Collaborative mapping HIS in Tanzania [1]) that are each devoted to different diseases or services. If my interpretation of the survey is reasonable, at least a mention should be made that results are indicative only that at least one system exists, and do not speak to the breadth of coverage relative to diseases or interoperability, to avoid overstatement of the findings.

Authors:

Thank you very much for this suggestion. We have added this text in lines 343-345:

“Importantly, these results are indicative of systems interpreted by key informants as meeting the survey definitions and do not speak to the breadth of coverage relative to specific diseases or interoperability.”