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Zimbabwe's Human Resources for health Information System (ZHRIS)—an assessment in the context of establishing a global standard

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Abstract

Introduction: There have been numerous global calls to action to utilize human resources information systems (HRIS) to improve the availability and quality of data for strengthening the regulation and deployment of health workers. However, with no normative guidance in existence, the development of HRIS has been inconsistent and lacking in standardization, hindering the availability and use of data for health workforce planning and decision making (Riley et al., 2012). CDC and WHO partnered with the Ministry of Health in several countries to conduct HRIS functional requirements analyses and establish a Minimum Data Set (MDS) of elements essential for a global standard HRIS. As a next step, CDC advanced a study to examine the alignment of one of the HRIS it supports (in Zimbabwe) against this MDS.

Method: For this study, we created a new data collection and analysis tool to assess the extent to which Zimbabwe's CDC-supported HRIS was aligned with the WHO MDS. We performed systematic "gap analyses" in order to make prioritized recommendations for addressing the gaps, with the aim of improving the availability and quality of data on Zimbabwe's health workforce.

Results: The majority of the data elements outlined in the WHO MDS were present in the ZHRIS databases, though they were found to be missing various applicable elements. The lack of certain elements could impede functions such as health worker credential verification or equitable in-service training allocation. While the HRIS MDS treats all elements equally, our assessment revealed that not all the elements have equal significance when it comes to data utilization.

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Authors' contributions

KW, AZ and RK conceived the project and developed the detailed protocol; KW conducted the assessments, facilitated by TS and ZB; KW performed the analyses, with input from AZ and RK; KW completed the first draft, AZ and TS contributed to subsequent drafts; all authors approved the final draft.

Conflict of interest

None declared.

Further, some of the HRIS MDS elements exceeded the current needs of regulatory bodies and the Ministry of Health and Child Care (MOHCC) in Zimbabwe. The preliminary findings of this study helped inspire the development of a more recent HRH Registry MDS subset, which is a shorter list of priority data elements recommended as a global standard for HRIS.

Conclusion: The field-tested assessment methodology presented here, with suggested improvements to the tool, can be used to identify absent or unaligned elements in either an HRH Registry or a full HRIS. Addressing the prioritized gaps will increase the availability of critical data in the ZHRIS and can empower the MOHCC and councils to conduct more strategic analyses, improving health workforce planning and ultimately public health outcomes in the country.

Keywords

Human resources information systems (HRIS); Human resources for health (HRH); Global public health informatics; Workforce surveillance; Data standards; Health workforce registry; Minimum data set (MDS)

1. Introduction

Health systems and services are dependent on the numbers, skills, and commitment of health workers [2]. Yet, in 2006, the World Health Organization (WHO) estimated the global shortage to be around 2.4 million physicians, nurses and midwives, and over 4 million health workers overall [3]. In 2014, the International Labour Office (ILO) estimated that globally 10.3 million additional health workers are required to close current gaps and ensure the delivery of universal health care. This estimation was based on a threshold of 41.1 health workers per 10,000 population necessary for providing quality services to all in need [4]. Most recently, the Commission on Health Employment and Economic Growth cited a projected shortage of 18 million health workers to achieve and sustain the United Nations Sustainable Development Goals by 2030, primarily in low and lower-middle income countries [5]. The situation is worst in developing countries. The WHO reported Africa as having 24% of the global burden of disease but access to only 3% of the world's health workers [3]. Simultaneously, there is a vast absence of basic data for monitoring human resources for health (HRH), such as on numbers of health personnel available for employment, their qualifications, and the geographic locations of those actively employed. There is also a lack of comparable HRH data standards between countries, poor timeliness and incentives for HRH data provision, and slow progress in the development of electronic systems for HRH data management [1,6] https://academic.oup.com/jamia/article/doi/10.1093/jamia/ocw141/2907914/Human-resource-information-systems-in-health-care (Human resource information systems in health care: a systematic evidence review). According to a 2013 WHO report, this is especially the case in countries where health workforce shortages are greatest [7].

A human resources information system (HRIS) is a system of collection, storage, analysis, and reporting of data to produce meaningful information about the health workforce, including demographics, capacity, training needs, deployment, and migration patterns. Reliable HRIS can provide information to facilitate evidence-based HRH

decision making [8], http://human-resources-health.biomedcentral.com/articles/doi/10.1186/s12960-016-0159-y (eSIP-Saúde: Mozambique's novel approach for a sustainable human resources for health information system), and are critical for targeting limited HRH resources to the areas of greatest need, reducing inequalities in health workforce distribution, and improving health outcomes.

There have been numerous global calls and initiatives to promote investments in HRIS, especially in Africa [9–12]. However, HRIS have faced a number of challenges to accomplishing the goal of effective HRH data management and use by key stakeholders [1]. HRIS across Africa also developed without global normative guidance or standards, and therefore lack consistency in data availability, quality, management and use across countries. To strengthen HRIS implementation globally, WHO, with funding and support from the US Centers for Disease Control and Prevention (CDC) under the President's Emergency Plan for AIDS Relief (PEPFAR), developed a methodology to better understand the business processes of HRH planning and management in select countries and to identify the essential data elements any HRIS should possess in order to ensure effective HRH data management and use. The methods used are known more formally as business process mapping and functional requirements analysis – two well-established informatics techniques [13,14].

The WHO methodology was conducted in three countries: Rwanda, Guatemala, and Nigeria, and involved in-depth interviews with hundreds of stakeholders across the health sector about their needs for HRH data, and their processes for the collection, analysis, and reporting of HRH data. Interviewees included directors, managers, and other key decision makers, at academic institutions, regulatory bodies, hospitals, and ministries (e.g., of health, education, finance, labor). The outcome of this work was a defined Minimum Data Set (MDS) of elements for an international standard HRIS, applicable to health care settings at every level of complexity. The global MDS was validated at international conferences by a technical body of global experts from over 20 countries [15,16]. In-country findings were validated through national stakeholder workshops. This MDS comprised 214 total data elements, with recommended data format standards for each.

As a next step, CDC conducted an exercise to assess the alignment of a national HRIS to this global MDS. This alignment exercise was the first of its kind, and was designed to identify missing data elements that should be added to national HRIS to improve HRH data management and use. The first country selected for this alignment exercise was Zimbabwe. Zimbabwe's HRIS (ZHRIS) was established in 2009, with initial support from Emory University's Lilian Carter Center for International Nursing, and ongoing support from CDC/PEPFAR. ZHRIS was implemented by the Ministry of Health and Child Care (MOHCC) and several national professional regulatory councils. The Health Informatics Training and Research Advancement Centre (HITRAC), a health IT unit based at University of Zimbabwe, has led development of the system since 2011. The system comprises several interoperable MySQL databases, deployed at each regulatory council and at national and subnational MOHCC offices. This paper reports the key findings from this innovative alignment exercise, and offers a recommended methodology for conducting future alignment exercises with other countries' HRIS, which ultimately will help strengthen HRIS implementation globally.

2. Methods

The methodology employed for this study was a gap analysis, designed to assess alignment of the ZHRIS with the WHO MDS and identify missing data elements which could impact the system's effectiveness. Two evaluation questions were assessed:

1. Which elements of the WHO Minimum Data Set are the ZHRIS databases not currently capturing?
2. Which elements of the MDS currently in the ZHRIS are not captured using the format recommended by WHO?

2.1. Tool development

As the first assessment of its kind, it was necessary to develop a completely new tool for this study. The MDS document produced for the Ministry of Health in Rwanda [17] was used as the source document for this tool. The MDS comprises 140 person identifiable elements (i.e. demographics), in addition to individual recommended data elements within each "major" lifecycle stage – planning, entry, exist and exit, and the "minor" subcategories of core activities within these stages (e.g. training) – bringing the total number of elements to 214.[1] The MDS also specifies data formats, often international coding standards (e.g. specific International Organization for Standardization [ISO] codes), the use of which is recommended to capture each data element and allow global comparability.

We translated the MDS into a structured MS Excel-based tool (Fig. 1), creating a suitable format for systematically cataloguing the existence and data standard of each of the 214 WHO data elements in the ZHRIS, and for performing data aggregation and analysis.

Strategies used to test the tool included soliciting input from subject matter experts at WHO and CDC HQ for face validity; entering dummy data to test the tool's functionality and behavior; and entering sample data from a real (decommissioned) HRIS as a way of anticipating potential issues. A non-research determination protocol for the study was approved through CDC's clearance process.

2.2. Data collection and analysis

Assessed databases included the MOHCC national HRIS database, and the HRIS databases deployed at the Medical and Dental Council of Zimbabwe (MDPCZ) and the Nursing Council of Zimbabwe (NCZ).[2] Data collection involved conducting desk audits of both person identifiable data elements and lifecycle data elements captured by the software for each of the ZHRIS databases in February 2013. Each data element in the MDS was searched for in the databases through manual queries, often in consultation with the lead software developer for that database.[3] The WHO definition of the elements was checked

[1] In 2015, WHO produced a follow-up report establishing a Minimum Data Set for Health Workforce Registries – 10 core data items comprising around 40 of the HRIS elements used in this study [18].
[2] The database at the NCZ served as a model/template for additional ZHRIS databases.
[3] Devising scripts to automate data extraction was considered as an alternate method of data collection but rejected because variations in naming conventions between the MDS and the ZHRIS databases would necessitate clarifying data element definitions even if the fields shared the same name (e.g., retirement date meant *end of worker's service* in the MDS but *deletion* from the ZHRIS databases).

with the developer to ensure that what was being captured was the same as what was being recommended. For Evaluation Question One, the following labels were then assigned to each data element:

- Yes – if the element was present and had the same meaning.
- Partial – if the element was present and had a close but not completely same meaning (which sometimes involved further discussions with a WHO expert to clarify definitions).
- No – if the element was absent from the database.

Conditional formatting was used to assign these labels colors for instant visual categorization: green (element present); yellow (element partially present) and red (element absent).

For Evaluation Question Two, which pertained to elements for which the answer to Evaluation Question One was Yes or Partial, the following labels were then assigned to each data element in a separate column of the tool, color coded as above:

- Yes – if the element was captured in the format recommended by WHO.
- Partial – if the element was captured in a similar but not completely same format (e.g. WHO specified a minimum field length to capture sufficient detail and the ZHRIS field contains far fewer characters, or a standard report can be produced for some not all elements specified by WHO).
- No – if the element was captured but not in the format recommended (i.e. WHO specified an international coding standard, such as ISO, and the ZHRIS database field was free text).

Summary tables and charts were created for each assessed database, characterizing the degree of alignment of Zimbabwe's HRIS, by each MDS category. This enabled the researchers to identify the major areas of weakness (i.e. poor alignment) in the system.

The researchers also produced more detailed narratives (not shown), ordered by categories and elements, with prioritized recommendations for changes to the ZHRIS in terms of high, medium, or low priority rankings, based on the relative importance of the data element to HR policy and programs in Zimbabwe. A summary of the International Coding Standards recommended in the WHO MDS (not shown), including hyperlinks that could be followed for further information on those standards, was produced for elements applicable to Zimbabwe.

3. Results

3.1. Evaluation question 1

"Which elements of the WHO Minimum Data Set are the ZHRIS databases not currently capturing?"

3.1.1. The MOHCC database—Looking at the data elements in aggregate (Table 1), the assessment found that 55% of the data elements outlined in the WHO MDS were present in the MOHCC database (43% fully present, and another 12% partially present), and 45% absent.[4] Of the WHO Major Categories, Person Identifiable was missing the highest number and percentage of elements. The Exist and Entry categories were missing the next highest number and percentage of elements, respectively. Some elements were deemed not appropriate for inclusion, due to in-country HR policies or practice. These elements were labelled N/A and formatted grey in the tool.

For the MOHCC database, with respect to the MDS domain of person identifiable data (Fig. 2), the WHO minor categories with the greatest number of missing elements were Birth History (10); Citizenship, Country of Residence, and Language (7); and Professional License and Certification (7).

In the MDS domain of lifecycle data (Fig. 3), the WHO minor categories with the largest numbers of missing elements were Training (in-service) (5); Education – Enrollment and Graduation (4); and Disciplinary Action (3).

3.1.2. The regulatory council databases—With respect to the two regulatory council databases, the figures and tables were also produced (not shown). Person identifiable categories with the largest numbers of missing elements for both councils' databases were Birth History; Citizenship, Country of Residence, and Language; and also Employment Current Address for the NCZ, and Education History for the MDPCZ. Lifecycle categories with relevant elements missing for both councils were Training (inservice); Education – Enrollment and Graduation; and Disciplinary Action. Some elements were not applicable for regulatory bodies. For example, the councils are not expected to collect data for HR functions such as Leave or Vacancies. These elements were also labelled N/A and formatted grey in the tool.

3.2. Evaluation question 2

"Which elements of the MDS currently in the ZHRIS are not captured using the format recommended by the WHO?"

Overall, the majority of the data elements present in the MOHCC database were captured using the WHO recommended formats (Table 2). The highest percentage of elements being captured not using the format recommended by WHO were in the Person Identifiable Category: 50%. For the regulatory councils, Person Identifiable was the only category in which elements were not all being captured in the formats recommended by WHO. The percentage not aligned was 39% in the NCZ database, and 37% in the MDPCZ database.

[4]Denominator for percentages was the total number of MDS elements excluding those not applicable to Zimbabwe.

4. Discussion

4.1. ZHRIS assessment findings

Overall, the ZHRIS databases contained the majority of the WHO essential elements. It is not suprising that the system was not fully aligned, given the lack of existing published standards and that ZHRIS was developed to meet the particular needs of stakeholders in country. However, at the time of the assessment, some important HRIS data elements were found to be absent. This section highlights some potential impacts.

4.1.1. Person identifiable elements—The ZHRIS databases all captured national identity (ID) numbers, which are valid for life in Zimbabwe, though none captured date and place of issue for any IDs and only MDPCZ captured date of expiration (for other IDs). MOHCC and MDPCZ could capture an unlimited number of other unique identifiers (e.g. for driver licenses, passports) and the developers had plans to add this functionality to the NCZ. The ZHRIS databases all captured date of birth and gender, which are Birth History elements that can be used to monitor workforce inequalities and discrimination. They were missing place of birth details and parents' names (in countries that do not have unique national identifiers, where people do not know accurate birth dates and frequently have the same names, these elements are required to uniquely identify someone), and only the MDPCZ had the capability to upload and store photographs. All of these elements are important for verifying health worker identities, avoiding duplicated records and matching with payroll. The ability of a MOH to verify credentials by confirming personal identities before offering employment helps to identify fraudulent applications by individuals who may not be qualified and to provide motivation for health professionals to register with regulatory councils [8]. ZHRIS captured citizenship but lacked country of residence, which is relevant to considering legal employment status (and may impact workers' employment terms and benefits) and to understanding reliance on foreign health workers. ZHRIS also lacked language abilities, which are relevant for communication in rural areas or emergency deployment in a country with multiple spoken languages.

The MOHCC deployment database did not capture the recommended professional license, registration and certification elements, instead depending on the regulatory council databases for individuals' data. Given the unreliability of the internet connection, a key recommendation was that the MOHCC database also captures these elements, enabling the instant verification of workers credentials and running of up-to-date reports. Lacking these elements risked the MOHCC being unable to enforce that health workers are qualified to practice.[5] Employment current address elements were not fully aligned in any of the ZHRIS databases. Although not being used at the time, the MOHCC database was able to capture GPS latitude and longitude coordinates, which would help determine deployment locations and faciliate analysis even in the absence of elements such as town or postal code. The NCZ database, however, captured no address details except facility name and type. The MDPCZ could capture the majority of address elements, though it was reported that the council was not interested in work address, only home address. Since regulatory council databases are

[5]HITRAC has since made it possible to transfer credentials and other information between the councils and the MOHCC through an integration platform based on OpenHIE and OpenInfoMan technologies.

often the only way of tracking where health workers in the private sector are deployed, it is important they take the opportunity to capture current employment details when the workers come to relicense each year.

A strength of the ZHRIS design is the ability to capture an unlimited number of previous employment posts, but it was only being used to capture public sector employment history. Non-government employment history was not being captured, meaning they might be missing important professional experience that is useful for planning.

4.1.2. Lifecycle elements—Many elements for Training (In Service) were not being captured by the ZHRIS databases, such as Location and Source of Funding for the training, and Certificates of Completion. As national governments and donors, such as PEPFAR, continue to make major investments in health worker training, it is important that MOHs track individual attendance and have the data available to use for strategic and fair allocation of training. Poor dedication of resources can lead to some individuals receiving the same training from different donors while other workers receive no training for years. Councils could also use these elements to track Continuing Professional Development (CPD), which is a critical vehicle for ensuring health professionals are keeping their skills up-to-date so they can deliver the best patient care. In many countries a health professional must meet CPD requirements in order to relicense. MOHs can analyze HRIS information on health workers' training to inform more equitable deployment strategies, aligning specialized skill sets with service provision (reference on eSIP-Saude, as above: http://human-resources-health.biomedcentral.com/articles/10.1186/s12960-016-0159-y).

MOHCC and MDPCZ databases lacked more than half the elements on pre-service educational enrollments, impeding the ability to track and analyse current enrollments by department and gender, hindering planning. Although the NCZ was only missing one element (Name of Department Enrolled), the council could not track students from the actual date of enrollment because it only became known when the students came to register at the council six weeks prior to their final exam. HRIS can be used to index students from when they enroll at academic institutions, as is done in Kenya [8], allowing the generation of regular reports on numbers of enrollees, by specialization and expected year of graduation. This "pipeline" is useful for strategic planning and gap analyses. Whether and when to capture it in ZHRIS is a policy decision that requires the MOHCC and regulatory councils to engage with academic institutions and agree on a process.

ZHRIS databases were missing some important elements with respect to Disciplinary cases, including dedicated fields for Employee Response and Notification. However, they were capturing additional elements beyond the MDS, such as Outcome Categories and Dates Resolved, which are very useful for managing information on cases. Also, none of the databases was able to capture name changes during an individual's working life – important for tracking disciplinary actions associated with a provider.

4.1.3. WHO recommended data formats—Many of the data elements present in the ZHRIS were captured using the WHO recommended formats. A few of those elements that had unaligned formats related to the use of text fields, instead of recommended numeric

or coded values, but most were due to the lack of implementation of international coding standards (e.g. ISO). The areas of greatest misalignment were contact details, home and employment address fields within the Person Identifiable Category. A recommendation is that HRIS should pull key employment address data elements from a national Facility Registry or Master Facility List, where functional.

Ensuring that all the elements are captured using the recommended international coding standards is important as it will facilitate faster analyses, and increase opportunities for interoperability with other systems and data comparability with other countries.

4.2. Methodological findings

The alignment assessment of Zimbabwe's HRIS was a pilot. It helped determine key areas of improvement for the ZHRIS databases, and also yielded insights into how to improve the methodology for future alignment assessments. With the modifications mentioned below, the tools created for this study could be used by other countries to self-assess their HRIS alignment[6] or by donors/stakeholders to conduct assessments.

4.2.1. Data collection—For the exploratory study, a completely new tool and methodology was developed. The tool worked well for data collection, and produced a verifiable record of the fields and tables within the ZHRIS databases containing the WHO MDS elements, which can serve as a baseline for future alignment assessment. Advance/remote access to the databases and data dictionaries, which might have saved some time in the field, was not possible from CDC Atlanta. However, cataloguing the existence of each MDS element, verifying its location and format in the ZHRIS databases, and interpreting the meaning, needed significant input from the developers. Accuracy and efficiency of the assessment would have been significantly reduced without this validation.

4.2.2. Data analysis—Data analysis presented some challenges. As anticipated, a simple Yes/No answer to whether an element is aligned was found to be often insufficient. Interpretation involved discussions with the developer, and sometimes the WHO expert. The discussions were also necessary for understanding the Zimbabwe context. New columns were created in the tool to indicate "Not Appropriate" (N/A), which applied to numerous elements for the reasons stated below. This column was also used to indicate where categories or elements in the MDS were not applicable to the councils, i.e. those which pertained to HR management functions.

4.2.3. Governance issues—Payroll Administration in Zimbabwe is controlled by the Health Services Board (HSB), which uses the Salary Services Bureau (SSB) Progress database. The MOHCC is, in effect, employed by the HSB. Payroll elements therefore will not be accessible in ZHRIS, as they are analyzed at a higher level than the ministry. The same applies for elements in other WHO categories: Action Plan and Budget (Total Budget Requested), Vacancy and Recruitment (Post Establishment Date, Funding Source & Details), and Reports (Projected HR Expenditures). It is therefore important that future replication

[6]A facilitated self-assessment of alignment was subsequently conducted for the CDC-supported HRIS in Mozambique, with minor modifications to the tool.

of this methodology takes into account unique contextual factors that explain a lack of alignment of a country's HRIS with the WHO MDS.

4.2.4. Repeated elements—The Identification Numbers, Education History, and Employment History categories in the MDS all repeated the same elements multiple times (i.e. for the last three employers). The relevant tables in the ZHRIS databases were typically set up to capture unlimited Identity Types, Education and Employment records. Repeating these element groups in the denominator would have given them undue weight, so for this assessment only the first instances were counted.[7] A modified tool might include an "If. . . then" question to address this (i.e. if database can capture unlimited [Identity Types etc], then exclude [repeated elements] from denominator, else include).

4.2.5. Prioritization—The MDS was described as the minimum elements required for a well-functioning HRIS, yet we found some to be more essential than others. An important development in the assessment methodology was separating elements into Low, Medium, and High Importance, in order to produce a list of prioritized recommendations for stakeholders. Although the country context was the key factor in determining priority, default importance could be attached to each element based on the impact of this information being missing and weighted-scores built into the tool. Without this weighting, the percentage alignment scores are less useful than the context-specific prioritized recommendations for identifying areas of the system in greatest need of strengthening.

4.3. Validation with WHO

At the time of assessments, the MDS was unpublished and undergoing validation. The alignment assessments identified aforementioned elements not appropriate for inclusion in the Zimbabwe country context. It also brought to light several areas where ZHRIS is collecting additional elements. These elements (such as differentiation between Full or Part time work hours, and permanent or temporary contracts; required and achieved number of CPD points or credit hours – by cadre and time period) were discussed with WHO experts and deemed to be too granular for the MDS: they could be captured in other systems rather than considered essential in an HRIS. One exception was the recommendation that a Receipts Module be included. During the alignment assessments, stakeholders reported that "councils will not use an HRIS that does not have a payments module" for tracking collection and payment history of fees for registration, re/licensing, and other items (e.g. badges). The MDS contains a Payroll Administration section for HR departments, but assumes fees are received when Date of License is recorded. This merits further consideration.

4.4. HRH registry MDS subset

Validation of the results from the CDC/WHO HRH Functional Requirements Analysis[8] in Nigeria indicated that the burden of capturing the full MDS in a country with a complex

[7]Excluding the payroll and repeated elements from the denominator (and numerator) for the MOHCC altered the percentage of unaligned elements by only a few points, and had no impact on the prioritized recommendations.

[8]CDC/WHO HRH Functional Requirements Analysis is described in the Introduction section of this paper. Nigeria was the third and final country in which the methodology was conducted.

health system should be mitigated by first introducing a “Health Workforce Registry” (aka Human Resources for Health [HRH] Registry) – a subset of the MDS with the truly essential elements [18]. The HRH Registry MDS comprises the majority of the person identifiable elements in the HRIS MDS plus the name of the institution submitting data, and date/time of the submission. In October 2014, Nigeria’s 57th National Council on Health (the highest health decision-making body in the country) approved, and thereby mandated, the implementation of the first ever National Health Workforce Registry throughout the country. PEPFAR now intends to use the HRH Registry MDS to ensure standardized data collection in each of the HRIS it supports. Additionally, the HRH Registry MDS serves as the foundation for the indicators in the primary module of the new National Health Workforce Accounts (NHWAs) [19], implementation of which was endorsed by a 2016 World Health Assembly resolution [20]. NHWAs aim to facilitate standardization of HRIS for interoperability and support tracking of universal health coverage.

4.5. Limitations

This assessment focused on identifying which of the WHO MDS elements were not being captured by the ZHRIS databases at the time of the assessment rather than on elements the system was collecting additional to the MDS, although some of the latter were discussed. Capturing the minimum recommended elements is only the first step towards establishing a well-functioning system. This assessment did not address data quality or data use. Future evaluations could assess completeness and accuracy of the data elements captured (e.g. by verifying the information in a sample of records, and checking the maintenance of the audit trail) and conduct interviews with senior officials at ministries and councils regarding the use and impact of ZHRIS data once the system is more established.

5. Conclusions

Our findings reinforce the need for global standardization of HRIS. The establishment of the world’s first MDS for HRIS is a critical endeavor. The ZHRIS databases were assessed for alignment with the HRIS MDS and were found to be missing various applicable elements, the lack of which could impede functions such as credential checking or equitable in-service training allocation. We recommend that a consistent data dictionary, compliant with international coding standards where applicable, is created for all components of the ZHRIS. Now that the WHO MDS is established this should assist developers conform to a uniform standard across the different databases.

Some of the HRIS MDS elements exceeded the current needs of regulatory bodies and MOHCC in Zimbabwe. These elements should be incorporated into the backend of the databases ready for the future. We recommend that presentation of counts and percentages of alignment be accompanied by a narrative explaining why the individual missing elements are important in the country’s context.

While the HRIS MDS treats all elements equally, our assessment revealed that not all the elements have equal weight. The development of the more recent HRH Registry MDS subset corroborates the need for prioritization. For all countries, we recommend alignment with the published HRH Registry MDS subset as an appropriate first step. The field-tested

assessment methodology presented here, with suggested improvements to the tool, can be used to identify absent or unaligned elements in either an HRH Registry or a full HRIS. We suggest that the WHO makes the full HRIS MDS available online, with supplemental guidance on how to prioritize the different elements, and that any further enhancements made to the MDS is done in collaboration with standard setting bodies.

Addressing the prioritized gaps identified by our assessments would strengthen Zimbabwe's systems for regulating and deploying health workers by increasing the availability of critical data from the ZHRIS and thereby empowering the MOHCC and councils to conduct more strategic analyses. This should improve health workforce planning and ultimately impact on public health outcomes.

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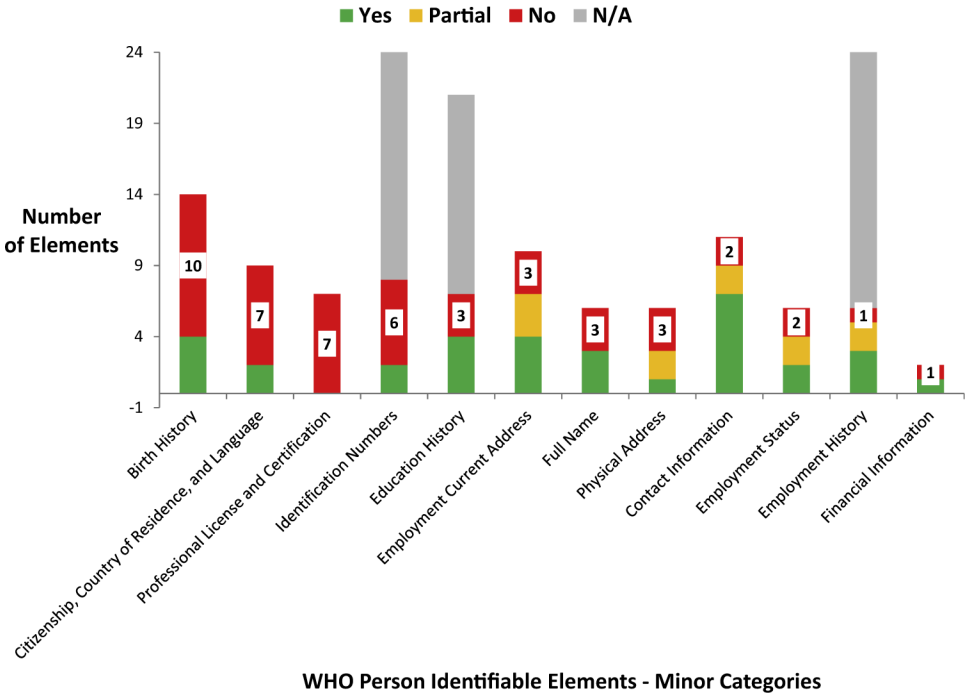

Fig. 1. –.

Snapshot of sample rows from the HRIS Alignment Assessment Data Collection Tool.

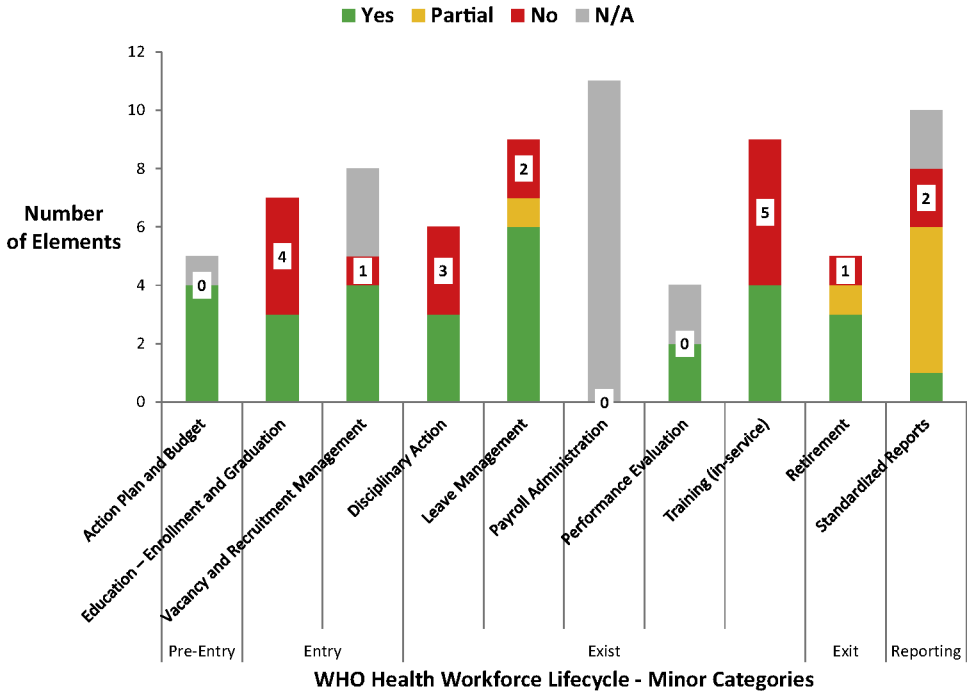

Fig. 2. –.

Number of Person Identifiable Elements aligned for MOHCC (ordered by missing elements).

WHO Major Category	WHO Minor Category	WHO Data Element	Field Exists	Local Fieldname	Comments	Format	WHO Valid Format	WHO Length
Exist	Training (in-service)	Employee UID					Same as UIN	16
Exist	Training (in-service)	Title of the Training					Alphanumeric	26
Exist	Training (in-service)	Date Requested					ISO 8601	8
Exist	Training (in-service)	Start Date of Training					ISO 8601	8
Exist	Training (in-service)	End Date of Training					ISO 8601	8
Exist	Training (in-service)	Duration of Training (days)					Decimal	2
Exist	Training (in-service)	Location of Training					Alphanumeric	26
Exist	Training (in-service)	Funding Source					Alphanumeric	26
Exist	Training (in-service)	Certificate of Completion (certifier's comment)					Alphanumeric	26

Fig. 3. –.

Number of WHO Lifecycle Elements aligned for MOHCC (ordered by lifecycle phase).

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Table 1

Number and Percentage of WHO Elements aligned for MOHCC.

WHO Major Category	WHO Minor Categories	Number (and percentage) ofelements					
		Total	N/A	Total Excluding N/A	Yes	Partial	No
Person Identifiable	Birth History	14	0	14	4 (29%)	0(0%)	10(71%)
	Citizenship, Country ofResidence, Language	9	0	9	2 (22%)	0 (0%)	7 (78%)
	Contact Information	11	0	11	7 (64%)	2(18%)	2(18%)
	Education History	21	14	7	4 (57%)	0 (0%)	3 (43%)
	Employment Current Address	10	0	10	4 (40%)	3 (30%)	3 (30%)
	Employment History	24	18	6	3 (50%)	2 (33%)	1(17%)
	Employment Status	6	0	6	2 (33%)	2 (33%)	2 (33%)
	Financial Information	2	0	2	1 (50%)	0 (0%)	1 (50%)
	Full Name	6	0	6	3 (50%)	0 (0%)	3 (50%)
	Identification Numbers	24	16	8	2 (25%)	0 (0%)	6 (75%)
	Physical Address	6	0	6	1 (17%)	2 (33%)	3 (50%)
	Professional License and Certification	7	0	7	0 (0%)	0 (0%)	7(100%)
Person Identifiable Total		**140**	**48**	**92**	**33 (36%)**	**11(12%)**	**48 (52%)**
Pre-Entry	Action Plan and Budget	5	1	4	4(100%)	0 (0%)	0 (0%)
Pre-Entry Total		**5**	**1**	**4**	**4 (100%)**	**0 (0%)**	**0 (0%)**
Entry	Education— Enrollment and Graduation	7	0	7	3 (43%)	0 (0%)	4 (57%)
	Vacancy and Recruitment Management	8	3	5	4 (80%)	0 (0%)	1 (20%)
Entry Total		**15**	**3**	**12**	**7 (58%)**	**0 (0%)**	**5 (42%)**
Exist	Disciplinary Action	6	0	6	3 (50%)	0 (0%)	3 (50%)
	Leave Management	9	0	9	6 (67%)	1(11%)	2 (22%)
	Payroll Administration	11	11	0	0 (0%)	0 (0%)	0 (0%)
	Performance Evaluation	4	2	2	2(100%)	0 (0%)	0 (0%)
	Training (in-service)	9	0	9	4 (44%)	0 (0%)	5 (56%)
Exist Total		**39**	**13**	**26**	**15 (58%)**	**1(4%)**	**10 (38%)**
Exit	Retirement	5	0	5	3 (60%)	1 (20%)	1 (20%)
Exit Total		**5**	**0**	**5**	**3 (60%)**	**1 (20%)**	**1 (20%)**
Reporting	Standardized Reports	10	2	8	1 (13%)	5 (63%)	2 (25%)

WHO Major Category	WHO Minor Categories	Number (and percentage) ofelements					
		Total	N/A	Total Excluding N/A	Yes	Partial	No
Reporting Total		**10**	**2**	**8**	**1 (13%)**	**5 (63%)**	**2 (25%)**
Total		**214**	**67**	**147**	**63 (43%)**	**18(12%)**	**66 (45%)**

Table 2

Number and Percentage of MDS Elements Captured in MOHCC Database Using WHO Recommended Format.[9]

WHO Major Category	Total	Yes	Partial	No
Person Identifiable	**44**	22(50%)	0(0%)	22 (50%)
Pre-Entry	**4**	1(25%)	2 (50%)	1 (25%)
Entry	**7**	6(86%)	1 (14%)	0 (0%)
Exist	**16**	12(75%)	2(13%)	2 (13%)
Exit	**4**	3(75%)	1 (25%)	0 (0%)
Reporting	**6**	1(17%)	5 (83%)	0 (0%)
Total	**81**	**45 (56%)**	**11 (14%)**	**25 (31%)**

[9]The number of present (63 Yes) or partially present (18 Partial) elements in Table 1 is the denominator (81 Total) in Table 2. Table 2 shows how many of those 81 elements were formatted as recommended by the WHO.