

Regulatory Framework for eHealth Data Policies in Zimbabwe: Measuring FAIR Equivalency

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ABSTRACT

The FAIR Guidelines—that data should be Findable, Accessible, Interoperable and Reusable (FAIR)—aim to improve the management of digital data assets for improved decision making. FAIR comprises 15 elements (called facets) that explain how data should be able to be reused by researchers and policymakers. For this research, eight policy documents were reviewed from Zimbabwe’s Ministry of Health and Ministry of Information and Communication Technology (ICT) from 1999 to 2020. These were scrutinised to determine the mention of the FAIR Guidelines or FAIR Equivalent principles. The vision, mission statement and objectives of these documents were analysed relative to the 15 facets of FAIR. The research found that none of the policy documents in health/eHealth or ICT in Zimbabwe explicitly mention the FAIR Guidelines, but all contain some FAIR Equivalent principles. Hence, the regulatory framework for health/eHealth data management in Zimbabwe is aligned with the FAIR Guidelines and, therefore, a policy window is open for the adoption of FAIR Guidelines in relation to health/eHealth data management.

ACRONYMS

FAIR	Findable, Accessible, Interoperable, Reusable
FE-Score	FAIR Equivalency Score
ICT	information and communication technology
TCP	Transmission Control Protocol

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1. INTRODUCTION

1.1 Background

The FAIR Guidelines for scientific data management and stewardship were first published in the Journal of Scientific Data in 2016 as guidelines for the 'Findability', 'Accessibility', 'Interoperability' and 'Reusability' (FAIR) of digital assets [1]. These guidelines were hinged on the ability of computer algorithms to find, access, interoperate and reuse digital assets (data and its metadata) with little or no human interference (machine actionability) [1, 2]. Since the computational capabilities of human beings are low, compared to computer systems, they rely heavily on machines to create and process big data in diverse environments. The FAIR Guidelines were crafted to suit different contexts, resulting in them being minimally defined [1].

1.2 General Objective

The general objective of this study was to critically analyse information and communication technology (ICT) and health policy documents in Zimbabwe with the aim of determining the possibility of opening a policy window for the adoption of FAIR Guidelines in Zimbabwe's health/eHealth systems.

1.3 Specific Objectives

The **first objective** of this study was to understand the health/eHealth governance framework in Zimbabwe as it aims to enhance eHealth as a solution for the management of digital health data. Two important perspectives were adopted to achieve this objective: (i) the health orientation and delivery perspective, and (ii) the digital data management perspective of ICT policies. These perspectives guided the examination of the vision, mission statement and objectives of each policy.

The **second objective** was to assess the alignment of FAIR Guidelines with the terminology used in Zimbabwe's policy documents to determine the possibility of opening a policy window for the adoption of FAIR Guidelines in relation to Zimbabwe's health data management, with particular attention to eHealth. This objective was achieved through the application of the FAIR Equivalency Score (FE-Score) to all the key policy documents from the Ministry of Health and the Ministry ICT.

The following research questions arose in order to address these two objectives along with the main objective of the study:

- **Research question 1a:** What are the common elements of the visions, missions, and objectives of the Government of Zimbabwe's health/eHealth and ICT policy frameworks from 1999 to 2019?
- **Research question 1b:** How does the health/eHealth governance framework relate to the ICT governance framework in Zimbabwe in terms of achieving data management and data access?
- **Research question 2a:** Do the health/eHealth and ICT policy documents mention the FAIR Guidelines for data management and, if so, to what extent?
- **Research question 2b:** To what extent do the provisions of Zimbabwe's health/eHealth and ICT policies allow for the opening of a policy window for the adoption of the FAIR Guidelines for the management of digital data of healthcare in the country?

2. MATERIALS AND METHODS

This study used a literature review following Basajja et al. [3]. The relevant policy documents of Zimbabwe's ICT and health ministries for the period 1999 to 2020 were selected and examined to determine if they mention the FAIR Guidelines or contain FAIR Equivalent principles. Only relevant and accessible ICT and healthcare policy documents were used from the two ministries. In order to address objective 1: 'To understand the health/eHealth governance framework in Zimbabwe as it aims to enhance eHealth as a solution for the management of digital health data', research question 1a was answered, followed by research question 1b.

In relation to research question 1a, Zimbabwe's health/eHealth and ICT policy documents and frameworks were analysed to determine the common elements of their visions, missions, and objectives. The documents analysed cover a relatively long period of time (over a decade), which enabled the researchers to examine a large number, as some documents were not available when requested, either as hardcopies or online [4].

To address research question 1b, Zimbabwe's health/eHealth policy documents were critically analysed to determine how they relate to the country's ICT policy documents in relation to data management and data access. The aim was to identify the alignment, inconsistencies, interdependencies and independence of these policy documents. This assessment was based on infrastructure perception and support, regulatory compliance, process guidelines and complexities, data access and data management. The examination of the vision, mission and objectives of these policies was meant to illustrate the coherence between the different policy documents in terms of achieving 'Findability', 'Accessibility', 'Interoperability' and 'Reusability'—or FAIRness [1]—in relation to digital assets in the health/eHealth policy documents.

In order to answer research question 2a: 'Do the health/eHealth and ICT policy documents mention the FAIR Guidelines for data management and, if so, to what extent?', the policy documents were scrutinised for their mention of the FAIR Guidelines or FAIR-like principles (FAIR Equivalency). The FAIR facets used to assess the occurrence of each element are: 'Findability' (F1, F2, F3, F4), 'Accessibility' (A1, A1.1, A1.2, A2), 'Interoperability' (I1, I2, I3) and 'Reusability' (R1, R1.1, R1.2, R1.3).

3. RESULTS

3.1 Mention of FAIR Guidelines in Policy Documents

A scan of Zimbabwe's policy documents revealed the use of some FAIR-like terminology in both health/eHealth and ICT policies. The following extracts stress the need to address eHealth concerns in the country through various objectives. Zimbabwe's E-Health Strategy of 2012–2017 cites the need to:

[...] have quality, timely and accessible health information for every Zimbabwean on an integrated platform; to have total interoperability among all health institutions countrywide in health information and services; to have timely and limitless access of health information to users through use of ICT; to have all health functions and services seamlessly running on a single integrated ICT platform; to attain

the highest possible level of e-Health technology in Zimbabwe; to have a seamless electronic health information system availed across Zimbabwe; to have an integrated electronic platform for health information access and sharing for quality health care delivery. [5]

In addition, the Ministry of ICT, in the Zimbabwe National Information and Communication Policy Framework 2005, emphasises the need to “spearhead social change and reduce the gap between the poor and the rich” [6]. Subsequently, the Government of Zimbabwe embraced an ICT policy, the focus of which was to enhance such policies, with the aim to see Zimbabwe become a knowledge-based economy, with ubiquitous connectivity by the year 2020, and to enhance the exploitation of ICTs in solving the socio-economic challenges facing the country [7]. Furthermore, in 2018 the Government of Zimbabwe published an ICT policy, the overall objectives of which were, among other things, to:

[...] ensure the integrity, reliability, availability, and superior performance of ICT Systems; ensure there is consistent use of ICT Systems with the principles and values that govern use of other Parliament of Zimbabwe’s facilities and services; and ensure that ICTs are used for their intended purposes; and establish processes for addressing policy violations and sanctions for violators. [8]

These extracts show that Zimbabwe’s ICT and health policies are synchronised and point in one direction—towards data availability countrywide on an integrated platform. The findings of this research also indicate that ICT solutions in healthcare are dependent upon the ICT regulations of the country.

3.2 FAIR Equivalency

This section looks at whether or not the policy documents mentioned the FAIR Guidelines or use FAIR Equivalent terminology or principles, such as: sharable data, integrate/integrity, availability, consistency, coordination, service delivery platforms, accessibility, interoperability, promotion of research, and data reuse, among other things. The mention of the FAIR Guidelines or FAIR Equivalent principles in the policy document was coded as ‘1’ and the absence of such terms was coded as ‘0’, as illustrated in Table 1.

Table 1. Coding of whether FAIR Guidelines or FAIR Equivalent principles were mentioned (‘1’) or not (‘0’) in policy documents reviewed (1999–2020).

Policy document	FAIR Equivalent	FAIR Mention
National Policy on HIV/AIDS for Zimbabwe 1999	1	0
Zimbabwe National ICT Policy Framework 2005	1	0
Zimbabwe’s E-Health Strategy 2012–2017	1	0
Zimbabwe National ICT Policy 2015	1	0
ZimHealth Strategic Plan 2016–2020	1	0
National Health Strategy for Zimbabwe 2016–2020	1	0
Zimbabwe School Health Policy 2018	1	0
Zimbabwe National Nutrition Strategy 2018	1	0
Total	8	0
Percentage	100%	0%

All eight policy documents reviewed used FAIR Equivalent terms and embraced their importance in their policy announcements for data access and management countrywide. It was, however, also noted that this analysis alone could not fully determine the extent to which the FAIR Guidelines or FAIR Equivalent terms were mentioned (research question 2a) in the policy documents. Hence, the FE-Score was used to further elaborate on the magnitude of their use. The FE-Score was used to assess the degree to which FAIR-like terminology was used each policy document [9] to determine the actual ‘FAIRness’ of each policy document. The total possible FE-Score is 15, as there are 15 metrics or facets (4 for ‘Findability’, 4 for ‘Accessibility’, 3 for Interoperability, 4 for Reusability). Therefore, the FE-Score is the total occurrence of the mention of the FAIR Guidelines/FAIR Equivalent terms in a policy document. Table 2 presents the FE-Score for each document, as well as the score for each facet.

Table 2. FAIR Equivalency in policy documents reviewed.

Policy Document	FAIR Equivalency																
	F1	F2	F3	F4	A1	A1.1	A1.2	A2	I1	I2	I3	R1	R1.1	R1.2	R1.3	FE Score	
Zimbabwe National ICT Policy Framework 2005	0	1	0	0	1	0	1	0	0	0	1	0	0	1	0	1	6
Zimbabwe National ICT Policy 2015	1	1	0	1	1	1	1	0	1	1	1	1	1	1	0	0	11
National Health Strategy for Zimbabwe 2016-2020	0	0	0	0	1	1	1	0	1	1	0	0	1	0	1	7	
Zimbabwe’s E-Health Strategy 2012-2017	0	0	0	0	1	0	1	0	0	0	0	1	0	1	1	0	5
ZIMHEALTH STRATEGIC PLAN 2016-2020	0	0	0	1	0	1	0	0	0	0	0	0	0	0	1	0	3
Zimbabwe School Health Policy 2018	0	1	0	1	1	0	1	0	0	0	0	0	0	1	0	0	5
National Policy on HIV/AIDS for Zimbabwe 1999	0	0	0	1	1	0	1	0	1	0	0	0	0	1	0	1	6
Zimbabwe National Nutrition Strategy 2018	0	1	1	1	0	0	0	0	0	1	0	1	1	1	1	0	8
Average	0.125	0.5	0.125	0.625	0.75	0.375	0.75	0	0.5	0.375	0.375	0.25	0.875	0.375	0.375		
Percentage	12.50%	50%	12.50%	62.50%	75%	37.50%	75%	0%	50%	37.50%	37.50%	25%	87.50%	37.50%	37.50%		
N	1	4	1	5	6	3	6	0	4	3	3	2	7	3	3		

Different policies had varying levels of FAIR Equivalency. The highest FE-Score was reported for facet R1.1, indicating a high requirement of clear and accessible data usage licences. The lowest score was for in A2, with none of the policies mentioning the availability of metadata when the data being described was no longer available (see Figure 1).

The highest FE-Score was recorded for the Zimbabwe National ICT Policy of 2015 and the lowest was for the ZimHealth Strategic Plan 2016–2020 [10].

4. DISCUSSION

The study found that all of the policy documents analysed contained FAIR Equivalent terms and concepts. However, none of the documents mentioned the FAIR Guidelines explicitly in ICT or health/eHealth. This suggests that there is a break between the health/eHealth policies in Zimbabwe and the FAIR Guidelines

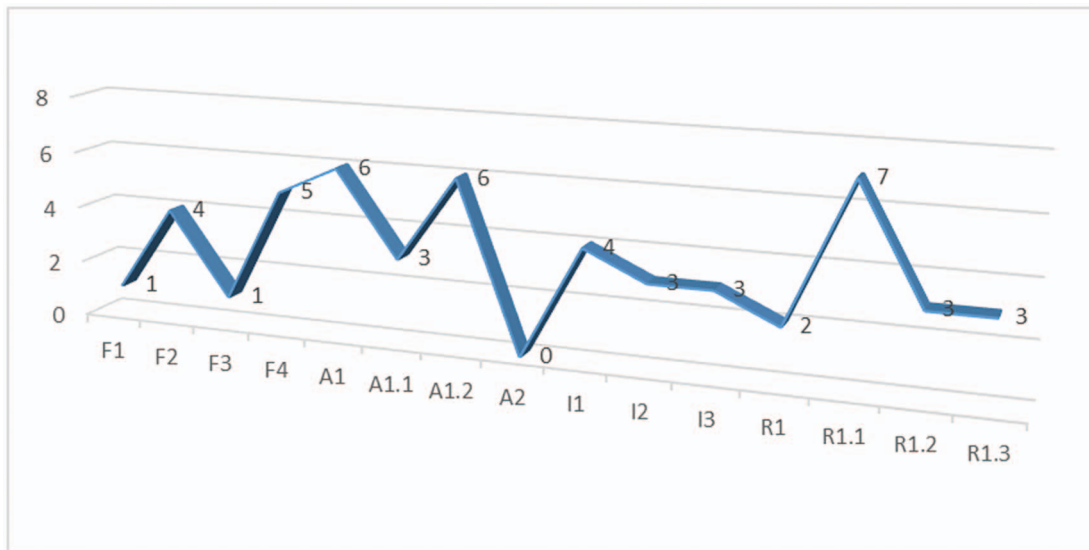


Figure 1. Mention of FAIR facets in all policy documents reviewed.

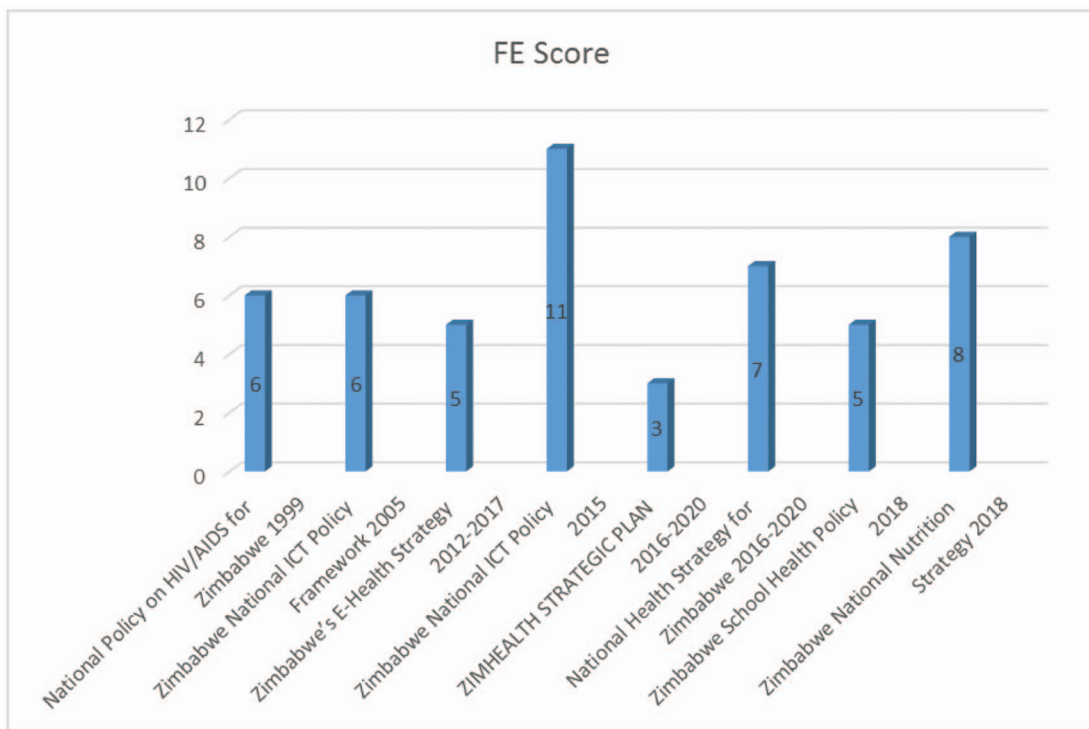


Figure 2. FE-Score for each policy document reviewed.

(a small level of cultural entropy). Van Reisen and others [2] and Stokmans, Van Reisen and Landa [11] argue that if cultural entropy is small, there is a possibility of participants (e.g., individuals in ministries, or innovators and adopters of technology) synchronising their opinions/positions and increasing productivity without difficulty. Hence, the small level of cultural entropy found in this study implies that the position of Zimbabwe's health/eHealth and ICT policymakers is roughly aligned with the FAIR Guidelines, although indirectly, as evidenced by the use of FAIR Equivalent principles and terminology.

4.1 FAIR Equivalency in Policy Documents

This section aims to answer objective 2: 'To assess the alignment of FAIR Guidelines with the terminology used in Zimbabwe's policy documents to determine the possibility of opening a policy window for the adoption of the FAIR Guidelines in relation to Zimbabwe's health data management, with particular attention to eHealth. The study found that different FAIR Equivalent terms were mentioned in varying degrees in the policy documents, as measured by mention of their facets: R1.1 was mentioned the most (87.5%); followed by A1 and A1.2 (75% each); F1, F3 (12.5% each) and A2 (0%) were mentioned the least.

4.2 Highest FE-Scores

4.2.1 Facet R1.1: (Meta)data are Released with A Clear and Accessible Data Usage Licence

Facet R1.1 of FAIR requires data and its metadata to be released with a clear and accessible data usage licence [1]. The emphasis on this metric is the legal interoperability of systems. Adherence to this construct ensures that data is not used for anything other than predefined reasons, but remains guided by the data usage information prescribed by the data owner. Such licences are standardised machine-readable documents designed to guide the end user on what exactly the data can be used for and the acceptable conditions surrounding data use and management. Licences are usually used when data is deposited into repositories. Data that is deposited without such licences is by default protected by copyright, although publicly accessible to everyone, therefore, would support open science. Hence, R1.1 states that (meta)data have to be licensed by an explicit and accessible licence [10].

Out of the eight policy documents reviewed in this study, seven of them recognised the need for licensing frameworks regulating operators and service providers. However, the documents focused more on data than metadata. The Zimbabwe National ICT Policy Framework of 2005 recognises the need for the development and implementation of licensing frameworks for data operators and service providers, as well as developing guidelines on obligations in relation to communication facilities [6, p. 25]. In addition, Zimbabwe's ICT Policy of 2015 [12, p. 30] acknowledges the importance of licensing telecommunication services to make required services seamlessly available to customers. These policies were meant to ensure sustainable data integration.

Another interesting licensing observation is found in the National Health Strategy for Zimbabwe 2016 by the Ministry of Health and Child Care [10]. This document advocates for the need to improve its service delivery platforms and entities. In line with this goal, Objective 15 of the strategy aims at reducing morbidity

through the provision of accessible, affordable and acceptable health services. The goal is to improve accountability and reporting through clinical data usage.

4.2.2 Facet A1: (Meta)data are Retrievable by Their Identifier Using A Standardised Communications Protocol

This data sharing element of FAIR requires (meta)data to be retrievable by their identifier using a standardised communications protocol. The logic is to produce a platform where high-level interfaces are interpreted by low-level protocols like the Transmission Control Protocol (TCP), so that when the user clicks a link, they are connected to the required digital assets. Such communications protocols include http(s), tcp, and ftp, among others. The backbone of modern Internet services is based on https and ftp. These two protocols are built on TCP to facilitate the request and provision of digital assets. Basically, the focal point of FAIR in this respect is that (meta)data should be retrievable basing on their identifiers [13, 14].

Zimbabwe's ICT and health ministries, through their respective policy proclamations, have developed web portals where visitors can browse and obtain policy documents and data published by the ministries. The Ministry of Health and Child Care's eHealth draft policy of 2012 acknowledges the use of the World Wide Web, together with its embedded protocols, for the purpose of data access and through standardised platforms [5, p. 8]. It also makes clear how standards can be used to enhance the interoperability of systems within the same, or from different, domains. According to this policy document, each patient must be uniquely identified online to enhance the accessibility of patient data in ethically bound clinical research. Subsequently, access domains are supposed to be crafted adhering to common terminology dictionaries [5, pp. 8–12]. However, the Zimbabwe Health Strategy Plan of 2016–2020 is silent on this A1 facet, a situation repeated in the Zimbabwe National Nutrition Strategy of 2018 [15, 10].

4.2.3 Facet A1.2: The Protocol Allows for An Authentication and Authorisation Procedure When Necessary

This facet requires the provision of explicit conditions that further elaborate how data should be available for reuse. According to A1.2, accessible data does not always mean that the data is open and freely available for open science. Therefore, it is recommended that data owners create accounts, choose repositories, authenticate the ownership of such data, and set out specific rights for data use. Such specifics would enable data, even maximally protected private data, to be legally accessible. This process enables machines (and algorithms) to examine the data access requirements, understand conformance requirements, and communicate such requirements to potential data users [16].

An analysis of Zimbabwe's health/eHealth policy documents shows that the country is working towards such authentication and authorisation procedures, which are necessary for ethical data access. Zimbabwe's e-Health Strategy Policy document of 2012–2017 emphasises the need for the authentication and authorisation of services (and data) in clinical care systems. This policy document focuses on enabling the secure availability and transmission of data within or between systems. Emphasis is placed on the use of patients' digital data by health practitioners to enhance the adoption of data repositories and their availability in clinics [5].

4.3 Lowest FE-Scores

4.3.1 Facet A2: Metadata are Available, Even When the Data are No Longer Available

According to GO-FAIR [17], maintaining an online resource is costly; hence, some datasets disappear or degrade with time. When this occurs, users following such degraded or disappeared datasets are frustrated by dead links. Therefore, A2 stipulates that metadata has to be persistent, despite the disappearance of the data being described. This concept has been supported by the fact that storing metadata is cheaper and easier than storing data itself. Embracing A2 in digital data management helps researchers and decision makers to replicate studies, especially when tracking the origin of the data, a development that improves data driven decisions in research. The A2 construct is closely equivalent to the F4 facet of Findability.

None of the policy documents reviewed focused on the relevance of metadata alone as a solution to data management. They referred to data and its metadata, i.e., (meta)data. This might be due to the fact that metadata is not yet the centre of interest for data management and health/eHealth policies in Zimbabwe. There was no discussion about the documentation of the data that is stored in different repositories. Most of the positive occurrences of A2 in policy documents were based on the use of data and its metadata collectively, although there was no clarity on how searches or indexing could be done to enhance the retrieval of data that is no longer available.

Metadata can be manually created to be more explicit or automated to contain basic information. The relevance of such metadata is equivalent to stories told to enable stolen archaeological artefacts to be found. In healthcare systems, data without context has little value in terms of reuse [18]. The scientific value of a dataset rests in its provenance or its metadata. Therefore, healthcare data is not only important in storytelling, but also for decision making in different contexts.

4.3.2 Facet F1: (Meta)data are Assigned A Globally Unique and Persistent Identifier

This is arguably the most important construct of the FAIR Guidelines. GO FAIR [13] argues that without F1 it is very difficult to achieve the other elements of FAIR. The benefit attached to F1 is that it clarifies the meaning of metadata and published data. The unique identifiers are assigned to each element of metadata, as well as other measurements attached to the datasets. Such identifiers are linked to the Internet using Uniform Resource Locators (URLs) to resolve the page that contains the data upon request. Making use of such identifiers enables computers to meaningfully understand data that is being deposited in repositories. These identifiers also assist with the comprehension of data by potential users and improve their storytelling in research. Successful implementation of F1 results in human-machine interoperation and improves citation and data reuse.

Furthermore, identifiers are one thing and their meanings another (I1–I3). F1 sets out two important conditions, which are: (i) the identifier must be globally unique, and (ii) the registry should guarantee that the identifier is resolvable into the future to maintain persistency. This means that nobody can reassign or reuse the same identifier without referencing your data. Registry services are used to guarantee the uniqueness of new identifiers. F1 also ensures that persistency is achieved in case of degraded or destroyed

datasets. Only 12.5% of the documents reviewed cited the need for the persistency of data stored in repositories. The rest were silent on this issue.

4.3.3 Facet F3: Metadata Clearly and Explicitly Include the Identifier of the Data They Describe

Data and their metadata are usually stored in separate files. Hence, there must be some logical explanation to show the relationship between the data item and its corresponding metadata. Such a relationship requires that some repositories automatically generate the unique and persistent identifiers whenever datasets are deposited [13]. These persistent identifiers have to be synchronised to the metadata file. Annotations are sometimes used to create this relationship, for example, in Resource Description Framework (RDF) metadata. This facet of FAIR had low visibility in the policy documents reviewed, appearing in only 12.5%, the rest were silent.

5. CONCLUSION

The Zimbabwe health/eHealth policies reviewed acknowledge that patient data is sensitive and, hence, focus on data access and control to ensure the consistency of purpose for data use [5, 10]. The health/eHealth and ICT policies acknowledge that technological evolution is predominantly ahead of customer comprehension. Therefore, ICT policies have an overriding role to play in ensuring that the speedy diffusion of technology in Zimbabwe does not jeopardise the rights of citizens. Hence, the Ministry of ICT has focused on the remedies available in the case of data breaches to protect digital data assets [8, 12]. These ICT policies advocate for the observance of safety in the use of new technologies, but do not discourage their adoption. Acceptance is supposed to be sustainable, according to the ICT policy documents. Accordingly, Zimbabwe's health/eHealth policy documents were crafted alongside ICT policies.

By not overriding the ICT policies, the health/eHealth policies ensure a holistic approach towards improving the standard of living in the country. Hence, there is coherence between Zimbabwe's ICT policies and health/eHealth policies in terms of the inclusion of FAIR Equivalent terms and concepts. Therefore, there is a good possibility that the FAIR Guidelines can play a positive role in digital health/eHealth data management in Zimbabwe, if policymakers are orientated on their importance. In other words, it appears that a policy window is open for the adoption of FAIR Guidelines in relation to Zimbabwe's health/eHealth data management.

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AUTHOR'S CONTRIBUTION

Kudakwashe Chindoza (kchindoza@gzu.ac.zw, 0000-0002-8346-5211): Conceptualisation, Methodology, Formal Analysis, Investigation, Writing, Visualisation.

CONFLICT OF INTEREST

The author declares that he has no competing interests.

ETHICS STATEMENT

Tilburg University, Research Ethics and Data Management Committee of Tilburg School of Humanities and Digital Sciences REDC#2020/013, June 1, 2020-May 31, 2024 on Social Dynamics of Digital Innovation in remote non-western communities

Uganda National Council for Science and Technology, Reference IS18ES, July 23, 2019-July Data Processing Agreement between Kampala International University and Great Zimbabwe, Andrew Chindanya, Provost Chancellor, University, October 30, 2020

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