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Original article

Systematizing Information Use to Address Determinants of Health Worker Health in South Africa: A Cross-sectional Mixed Method Study

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ABSTRACT

Background: Recognizing that access to safe and healthy working conditions is a human right, the World Health Organization (WHO) calls for specific occupational safety and health (OSH) programs for health workers (HWs). The WHO health systems' building blocks, and the International Labour Organization (ILO), highlight the importance of information as part of effective systems. This study examined how OSH stakeholders access, use, and value an occupational health information system (OHIS).

Methods: A cross-sectional survey of OSH stakeholders was conducted as part of a larger quasi experimental study in four teaching hospitals. The study hospitals and participants were purposefully selected and data collected using a modified questionnaire with both closed and open-ended questions. Quantitative analysis was conducted and themes identified for qualitative analysis. Ethics approval was provided by the University of Pretoria and University of British Columbia.

Results: There were 71 participants comprised of hospital managers, health and safety representatives, trade unions representatives and OSH professionals. At least 42% reported poor accessibility and poor timeliness of OHIS for decision-making. Only 50% had access to computers and 27% reported poor computer skills. When existing, OHIS was poorly organized and needed upgrades, with 85% reporting the need for significant reforms. Only 45% reported use of OHIS for decision-making in their OSH role.

Conclusion: Given the gap in access and utilization of information needed to protect worker's rights to a safe and healthy workplace, more attention is warranted to OHIS development and use as well as education and training in South Africa and beyond.

1. Introduction

The critical value of protecting the health of health workers (HWs) that was vividly recognized globally during the severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) pandemic calls for deepening understanding and monitoring of occupational hazard and risks, health outcomes as well as occupational health services for HWs so that they can be effectively managed [1]. This is particularly urgent in low and middle income countries (LMICs) where adequate resources for mitigating occupational risks have been particularly lacking [2]. In this article, we examine barriers to implementing information systems for better targeting often ignored determinants of HWs health, with particular attention to circumstances in the Global

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South where the digital divide persists and data systems are underutilized [3].

Recognizing that the human right to decent work includes having a safe and healthy workplace [4–8], the International Labour Organization (ILO) calls for occupational health services to support employers, workers and their representatives in providing a safe and healthy work environment [9] and the World Health Organization (WHO) specifically calls for implementing occupational safety and health (OSH) programmes for HWs [10]. Attention to such recommendations is especially warranted in South Africa, where inadequate access, coverage and infrastructure prevail [11–16] as an ongoing legacy of the Apartheid era and neoliberal sequelae [17].

In its characterization of "six building blocks" that constitute health systems, the WHO explicitly includes "health information systems" (HIS) [18], reinforcing the ILO's attention to the need for "collaboration in providing information, training and education in the fields of occupational health …" [9]. Information, after all, encompasses the data and knowledge that intelligent systems (human and artificial) use to support their decisions, and for occupational health this not only includes recognition of accurately applying what is generally known in the scientific literature about workplace risk factors, but includes consideration of how surveillance information (e.g. concerning job history, work site exposure, environmental agents etc.) is systematically collected and applied; [19,20]. Sound and reliable information, after all, is the foundation of decision-making across all health systems, including those used for OSH purposes for HWs – and is the basis for evidence-based management within the health sector for patients and workers alike [21,22], especially in the digital age [23], to identify areas of shortcomings and opportunities for improvement. Occupational health information has indeed been critical to providing a healthy and safe health workforce in the era of the coronavirus disease 2019 (COVID-19) pandemic, see Box 1 [24,25], when many HWs suffered and succumbed from work-related diseases and injuries [26,27], with SARS-CoV-2 infection itself being just one of many serious occupational hazards. For example, it has long been known that HWs have higher rates of latent and active tuberculosis (TB) than the general population due to persistent occupational TB exposure, particularly in high-burden countries like South Africa, such that many TB experts have emphasized the need for OSH programmes which include computerized data collection to facilitate operational monitoring and evaluation [28].

When managing under-resourced health systems, information-based decision making is an especially critical tool to influence policy-making, programme action and research [21,29,30]. In OSH, an occupational health surveillance system encompasses the collection, analysis, and dissemination of occupationally related data at the individual, group, enterprise, community, regional and country levels that could impact a workers' health" [31,32]. Indeed, over 20 years ago Benach et al. explicitly called for "expanding and improving occupational health information and data systems" to be part of a "new occupational health agenda for a new work environment" [22]. Occupational health information systems have the potential to improve the management of the health of workers in general and HWs in particular, while contributing to better understanding of determinants of health for workers. As in electronic health records which are widely used in patient care, occupational health information systems (OHIS) could systemically collect clinical and non-clinical information on HWs at work [33].

While South African health facilities have free access to the District Health Information System, a repository for patients' aggregated routine health data, the system does not collect OSH data, such as workplace characteristics [34,35]. Globally, many LMICs lack adequate information and infrastructure for protecting HWs, impeding attention to mitigating OSH hazards, as well as planning and operating an effective OSH programme [36]. Nonetheless, the successful implementation of an OHIS in South Africa's National Health Laboratory Service called OHASIS (Occupational Health and Safety Information System) provided an opportunity to assess the feasibility of applying such an information system for hospital-based HWs [25,37,38].

When the African National Congress won South Africa's first ever democratic election in 1994, it inherited a health service that was severely marked with the inequities of the Apartheid era, highly privatized and distorted toward hospital needs of urban Whites [17]. The health service had to confront, as Pillay and Bond wrote, "the challenge of recasting apartheid social and health policies, transforming a moribund bureaucracy's mode of governance, and restructuring a variety of public and private institutions, including the National Department of Health" [39]. Much progress has been made in attempting to redress racial, gender, and class inequities, but numerous challenges remain. An important barrier to OHIS application in South Africa is the lack of experience of the buyer (government), realistic concern about corruption, and attendant costs and cumbersome bureaucratic procedures to have OHIS accepted, installed, staff trained, etc. [40,41]. The study we report on here is complementary to broader efforts of an international team to strengthen protection of health workers globally [42], for example, by applying the WHO-ILO HealthWISE tool developed for the health sector [43] and examining health equity and economic inequality determinants of HW protection [2].

This study constitutes the first part of a quasi-experimental intervention, utilising a mixed methods approach to examine changes in healthcare workplace management systems (infrastructure, technology and information management) accompanying the implementation of an OHIS intervention, so that it can then be systematically applied and monitored with regard to improving OSH in HW workplaces. Here we discuss the pre-intervention findings collected through a cross-sectional survey to assess the perceived value of implementing a comprehensive OHIS capable of monitoring health determinants as well as the degree to which occupational health information is currently used to inform decision-making by OSH stakeholders in the healthcare sector, especially during the COVID-19 pandemic [44]. The main objective of this article is to determine the degree to which OSH stakeholders in hospital settings in South Africa are satisfied with current occupational health relevant information practices, and to serve as a baseline upon which to evaluate implementation of a system to promote comprehensive evidence-based management of OSH challenges in the health care sector.

2. Methods

The study was conducted in four government health facilities (two interventional and two comparison sites implementing OHASIS). The intervention sites were a Gauteng Provincial Department of Health (GPDOH) academic hospital with 4300 HWs and a Mpumalanga Provincial Department of Health (MPDOH) tertiary hospital with 1300 HWs. The comparison sites were a GPDOH academic hospital with 6,200 HWs and a MPDOH tertiary hospital with 893 HWs. Together the four participating hospitals had a total of 12,693 health workers. The study population were formally employed OSH stakeholders (hospital managers, health and safety representative, trade unions, and OSH professionals) who provided informed consent. The health facilities and participants were purposefully selected, as they were the two largest hospitals in each participating province where the researchers were working on other research projects. All OSH stakeholders and senior managers were invited to an interview by the research team.

To carry out our study, we adapted a previously piloted and pretested questionnaire for health information system evaluation [45,46]. There were 13 close and open-ended questions, to allow for further probing and clarification. The questionnaires were administered by a researcher or trained research assistant with physical distancing, wearing of medical masks and hygiene measures employed to reduce the risk of transmission of SARS-CoV-2 during the data collection process. The study was approved by the GPDOH and MPDOH and the University of Pretoria Faculty of Health Sciences Research Ethics Committee (Ethics Reference No.: 801/2020) as well as the University of British Columbia Behavioural Ethics Review Board (H20-03183).

3. Results

Our baseline findings, were similar in all four hospitals, of which none had an operational OHIS in place. Of the 73 invited participants, only 71 participated in the study, with 56% being female, and 51% having post-graduate qualifications. Broken down by position, 44% were hospital managers, 20% were health and safety representatives (HSRs), 15% were trade union representatives, and 21% were OSH professionals. Participants described the processes that were in place in their hospitals to provide relevant OSH information as being "poor" for planning or making decisions about OSH interventions. Participants' designation of the status of the information they were provided as poor was particularly high with regard to relevance (37%), timeliness (42%), and accessibility (42%), while participants reported accessibility, accuracy, comprehensiveness and timeliness as important characteristics when selecting an OHIS; 59% also deemed cost a major factor in the acquisition of OHIS. More than 40% reported OHIS data collection, storage and retrieval as poor, and as reported in Table 1, the current system was in need of major upgrades. Over 85% of participants across all groupings reported that the existing OHIS needed significant reform. Data on health risk assessment, occupational health clinic use, and occupational TB, were seen as less important than the information related to the COVID-19 pandemic; a full 76% reported that COVID-19 data that were provided to them as the pandemic evolved were critical for their decision-making, higher by 10-fold than their assessment of how other OSH information met their needs.

Though the participating hospitals reported about 50% access to computers for all HWs, 27% of certain groupings of participants (trade union representatives) reported poor computer skills (Table 2). Similarly, even though more than 90% of participants indicated a belief that information technology (IT) improves efficiency and effectiveness, a majority of all respondents reported only occasionally or never applying IT and its tools. Fifty-eight percent within management but more than 72% of HSR, OSH professionals and trade union representatives reported knowledge of an up-to-date HIS policy (dealing with patient care) for their hospital. Of concern, 42% of HSRs and 61% of managers did not know of a confidentiality and privacy OHIS policy.

Table 1
Do existing processes for providing OSH information need significant reforms?

	Do you think existing processes for providing OSH information need significant reforms			
	Health and safety representatives n = 14 (%)	Management n = 11 (%)	OSH professional n = 15 (%)	Trade union representatives n = 11 (%)
Yes	12 (85.7)	29 (93.5)	14 (93.3)	11 (100.0)
No	1 (7.1)	1 (3.2)	1 (6.7)	0
Unsure	1 (7.1)	1 (3.2)	0	0

Table 2
Reported computer skills of OSH stakeholders.

	How do you explain your computer skills			
	Health and safety representatives n = 14 (%)	Management n = 11 (%)	OSH professional n = 15 (%)	Trade union representatives n = 11 (%)
Excellent	4 (28.6)	10 (32.3)	6 (40.0)	1 (9.1)
Good	7 (50.0)	18 (58.1)	5 (33.3)	4 (36.4)
Satisfactory	1 (7.1)	3 (9.7)	2 (13.3)	3 (27.3)
Poor	2 (14.3)	0	2 (13.3)	3 (27.3)

Shortcomings in knowledge about the availability of plans addressing key OSH data (Table 3) were observed; only 50% of the trade union representatives reported that the health and safety committee (HSC) was functional, and only 36% of trade union representatives reported that there was good coordination between their province and the hospitals. As high as 90% of management, and 87% of OSH professionals, reported a lack of a specific OHIS policy. Eighty percent reported lack of adequate capacity and staff for HIS, and no internal capacity for IT design and development; over 70% reported the lack of a specific budget for HIS and at least 62% reported that there was no data warehouse. While almost half the participants knew of core indicators for OSH, only a third reported that their province had collaborated in defining these and only a quarter reported the use of explicit criteria in selecting core indicators. Most HSRs, management, and OSH professionals, but only 30% of the trade unions representatives, reported regularly receiving an OSH report with descriptive statistics, although 57% noted receiving information after a significant lag in time. Table 3 also shows that other than OSH professionals, fewer than half (43%) of participants use OSH reports for ascertaining OSH coverage needs.

Between 35 and 50 % of the respondents stated that the quality of the COVID-19 data collection, timeliness, periodicity, representativeness and disaggregation (breakdowns by area or group) was inadequate or even poor. The highest concern was related to the perceived insufficient quality of the adjustment method used (50%) (Table 4). A strong majority (72%) of all participants reported desire for OHIS information, however, of concern, fewer than 50% of trade union representatives did so. Twelve percent, reported that HWs had access to widely distributed information on OHIS including COVID-19; 20% trade union representatives reported ever receiving OSH information. Only 29% participants reported that OHIS is used to set annual budgets; and a mere 49% of the participants stated that such information is called upon to advocate for lower risk at work.

In probing participants with open-ended questions, emerging themes on qualitative data regarding OHIS policy enforcement and OHIS plans included "ignorance on HIS" and "a lack of leadership, oversight and accountability." One participant stated: "the lack of support from province, no orientation for new staff and constant changes of CEOs are responsible for lack of leadership on OSH and its information …" (hospital manager).

On the theme of weaknesses in the capacity and staffing for HIS and OHIS, participants reported a "lack of capacity for processing data and producing information" and "lack of trained human resources on OHIS." However, one HSRs reported: "it is difficult to say because there is no HIS, so no weakness can be identified; everything is missing including general training on OHIS." Participants raised the concerns that, "OSH in general was not a priority so OHIS in turn was not a priority," thus the lack of budget for OHIS.

On the lack of basic IT infrastructure such as functional computers, participants noted that IT is controlled at the provincial level so only specific staff use it, and available computers were for specific disease programmes. Similar reasons were provided for the lack of an integrated and user-friendly data warehouse at the

Table 3
Knowledge of, access to and use of plans for various data sources

	Answered yes			
	Health and safety representatives n = 14 (%)	Management n = 11 (%)	OSH professional n = 15 (%)	Trade unions n = 11 (%)
written plan addressing the hospital survey	6 (42.9)	15 (48.4)	9 (60.0)	2 (18.2)
written plan addressing the human resources administration	11 (78.6)	19 (61.3)	12 (80.0)	5 (45.5)
written plan addressing OSH clinic records	7 (50.0)	18 (58.1)	13 (86.7)	7 (63.6)
written plan addressing safety assessment	10 (71.4)	13 (41.9)	9 (60.0)	7 (63.6)
written plan addressing the OSH Incidents	11 (78.6)	16 (51.6)	9 (60.0)	6 (54.5)
Use OSH reports for planning health coverage and services	7 (53.8)	14 (45.2)	14 (93.3)	3 (30.0)

Table 4
Quality assessment criteria on data collection method on COVID-19

	Adequacy assessment of data that was provided during COVID-19 by various evaluation criteria					
	Data collection n = 69 (%)	Timeliness n = 69 (%)	Periodicity n = 69 (%)	Representativeness n = 69 (%)	Breakdown by group/area n = 69 (%)	Adjustment method n = 69 (%)
Highly adequate	12 (17.39)	14 (20.29)	13 (18.84)	11 (15.94)	12 (17.39)	5 (7.25)
Adequate	34 (49.28)	26 (37.68)	33 (47.83)	34 (49.28)	30 (43.48)	30 (43.48)
Not adequate	21 (30.43)	23 (33.33)	18 (26.09)	19 (27.54)	23 (33.33)	24 (34.78)
Poor	2 (2.90)	6 (8.70)	5 (7.25)	5 (7.25)	4 (5.80)	10 (14.49)

hospital level, though the inadequate quantity of qualified staff also emerged prominently. A health manager reported that "IT keeps breaking and maintenance is under-resourced so it is left unattended, especially after the completion of some project funded programmes."

The reasons forwarded for the lack of sharing OSH information with HWs included lack of information to share, and that there was personal information and confidentiality requirements which did not allow for sharing of OSH information beyond the human resources department. However, one of the trade union representatives reported: "I think they are hiding sensitive information." A response to a specific question about the reasons trade union representatives are not utilising OHIS was that "trade unions are not participating in health and safety committee; they do not prioritise OSH; and there is ignorance and poorly functioning health and safety committee." A senior trade union representatives said: "I did not know I can request this type of information and that we were entitled to use it to support our members."

Box 1
Examples of health information use for COVID-19

- In British Columbia, Canada, data on HW infection rates and vaccinations are extracted daily to populate the occupational health database for HWs, which includes occupation and work location, respirator fit-testing results, etc. Data extracted from this database are used for regular occupational health surveillance of all HWs COVID-19 infections as well as monitoring and promoting vaccine uptake.
- While in South Africa, the Occupational Health and Safety Information System (OHASIS) is used to monitor all incidents of COVID-19 infections amongst HWs. HWs self reported symptoms and a professional OSH contacted them for further management without involvement of employer, and OHASIS reports were used by management to develop policies for vulnerable workers and they informed procurement practices for PPE.

With regard to whether OSH stakeholders who are expected to use the information have the necessary skills to judge OSH information, the majority including health and safety committee members, reported that they lack knowledge and were not trained on OSH. This was suggested as being because OSH is not taken seriously so information from it also not taken seriously. A senior manager reported "because people in this hospital do not realise how critical it is to use this information for planning purposes they will not ask for information; even when we do have sufficient budgets we do not ask for this information and we do not even budget for anything related to OSH."

4. Discussion

It is increasingly well-established that appropriate data should support OSH for HWs at all its stages [47,48]. Computerised information is known to improve the quality of health information, due to increased speed, integration of data and easy access to all sources [49]; studies have shown that web-based systems improve data completeness and data accuracy [41,50], albeit there is abundant evidence that most information systems fail in their actual use. As such research on how implementation is conducted is essential to ensure successful implementation and sustainable use [51]. In most LMICs, OSH is woefully underdeveloped and generally operates without functioning OHIS [52]. Where data collection exists, it is frequently paper based, resulting in poor quality information [41,53]. That OHIS is poorly organised and in need of reform in other LMICs is becoming increasingly apparent, with management support for OHIS unsatisfactory and political and donor pressure drawing attention away from OHIS for worker's health and wellbeing [46]. This, despite the knowledge that "nothing exists until it is measured" [54], and the emphasis by the WHO that HIS are critically important for the good management of health organizations [21,30,45,55].

Consistent with other reports on unsatisfactory access to occupational health services [15,16,56–58] and TB Infection prevention and control [59] systems for workers in South Africa, the limited knowledge about OHIS described in this study is not surprising, but is concerning. In almost all the participating hospitals, OHIS was

predominantly paper based, consistent with documented poor access to information systems in general in South Africa [34,35]. Adding to the concerns about accessibility, here we found, as reported elsewhere, that even where systems exist, if data are not provided in real-time, the usefulness of information for decision-making is limited [9,41,60]. However, conversely, as others have also noted, OHIS, if accessible and timely, can be used for monitoring and evaluating costing, outcomes and impacts related to OSH in the workplace [61]. The strong views expressed on the value of having access to COVID-19 data and the desire for OSH-related data more generally in this study support the conclusion that OHIS is feasible and can be critical for effective surveillance and planning [62,63]. Indeed, the reported higher utilisation of COVID-19 related information for decision-making documented in this study should strengthen the call for an upgraded and functional OHIS for other hazards as well.

While this study was limited to four hospitals, two in each of two provinces, and was intended only as a baseline description, some of the observations from the purposive sampling are quite cogent. In this South African public healthcare sector environment, access to computers was insufficient to allow increased use of OHIS. Even with computer availability, interviewees did not maximally utilise the OHIS, consistent with the analysis that the digital divide disadvantaging LMICs is not just about lack of access, but also encompasses a range of needed policy, infrastructural and training supports to meet the needs of all stakeholders [51]. This study identified some of the challenges facing hospitals around OHIS, including lack of knowledge of OHIS written plans and policies and information on privacy and confidentiality, which is similar to findings related to TB in HWs [64–66]. Written plans and policies define how data should be collected, stored, transferred, and released [61]. Without the written policies, confidential personal health information may be compromised leading to poor OSH data use by HWs fearing lack of privacy and confidentiality [65]. Moreover, lack of policies may well be an indication of inadequate thought and attention as well as worker participation, which has implications for privacy and confidentiality [67].

Although South African OSH legislation is explicit on OSH being the responsibility of employers and managers [68], this study confirmed short-comings including a dearth of OSH orientation as well as high turnover of managers [64]. This was accompanied by the lack of human and other resources, including training for OSH and OHIS, similar to previous studies [15,56,69]. Our qualitative analysis concluded that OSH was not seen to be a priority, and in turn systematically providing related information, such as in an OHIS, was not prioritised, leading to the lack of training, demand and resources for OHIS, similar to challenges faced in HW TB control [64]. The perception that OHIS is not prioritised in order to hide sensitive information merits further investigation, as is the allegation that unions have more generally had limited interest and participation in OSH in general. In this study, both management and trade unions, despite indicating their appreciation of having more regular access to relevant information, appear to be demonstrating limited commitment to promoting OSH and, in turn OHIS, as a key intervention in health equity has been neglected [70,71].

The WHO lists the workplace as one of the key determinants of health, including workplace issues such as job security, income and social protection, and working life conditions such as access to OSH and information [72]. While accessibility and effective use of OHIS in LMICs would have a positive impact, it would be of little value if it is not available in formats that meet the needs of multiple users, including policy-makers, planners, managers, healthcare providers (OSH professionals), health and safety representatives and health and safety committees, as well as trade unions and individual workers, all of whom need different kinds of information on health determinants and the contextual environments within which the health system operates [21].

It is reported that organizations that adopt OHIS have a clearer vision of health and safety goals, better communicate these goals to their OSH stakeholders and workforce, and more rigorously assess risk to workers, define corrective action more often, and exhibit improved attitudes towards worker training [73,74]. Research has linked lower injury rates in organizations with elements of OHIS [73,75–78]. Sarbazet al. [79], showed that the implementation of a Web-based information system improved infection prevention and control among HWs [79]. The relationship of improved information, demand for information, and continued information use thus creates a cycle that leads to improved health programmes and policies [80,81], and is likely to positively impact the well-being of HWs.

TB experts have pointed out that accurate surveillance and reporting of TB disease in HWs in LMICs is crucial to gaining a better understanding of the epidemiology of TB in this high-risk population, noting that despite the WHO recommendations on its global strategy of occupational health for all in 1994, only a tiny percent of workers have access to adequate OSH services [28]. The COVID-19 pandemic highlighted the social and economic factors impacting health equity in the COVID-19 pandemic in South Africa [82], our study highlights how strengthening information to support workplace health and safety for HWs provides a feasible way to better recognize and address determinants of health. Indeed, HWs not only have a right to a safe workplace but the well-being of HWs can have profound impacts on provision of universal healthcare, with HWs serving as powerful advocates for health equity for all.

While the post-Apartheid era has brought significant new rights to South African workers, South Africa's re-integration into the global economy presented new challenges for the labour movement with trade unions significantly weakened by retrenchments, outsourcing, subcontracting and privatisation. This study has documented that the interest is there and the need critical. The next phase of this study, post-OHASIS implementation, aims to shed further light on these issues.

5. Conclusion

Within continued efforts to redress enormous challenges in a society marked by huge inequities rooted in its political history, OHIS to protect the health of HWs in South Africa merits implementation. We found widespread support for an efficient OHIS, however, it can be concluded that to be effective, high quality information on work-related health must be provided to all knowledge users in a timely way, with implementation accompanied by policies, good coordination, training in OHIS use and support from trade unions, as well as health and safety committees, occupational health professionals, and employers alike. Consistent with what has been reported elsewhere and the lessons from the COVID-19 pandemic, other countries would do well to consider doing likewise.

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Conflicts of interest

The authors declare no potential conflict of interest with respect to the research, authorship, and/or publication of this study.

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