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Making the case for investing in Routine Health Information Systems (RHIS) to achieve the health-related SDGs

Work package 3

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INVESTMENT CASE

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Disclaimer

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ABBREVIATIONS

CDSS	Clinical Decision Support System
CHEATS	Clinical, Human and organisational, Educational, Administrative, Technical, Social
CRVS	Civil Registration and Vital Statistics
DALY	Disability-adjusted life years
EMR	Electronic Medical Records
FMIS	Financial Management Information Systems
GDP	Gross Domestic Product
HIS	Health Information System
HMIS	Health Management Information System
HMN	Health Metrics Network
HRIS	Human Resource Information Systems
ICER	Incremental Cost-Effectiveness Ratio
ICT	Information Communication and Technology
IEMIS	Infrastructure and Equipment Management Information Systems
IS	Information Systems
IT	Information Technology
LMIC	Low- and Middle-Income Countries
LMIS	Logistics Management Information System
QALY	Quality-adjusted life years
QC	Quality of Care
QIP	Quality Improvement Project
RHIS	Routine Health Information System
ROI	Return on Investment
SAMRC	South African Medical Research Council
SDGs	Sustainable Development Goals
Swiss TPH	Swiss Tropical and Public Health Institute
UHC	Universal Health Coverage
USAID	United States Agency for International Development
WHO	World Health Organization
WP	Work package

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Executive summary

Routine health information system (RHIS) encompasses the resources, tools, and processes to collect, analyse, interpret, store, and transmit all routine data produced in health care services to support health care and public health encounters. One of the main features of RHIS is that, at the source, it is fully integrated in the processes of care; making it the only information system that cannot be conceived outside the processes of care. Making the case for investment in RHIS is a potentially useful approach to advocate for investments in RHIS by governments, donors, and the international community. This case study was based on the findings from our recent works on HIS framework synthesis, a scoping review of return on investments of health systems interventions (work package 1), country case studies [work package 2 (WP2)], as well as discussions with HIS experts involved in this work and additional literature.

We have identified several RHIS definitions and conceptual frameworks for RHIS evaluation. Often RHIS are conceived as data reporting mechanisms with less attention to data use for decision making. RHIS should also be responsive to data needs at national and international level, such as for the monitoring of SDG, although only a small number of SDG can be measured using RHIS. All these functions should not divert the main purpose of RHIS, which is to support clinical and public health care events. A number of sources have already suggested the importance of RHIS as quality of care instruments.

We are reporting on different types of issues describing the current status of RHIS: generic issues, IT and human resources. Generic issues include all those challenges that have been affecting RHIS for decades, including design issues and their links with data use and decision-making. IT issues are numerous and while digital technologies have been able to show remarkable performance achievements in RHIS, they have also become problems in themselves and worsened some of the situations. Finally, we examine human resources issues to underline the importance of protecting health care staff from overburdening them with administrative or data management tasks.

Building on existing initiatives, including the “Global strategy for optimising Routine Health Information Systems in countries 2022 – 2030” we propose a new paradigm shift for the RHIS of the future: from the emphasis on data and dashboards, to the emphasis on quality of care; from RHIS designed under a technocratic perspective to using human centred design; from insisting on the use of data to providing a decision-making framework for clinical and managerial decisions; from basing RHIS interventions in observational and biased studies, to the promotion of robust, experimental evidence to inform RHIS interventions; from multiple, small and limited pilots, to deimplementation of what does not work or harms; and finally, from good governance of bad systems to good governance of good systems.

1 Background

Routine health information system (RHIS) encompasses the resources, tools, and processes to collect, analyse, interpret, store, and transmit all routine data produced in health care services to support health care and public health encounters. The primary aim of the RHIS is to support and document those encounters. Information produced in these encounters is processed, aggregated, and transmitted to higher tiers of the health systems to support coordination and planning of activities, as well as strategic decision-making. Furthermore, RHIS contribute to providing data on several health-related Sustainable Development Goals (SDGs) [1], as well. Hence, RHIS are relevant for a rather wide scope of processes, ranging from individual care at community level up to international monitoring of global trends in health-related indicators.

One of the main features of RHIS is that, at the source, it is fully integrated in the processes of care; making it the only information system that cannot be conceived outside the processes of care. Healthcare workers can use the RHIS to ask, search, and retrieve information that they use on the spot to handle an array of health problems, at individual and community levels. In some settings, they can be supported by staff specialised in managing data; but at the source, there is always a healthcare worker producing the information.

There is a wealth of knowledge about the structures and functioning of RHIS within health systems. For example, research evidence on RHIS includes studies that assessed data quality, that described health care providers' interactions with the system, that tested new devices, such as digital apps, or that described components of the system, to cite some examples. Other evidence is produced in the implementation context describing how RHIS, or their components, work in real life situations. Yet, the prevailing perception seems to be that some of the issues affecting RHIS have remained unsolved for decades. Furthermore, current initiatives targeting some of those issues are informed by rather weak and often inconclusive evidence.

Making the case for investment in RHIS is a useful approach to advocate for investments in RHIS by governments, donors, and the international community [2]. With this 'investment case' we aim at supporting global and national stakeholders as well as governments in (i) realising the critical roles that RHIS play in the health sector, from local to global levels; (ii) acknowledging the wide scope and complexity of decisions that are informed by RHIS; and (iii) making strategic choices to fund this critical component of health care.

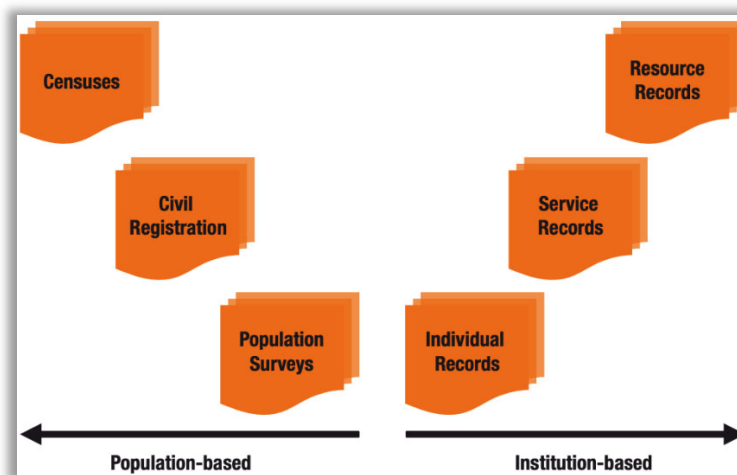
This case study was based on the findings from our recent works on HIS framework synthesis, a scoping review of return on investments of health systems interventions (work package 1), country case studies [work package 2 (WP2)], as well as discussions with HIS experts involved in this work and additional literature.

2 Routine Health Information Systems framework: quality of care

We have identified several RHIS definitions and conceptual frameworks for RHIS evaluation. While the reporting aspects of the RHIS have been highlighted for years [3], together with the importance of data issues, such as quality [4], the use of the RHIS data, while also mentioned, has been less prominent [4, 5]. A good RHIS is rooted in data collected at service delivery points and, hence, should support and enhance the clinical and public health decisions of the front-line health workers, thus potentially having a large impact on the health of the populations.

Ideally, any initiative on health systems and health information systems should be guided by a validated conceptual framework. However, to our knowledge, there is no health systems analytical framework widely accepted that allows modelling the different events that take place in the system as well as predicting the behaviour of the system components under several scenarios. This may be partially due to the complexity of health systems and also to the challenges in carrying out applied research in these areas. The frameworks we identified tend to be simplistic, static, and lacking an empirical base. For example, RHIS can be seen as the data sources and processes that produce and manage data at institutional level, as opposed to population levels (see Figure 1 [6]).

Figure 1. Health information data sources.



Source: WHO Framework and Standards for Country Health Information Systems, second addition

Furthermore, institution-based data encompasses a series of sub-systems [7] that include:

- Individual record systems (facility- and community-based, paper-based and/or electronic that collect data on patients' and disease features and service utilization)
- Service records systems
 - Health management information systems (HMIS)
 - Laboratory and imaging information systems (LIIS)
 - Disease surveillance information systems
- Resource record systems
 - Financial management information systems (FMIS)
 - Human resource information systems (HRIS)
 - Logistics management information systems (LMIS)
 - Infrastructure and equipment management information systems (IEMIS)

In the area of IT evaluations, there are multiple frameworks, not being developed using systematic methods designed to reduce the risk of bias in these evaluations [8]. Despite their limitations, existing frameworks are still useful, though, to the extent that they point and describe domains or dimensions of the system, particularly if they are not misunderstood as the ultimate analytical framework to understand RHIS [10].

The main function of RHIS universally mentioned across all consulted sources is to provide measurements in several domains, including the SDGs, where SDG 3 is related to health and well-being. A recent article [1] identified 57 indicators across 12 health-related SDGs, with 12 data sources required to provide data on these indicators (three of which are national surveys). One of these data sources is “administrative records” which include the RHIS that could be used to address only five (9%) of these 57 indicators:

- Indicator 3.5.1: Coverage of treatment interventions (pharmacological, psychosocial and rehabilitation and aftercare services) for substance use disorders.
- Indicator 3.8.1: Coverage of essential health services (defined as the average coverage of essential services based on tracer interventions that include reproductive, maternal, newborn and child health, infectious diseases, non-communicable diseases and service capacity and access, among the general and the most disadvantaged population)
- Indicator 8.8.1: Frequency rates of fatal and non-fatal occupational injuries, by sex and migrant status.

In Table 1, we summarise the indicators and preferred data systems, according to their relationship with RHIS.

Table 1. Health-related SDG indicators and preferred data systems for measurement.

Health related SDG indicator	Preferred data system
With a potential role for RHIS:	
Indicators 1.5.1, 11.5.1, 13.1.1: Number of deaths, missing persons and directly affected persons attributed to disasters per 100,000 population	Deaths: civil registration and vital statistics systems; Missing and directly affected persons: administrative data
Indicator 3.5.1: Coverage of treatment interventions (pharmacological, psychosocial and rehabilitation and aftercare services) for substance use disorders	Nationally representative household surveys and administrative data on intervention delivery
Indicator 3.8.1: Coverage of essential health services (defined as the average coverage of essential services based on tracer interventions that include reproductive, maternal, newborn and child health, infectious diseases, noncommunicable diseases and service capacity and access, among the general and the most disadvantaged population)	Nationally representative household surveys without biomarkers, civil registration and vital statistics systems, administrative data
Indicator 3.b.2: Total net official development assistance to the medical research and basic health sectors	Administrative data; National Health Accounts
Indicator 8.8.1: Frequency rates of fatal and non-fatal occupational injuries, by sex and migrant status.	Administrative data; National Health Accounts
Without a potential role for RHIS:	
Indicators 1.a.2, 2.2.2a and b, 3.1.1, 3.1.2, 3.2.1, 3.2.2, 3.3.1 to 3.3.5, 3.4.1, 3.4.2, 3.5.2, 3.6.1, 3.7.1, 3.7.2, 3.8.2, 3.9.1-3, 3.a.1, 3.b.1-3, 3.c.1, 3.d.1, 4.2.1, 5.2.1-2, 5.6.1-2, 6.a.1, 6.1.1, 6.2.1.a and b, 6.3.1, 7.1.2, 11.6.2, 16.1.1-2, 16.1.3a-c, 16.1.4, 16.2.1, 16.2.3, 16.9.1, 17.19.2a to c	National Accounts; National Health Accounts; Nationally representative household surveys without biomarkers; Civil registration and vital statistics systems; Nationally representative household surveys; Alcohol sales data; Health facility surveys; Labor force participation surveys; Joint External Evaluation mission reports; National self-assessment; Nationally representative household surveys on crime victimization or from other household surveys with a module on crime victimization; Census; national self-assessment; Birth registration; Death registration; registration evaluated using death distribution methods

Together with this ‘measurement’ function of RHIS, data collection in the context of services delivery, as is the case of RHIS, have to primarily serve the health care events that are supported by that data collection. Not surprisingly, target 3.8 focuses on quality of care (*“Achieve universal health coverage, including financial risk protection, access to quality essential health-care services and access to safe, effective, quality and affordable essential medicines and vaccines for all”*) and none of the other targets can be even conceived without considering the central role that quality of care plays in reaching (or missing) those targets. Quality of care is a useful paradigm to analyse health services in a country. Quality of care is central to the concept of Universal Health Coverage (UHC), which encompasses and makes explicit all those aspects that make health services appropriate and responsive to the population they serve. These may include any combination of

the following: accessibility, efficacy, human-centeredness, equity, affordability, and efficiency, among many other features.

The relationship between quality of care and health outcomes is patent by definition; but it has also been quantified in several ways [19]. “Availability and quality of health services are integral to achieving universal health coverage (UHC) and the health-related Sustainable Development Goals (SDGs)” [9].

RHIS are decision-making tools [10] and have to support the decision-making functions of users [3]. However, there is scant evidence on the links between availability of data and decision-making [3], and there are studies that did not find a clear link between them [11]. Other research points to the overload of indicators in governmental HISs [12]. How the RHIS, especially the registers in the health facilities, can support health workers in their clinical work, public health work and managerial work is often overlooked. It is, however, a paramount aspect of the RHIS. Even very comprehensive studies on quality of care have a predominant view by which health management information systems (HMIS) are measurement instruments rather than quality improvement tools [13].

A recent review [14] summarised from the 16 included studies that there are three main categories of benefits that an effective RHIS/HIS has on the healthcare system: (i) cost reduction and overall efficiency and effectiveness, (ii) improvements in quality and utilization of needed healthcare services and coverage, and (iii) monitoring of facility healthcare capacities and population needs. Note that improvements in quality of services is mentioned. However, the document does not clarify what exactly is meant by “quality”. Other evidence on related interventions points at similar directions [15].

We strongly emphasise that RHISs are quality of care instruments, not only as tools to measure quality, but actually as components of quality improvement initiatives. This view was already suggested by Stansfield and colleagues in 2006 [16] and by Krickeberg in 2007 who asserted: “*HIS is not only a tool for collecting indicators; it is intimately tied to clinical and preventive practice, as well as to health management and health economy. In fact, it permeates the entire health system.*” [17]. Similarly, the WHO Health Metrics Network (HMN) stated in 2008: “*One of the most important functions of these records [individual health records and disease records... routinely produced by health workers] is to support the quality and continuity of care of individual patients*” [18]. We do emphasise the actionable over the measurement aspects, with the potential to improving the quality of services, and, thus, reducing morbidity and mortality [19]. Similarly, the CHEATS tool [20] considers the clinical domains, alongside the human and organisational, educational, administrative, technical, and social aspects when assessing information communication and technology (ICT) in health care. A review focusing on information needs of health care workers [21] also suggests that the various registers at the facility level need to be designed in such a way that sound clinical decisions are facilitated, to ensure that they serve not merely as a tool for data collection but as a tool that improve the offered care, especially clinical care. In addition, the WHO states that “*Quality of care] for pregnant women and new-borns in facilities requires competent and motivated human resources and the availability of essential physical resources. Also, evidence-based practices for routine and emergency care, **actionable***”

***information systems** where record keeping enables review and audit mechanisms, and functional referral systems between levels of care should be in place”^a[22].*

Conclusions:

- RHIS are tools to improve and to measure quality of care;
- the primarily role of RHIS is to support decision-making at the points of care;
- RHIS are also a fundamental source of data to support decision-making at sub-national and national managerial levels;
- RHIS have a limited scope in monitoring SDGs.

^a The bold is ours.

3 The current status of RHIS

From the previous work, we highlight here three aspects related to the current status of RHIS and the availability of evidence on interventions to address existing challenges, in three sections: *generic issues*, *IT* and *human resources*. *Generic issues* affect most of the RHIS and are difficult to circumscribe to any specific process. *IT* is an area that has been exploding over the last years or decades, with large investments and relatively modest achievements, even where systemic efficiency gains have been described. *Human resources* have a key role in the deployment of RHIS and carry the heaviest load for making RHIS operational.

Some assumptions that may be wrong or at least require stronger evidence include:

- (i) *that the main problem related to data quality and use is health workers' capacity to produce and use data*, instead of the RHIS being ill-conceived. If this assumption is wrong, continual investments in training interventions actually means investing in promoting the use of a wrong tool;
- (ii) there can be good quality data regardless of the quality of care;
- (iii) *interventions aimed at improving RHIS (e.g., IT) are harmless*; it may well be that there are no harms because we actually do not measure them.

The following paragraphs are meant to illustrate these issues.

3.1 Generic issues

RHIS can eventually be affected by any issue that impacts other components of the health system. For example, in the Democratic Republic of the Congo, the United States Agency for International Development (USAID) conducted a baseline study on health governance and leadership, service readiness, and service quality [23]. Surveys were applied to provincial health offices, health zone offices, health centres, hospitals, and health workers. The results suggest that the government-run health system faces myriad of challenges to effectively plan, implement, and monitor services. These challenges include problems with electricity, cellular communication, and Internet connectivity; wide variations by province in the availability of medicines and equipment; limited managerial autonomy with respect to resource generation and budgeting practices; wide variations in the levels of external supervision of hospitals and health centres; insufficient number of staff at health facilities; and low levels of health worker satisfaction. However, RHIS may be totally ignored in research addressing the wider health system [24].

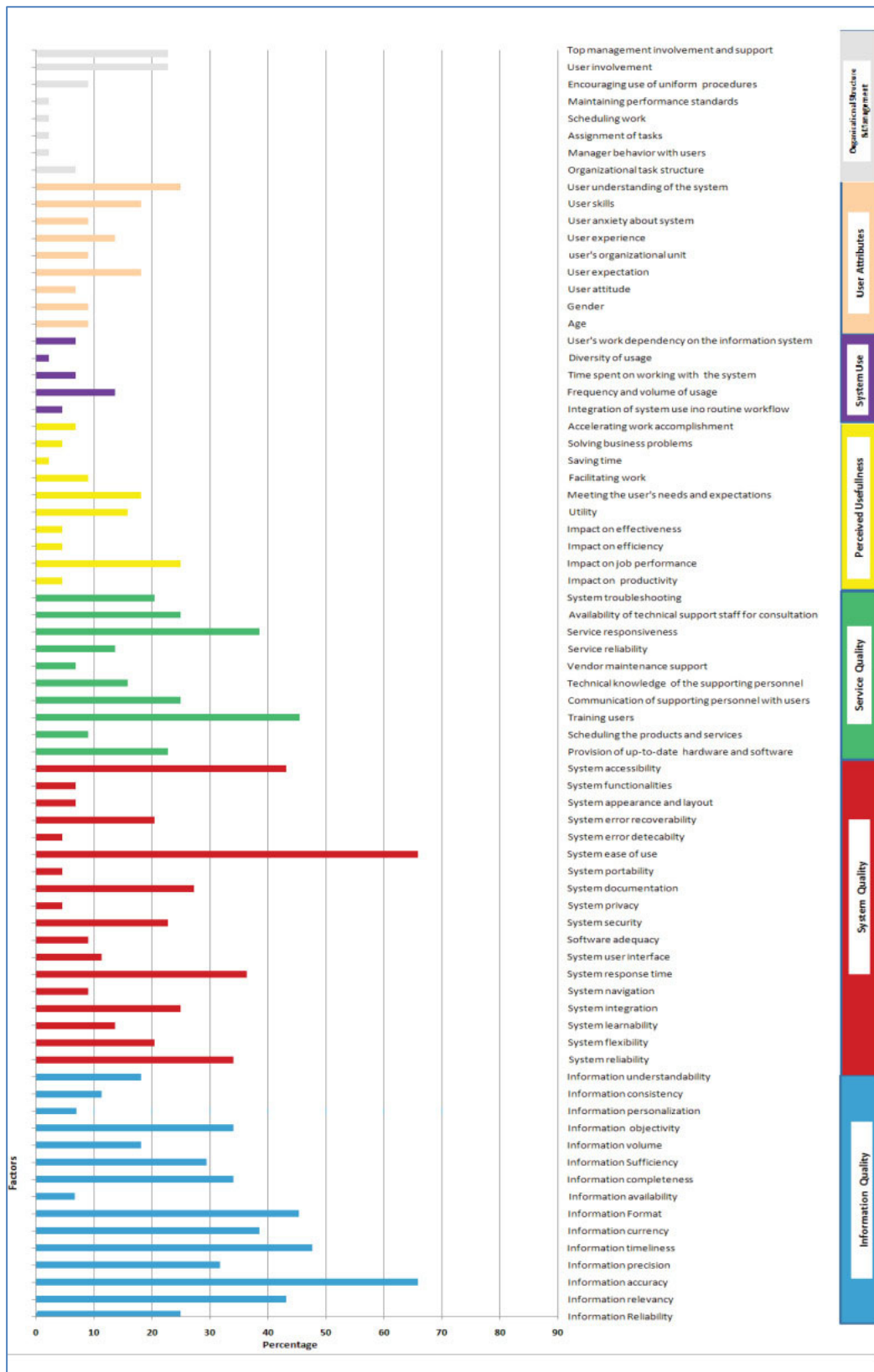
Studies on interventions to improve RHIS performance in a variety of outcomes (e.g., management, but also health outcomes) suggest that there is no clear evidence of beneficial effects in terms of health workers' motivation, receipt of training by health workers, health information index scores, or quality of clinical observation of children and adults (very low certainty evidence) [25].

One of the main challenges of RHIS widely reported is that their utilisation for decision-making is low, although describing the 'use of data' is not easy. For example, in Ethiopia, a study on routine

health information system utilization for evidence-based decision-making among department and health facility heads [26] found very low utilisation rates. Authors suggest that displaying demographic and performance data, providing feedback to the HMIS unit, maintaining performance monitoring team minutes, conducting supervision, using HMIS data for target setting and work location, were factors associated with the use of RHIS. The authors strongly recommend strengthening the capacity of department heads on data displaying, supervision, feedback mechanisms, and engagement of senior management. But, very often, the focus is on the use of data beyond the health workers who collect them [27], as opposed to the use of data for clinical or public health decisions at facility level.

A study in Ethiopia on data use [28] identified barriers to fostering local-level data use culture at each level of a health system. Data use at local level can be jeopardised by issues such as awareness gaps, lack of motivation, inconsistent supervision, poor community engagement, lack of accountability; high staff turn-over at health facility level was another identified barrier [28]. While very often most of the blames related to data quality and use fall into health workers, other evidence suggests that the system, as well as organisational issues, are much more critical [Figure 2) in explaining the failures.

Figure 2. Factors affecting the access and use of data.



3.2 Information technology issues

IT is often seen as a solution to improve efficiency in health care management processes [29], for example, using systems that improve communication between institutions, assist in ordering and managing medications, and help monitor and detect patients who might abandon care show promise [30]. However, a myriad of problems, not only in resources-constrained settings, jeopardises the implementation of these types of solutions, such as technical infrastructure problems such as unreliable electric power and erratic Internet connectivity, clinicians' limited computer skills and failure by providers to comply with the reminders were the key impediments to implementation and effectively use of CDSS (electronic health record-based clinical decision support system).

Even recent developments in IT have not been able to provide solid grounds on what needs to be done at present and in the coming years. For example, studies on the clinical significance of outcomes related to CDSS have shown to be very limited [31]; an assessment of mobile health interventions in LMIC [32] suggested that most of them were not ready for interoperability and to be integrated into the existing HIS:

“...the evidence reporting on mHealth research in low-setting developing countries significantly lacks essential criteria meeting, which indicates that mHealth interventions in the context of developing countries have still a long way to go to deliver the optimal benefits. Also, it is found that most of the mHealth studies selected did not follow any design science-based method and theory-based framework for developing mHealth interventions”.

Others have synthesised studies on the effects of health IT on patient outcomes [33], showing that 25 (36%) studies found benefits on direct patient safety outcomes for the primary outcome measured; 43 (62%) studies either had non-significant or mixed findings and 1 (1%) study for which health IT had a detrimental effect. In the area of patients' satisfaction with electronic medical records (EMR) there may be promising results but, again, the lack of rigorous studies challenges these findings [34]. IT interventions may more easily show effects when they are not systemic and circumscribed to specific health care areas; for example, in antibiotic prescribing [35].

There are also intrinsic technological issues that jeopardise the deployment of IT solutions. For example, studies on open-source point-of-care EMRs for use in resource-limited settings without reliable internet access showed that none of the EMR studies met the minimum requirements for a fully functioning EMR suitable for use in resource-limited settings [36].

Finally, we have to realise that even studies showing promising effects may have been carried out without the minimally acceptable research rigour that can make findings credible. Another caveat is the lack of studies measuring clinical outcomes or even harms of any nature.

Investments in IT have to be implemented very carefully and guided by available evidence and a strong M&E context.

3.3 Human resources issues

In WP2, we described the large share of costs related to human resources' time use in RHIS. The heavy, and often unreasonable, load of work that RHIS impose on health workers has been widely described. There is evidence of consistent negative effects of digital health technologies on mental workload in health care [37]; we have shown in WP2 the relatively high proportion of time used by health workers in administrative tasks, including RHIS, as opposed to the provision of care. An overview of systematic reviews [38] suggested that IT can have almost equality between positive and negative effects on the time distribution of nurses. In the same overview, several positive effects of IT were described in terms of education of patients or nurses' perspective on quality of care; however, there were remarkable cases of dissatisfaction of nurses with IT.

These aspects are closely related to the capacity of health workers to provide care and health workers' information needs. A study, for example, reported a gross lack of knowledge about the basics on how to diagnose and manage common diseases, going right across the health workforce and often associated with suboptimal, ineffective, and dangerous health care practices, especially in Africa [21].

Consistently with these assumptions, common approaches describing RHIS challenges and ways to overcome them tend to focus on human resources limitations. For example, a recent scoping review on improving quality and use of routine health information system data in LMIC found that a combination of interventions, addressing both behavioural and technical factors, improved data quality and use for planning [39].

The diversion of health workers' time towards administrative, as opposed to health care tasks has also been approached from a deontological point of view. In Catalonia, for example, these issues are referred to as bureaucratisation of health care [40], stating that^a:

1. The time dedicated to activities that do not add value [...] compromises the time dedicated to health care to improve the health of the people and communities, it is a waste of public resources and generates a climate that affects professionals' self-esteem.
2. [...]
3. Bureaucratic activities that can be carried out with IT, registries or with the contributions of other professionals should be carried out outside the health care pathways.
4. Any change considered should be compatible with [...] the deontological recommendation to prioritise the health care clinical activity that cannot be delayed because of other activities, administrative in nature.

Instead, putting the users at the centre of the system, particularly in the design of information tools, is a relatively new concept, although this has already been suggested by some [41, 42].

^a Translated by the authors of this report.

4 The future of RHIS: investing in a RHIS paradigm shift

There is a clear imbalance between the (i) critical role of RHIS in the provision of care and in measuring quality of care and SDGs, (ii) the little financial investments on them and (iii) the heavy workload of the RHIS for health workers, who are the critical component of health systems. Furthermore, evidence on what works or doesn't relies on obsolete frameworks that focus on data quality and use, in disconnection with the primary mandate of the health systems toward the population they are meant to serve.

The WHO global strategy for optimising RHIS in countries can be seen as a first step towards a paradigm shift. The focus on the purpose of the RHIS is indicated in the subtitle of the global strategy, namely, "Global strategy for optimising Routine Health Information Systems in countries 2022 – 2030"[43]. It has five strategic objectives, briefly commented in the following paragraphs.

- 1) Strategic Objective 1. Strengthening governance and partnership structures for RHIS
Guiding principles: (i) country ownership; (ii) integration of RHIS within a HIS architecture; and (iii) alignment of stakeholders to support one plan. We understand that our findings fully support these principles. This strategic objective can be the opportunity to establish the quality of care / UHC concept as the key reference for RHIS. The quality of care framework could orchestrate the relationship between RHIS and other sub-systems, such as Civil Registration and Vital Statistics (CRVS) and can promote use of quality improvement mechanisms such as clinical audit and feedback, which requires good data quality. In this way, the RHIS is not only or mainly a "measurement" tool but also a performance improvement tool, through better decision-making.
- 2) Strategic Objective 2. Strengthening RHIS data collection, health information management and data quality.
Guiding principles: (i) user-focused approach as routine data users have distinct and varied needs; (ii) national list of indicators that ensures inclusion of all key indicators from national programs and global framework; (iii) coherence and interoperability of all digital tools and applications across the system; (iv) quality assurance and use of data at the level at which the data are first generated; and (v) robust global data quality assurance system.

However, in our opinion, these principles have to make explicit the trade-offs between quantity and quality of data, the different priorities from different users and the quality of data and quality of care. This is also the opportunity to adapt information sub-systems to different decision-making needs and spaces and establish the links between them. The discussions on indicators would be subordinated to the discussions on how to harmonise quality of care indicators and quality of care improvements.

- 3) Strategic Objective 3. Improving integration and interoperability of RHIS as part of the overall health data ecosystem.
The main guiding principle is the establishment of a culture of information. This principle is further developed with considerations related to user-centredness, human-centred design and decision-making. It is paramount that decision spaces are pinned down to consider whether to promote a culture of information as opposed to a culture of decision-making. In the latter there is a clear subordination of information to decisions, which helps to configure all the data-information domains. Any intervention related to this building block requires acknowledging the complexity of decision-making processes, the complex requirements of information of different nature and sources and the subjectivity of judgments. 'Pushing' for a culture of information should never be implemented to the detriment of a culture of health care. There should be an explicit vigilance on removing workload from health workers in detriment of their conditions of work and health care activities. This is also the opportunity to promote (and demand) rigorous research on digital health interventions. The perspective of quality of care could be used as an underlying criterion of what should be prioritised and what should be considered as secondary.
- 4) Strategic Objective 4. Building capacities for RHIS data analysis, data use and dissemination. It has to be fully recognised that without resources the RHIS will not work properly. It is also true that systems and contexts with similar resources show very different levels of performance. It is critical that the resources invested in data systems are not drained from other domains that are more directly related to the health care and wellbeing of populations. Specific and realistic job descriptions should be revisited to make sure that roles and functions related to RHIS are balanced and have no detrimental impact on quality of health care.
- 5) Strategic Objective 5. Securing the necessary human and financial resources towards a sustainable RHIS. Human resources with clinical skills should be seen as health care providers and their inputs to the system should be minimised. Other professional profiles should be considered to fulfil the data management functions, even at primary health care level. However, this is in itself a challenge when health care staff is already scanty. Costs of RHIS have to be fully funded including the shares of costs with other domains, as we suggested in WP2.

Furthermore, focusing on the use of RHIS for measuring the SDGs, we should acknowledge that a RHIS is also a tool to accelerate the achievement of SDGs:

- 1) Health-related SDGs cannot be achieved with suboptimal quality of care, from accessibility up to effective care; the RHIS is at the core of health care decisions that directly affect the health status of individuals and communities;
- 2) Health-related SDGs cannot be achieved if effective national policies cannot be efficiently implemented. Policies require accurate descriptions of problems and their specific contexts, which are, at least partially, based on data from the RHIS;
- 3) Health-related SDGs cannot be achieved if the international community does not come together in understanding trends on health problems and services coverage.

An agenda for RHIS investments, building on the global strategy for optimising RHIS, could include the following:

- Establish standards for RHIS that align with processes of care delivery and in support of promoting quality of care improvement mechanisms.
- Set up a global RHIS research agenda, including generic protocols to promote efficient and effective research grant applications.
- Elaborate quality of care frameworks that articulate the critical functions of RHIS and its role in decision-making in clinical care, health service and system management and promoting public health.
- Optimise the efficiency and effectiveness of the RHIS, by considering several strategies, including the use of alternative data sources, use of proxy indicators, reassessing the timing and geographical distribution of data needs, promoting efficiency through interoperability of existing electronic data bases, and other strategies.
- Promote the vision of an RHIS as a means to improve health care and impact of the SDGs.
- Budget the required investments in RHIS, including for the contributions in time by health care workers, and the time, procedures and resources necessary for effective use of routine health information in decision-making.
- Engage stakeholders along the full continuum of health systems management, including health providers and health users in building a culture of using routine health information for planning, monitoring, and improvement.
- Complement the RHIS in such a way that it offers helpful prompts for health facility heads and other health professionals with oversight responsibilities; these prompts should push staff in leadership to sound management principles (such as those identified in a literature review that examined how interventions interact with contexts and mechanisms to influence the sustainability of cultural change[44]).

Tables 2 and 3 outline the paradigm shift and a proposed sharing of responsibilities towards this shift across several constituencies.

Table 2. The paradigm shift in Routine Health Information Systems.

	Investing in the old paradigm	Investing in the new paradigm	Comments
Overall perspective	Data (and use)	Decision-making	Note that often 'data use' is not referred to a decision-making
Primary aim	Collect data for the higher tiers of the system Measuring SDGs	Support good quality clinical and public health care	Frontline managers and staff should feel invested in using the data they produce.
Secondary aim	Planning in health facilities	Managerial decisions Measuring SDGs	See above.
Promoters	Data specialists and managers	RHIS designers, health workers, health management and health user advocates	
Main users	Managers of health services, national and international community	Frontline health workers and their management	
Quantity of data	As much as possible	Just the amount needed at the site of data collection	The link between data collected and decisions made should be evident for frontline users
Quality of data	As much as possible	Optimal quality according to the context	Decisions may need to be made on 'good enough' data. Use of data for decision making can increase demands for improving data quality.
Data collection site	Health facilities and community health	Health facilities and community health	Community level surveillance data can supplement RHIS data
Tools and processes	Tables; 'silos'; programme specific, fragmented and duplication	Processes and tools that are aligned with clinical care delivery and quality improvement processes. Accessible formats, incl. visual language, interoperability of systems	Either paper or digital in both paradigms
Support mechanisms	Supervision, training on data collection and data quality	Clinical audit, public health, training on health care, Other sources of knowledge (e.g., guidelines) Prompts for helpful management processes.	RHIS information can provide the foundation for decision-making if it is well designed. It can be supplemented with other data sources.
Outputs	Routine data reports and dashboards, usually for higher levels in the system.	Health care, service and systems decisions at community, health facility level and above	
Outcomes	Overburden of health workers; poor link between RHIS usefulness and quality of care	Quality of care and public health improvements directly supported by a well functioning RHIS.	Under both paradigms it is challenging to show a direct link between RHIS functioning and health service and system, and public health outcome. Proxy measures should be put in place.

	Investing in the old paradigm	Investing in the new paradigm	Comments
Impact	Impact of RHIS on health care, service and systems, and public health would be difficult to demonstrate.	Demonstrating the relationship between improved RHIS for decision-making and improved health care, service, systems and public health should be easier.	Quality of care improvement mechanisms will be able to show more clearly how use of data supported decision-making.
Research	Opportunistic, observational	Rigorous, systemic	Routine data systems could be made available more easily for operational research
Future	Like the past	Innovation	New thinking, new methods, new people

Table 3. What is done and what should be done in the new Routine Health Information Systems paradigm?

	Investing in the old paradigm	Investing in the new paradigm	Comments
Health care providers	Strive to (and be trained on) obtaining more and better data	Strive to (and be trained on) treating patients and implement public health interventions	
Health care managers	Erratic use of paper and digital tools; emphasis on data quality	Support clinical and public health work; use health care data for management	
Policy makers	Responsive to external and internal pressures	Embrace innovation driving all HIS components in a national HIS strategy	
Governments, finances	Limited, if any, allocation to RHIS; workforce time costs not accounted for	Budget the new HIS national strategy	
Experts	Focus on workforce challenges; driven by data	Designers co-creating in transdisciplinary approach; including communities	“Deimplementation”[45]
Global Health Initiatives	Push for more indicators; penalise poor data quality	Support evidence-driven innovation; align	Consider the creation of a body to test IT products to determine their clinical functionalities and limitations [36].
Donors	Push for more indicators; penalise poor data quality	Filter initiatives; establish stringent funding criteria	
WHO	Aiming at consensus	Providing guidance and vision	Principle of alignment with RHIS [46] ^a .

^a In a recent initiative to reflect on a call for action for a robust reproductive, maternal, new-born and child health (RMNCH) the principle of alignment with RHIS was emphasised. In this article, the challenges and potential of RHIS to inform RMNCH issues is outlined, and recommendations are made suggesting that “UNICEF and WHO should join forces to develop long overdue standardized registers for RMNCH services as a fundamental step towards

5 Conclusions

- 1) To achieve UHC, the **primary mandate of the health care workforce is to provide good quality health services** to the populations, in decent working conditions.
- 2) Health care workers, managers and policy-makers have also a **secondary managerial responsibility** to organise good quality service delivery in the most effective and efficient way.
- 3) Accordingly, **the primary aim of RHIS is to support the clinical and public health decisions** affecting populations; the secondary aim is to support managerial responsibilities and feed national and international indicators, including the SDGs.
- 4) Any ideation, adaptation, or support to **the RHIS has to demonstrate that it improves** the health care mandate of health care workers.

Notes:

- ‘secondary’ does not mean that management can be ignored because it is secondary; it rather means that none of the management issues can jeopardise the provision of health care;
- the issues about RHIS are actually issues about health workforce; hence the importance of design.

strengthening RHIS systems, improving the comparability of RHIS data across settings and time, and reducing the reporting burden on front-line health workers” and that more investments in RHIS are required. However, while the principle is valid, the approach may not be to “standardise registers”, but rather to support the health care decision-making with appropriate tools.

ANNEXES

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