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Human Factors Affecting the Quality of Routinely Collected Data in South Africa

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Abstract

Evaluations that have looked at the people aspect of the health information system in South Africa have only focused on the availability of human resources and not on competence or other behavioural factors.

Using the Performance of Routine Information System Management (PRISM) tool that assumes relationships between technical, behavioural and organizational determinants of the routine information processes and performance, this paper highlights some behavioural factors affecting the quality of routinely collected data in South Africa.

In the context of monitoring maternal and child health programmes, data were collected from 161 health information personnel in 58 health facilities and 2 district offices from 2 conveniently sampled health districts. A self-administered questionnaire was used to assess confidence and competence levels of routine health information system (RHIS) tasks, problem solving and data quality checking skills, and motivation.

The findings suggest that 64% of the respondents have poor numerical skills and limited statistical and data quality checking skills. While the average confidence levels at performing RHIS tasks is 69%, only 22% actually displayed competence above 50%. Personnel appear to be reasonably motivated but there is considerable deficiency in their competency to interpret and use data. This may undermine the quality and utility of the RHIS.

Keywords:
District Health Information System (DHIS), routine health information system (RHIS), behavioural factors, data quality, human resource for health informatics, competence level, Performance of routine information systems management (PRISM) tools.

Introduction

Several studies [1-3] have highlighted the importance of maternal and child health interventions as essential to meet the millennium development goals (MDGs) 4, 5, and 6. However, tracking coverage of these interventions is challenging due to a lack of accurate and reliable statistics [4-10].

The South African National Department of Health has developed a district health information system (DHIS) to collect monthly facility based data from the public sector primary health services and district hospitals [11]. Audits of the human resources and equipment to support the DHIS have been undertaken [12, 13], but there has not been a comprehensive evaluation.

Most studies on the evaluation of health information systems' (HIS) performance primarily focus on technical and organizational issues or clinical processes [14-16] and generally fail to explain the determinants of HIS successes or failure in different settings. Very few studies have examined the people aspect of HIS, and these only focus on the availability of human resources [17] and not on competence and motivation, nor use of data for decision making and improving services.

One of the challenges of routine health information system (RHIS) in low and middle income countries revolves around nurses, who are faced with the dilemma of seeing patients and compiling monthly statistics. A major concern is that clinic personnel, such as nurses, have multiple responsibilities, including primary clinical responsibilities, which may interfere with the time they allocate for data collection. Clinic staff may value the care of patients over data collection; hence data collection may be completed many days after the event has occurred, and this lag-time may impact on the quality of the statistics they produce.

Another concern is that at the facility level, there are piles upon piles of registers and tally sheets that need to be collated, summarized and sent to the sub-district level. Training is not usually provided for clinic staff involved in data collection processes, who often times, have very limited data quality checking skills and do not understand the value of the data being collected; as such data captured into the RHIS may be of low quality. Studies have shown that data from the RHIS are inaccurate, and data collection methods are not complete [4-7, 18, 19].

In the case of the DHIS, the data are collected at the facility level in paper format and captured into electronic format (Excel) at the sub-district level, which is then imported into the DHIS at the district level. Consequently, there are a number of opportunities for transcribing errors, particularly when these tasks are performed in un-conducive environments.

This study, which is part of a comprehensive evaluation of the RHIS using mixed methods, reports on the experience in two health districts using a modified version of the PRISM's Organizational and Behavioural Tool (OBAT) [20] to assess the behavioural factors affecting the RHIS performance in maternal and child health HIV programmes.

Methods

Framework

This study used the PRISM framework and tools, which are designed along the logic framework – input, process, output, outcome and impact – that identify the health information requirements to result in improved health (Figure 1). The PRISM framework is the first of its kind to empirically test the relationships between technical, behavioural and organizational determinants of health information systems processes and performance. It focuses on "neglected routine health information system (RHIS) processes, such as checking data quality, displaying of information and giving feedback" to health facilities as well as the behavioural aspects that have previously been ignored [21].

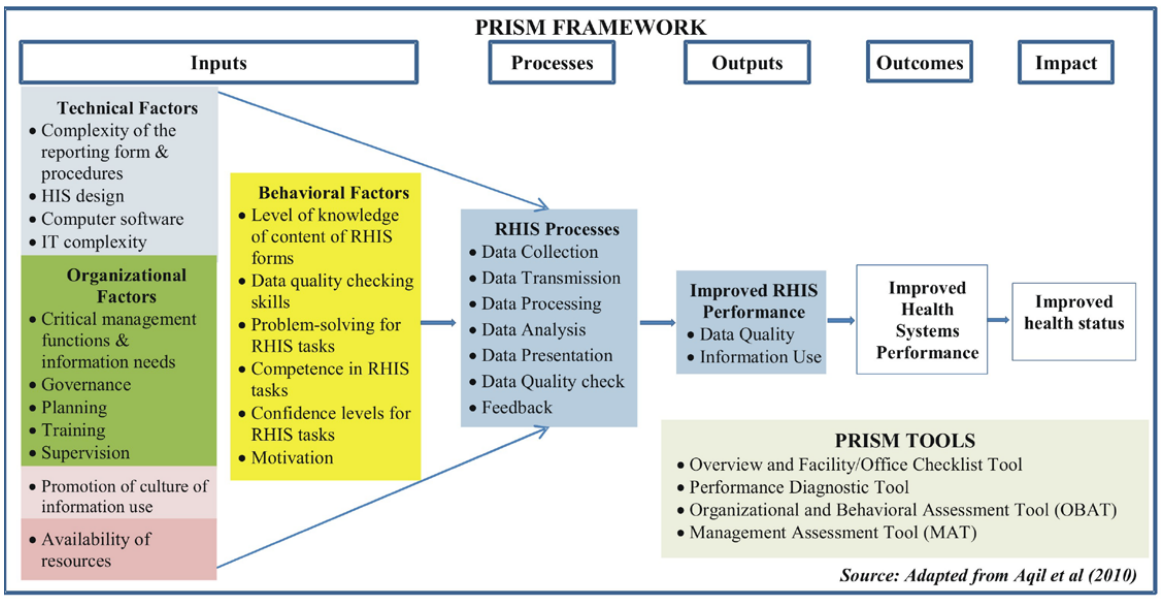

Figure 1 - The Performance of Routine Information System Management (PRISM) framework and tools [20, 21]

The framework proposes that performance is determined by RHIS processes (data collection, transmission, processing, analysis, display, data quality checking and feedback), which in turn are affected not only by technical concerns, but also behavioural and organizational determinants. The framework and tools have been tested in different settings [21-26].

This study focuses on one of the input components of the framework (Behavioural factors). The key behavioural factors that are of interest are knowledge of RHIS rationales, data quality checking skills, problem-solving for RHIS tasks, competence in RHIS tasks, confidence levels for RHIS tasks, and motivation (Highlighted in yellow in Figure 1).

Study design and survey techniques

A comparative observational study was based on a survey of health information personnel between July and November 2012. Data were collected from 161 health information personnel in 58 health facilities and 2 district offices from 2 conveniently sampled health districts in South Africa, using a modified version of the PRISM's self-administered Organization and Behavioural tool (OBAT) [20]. Behavioural factors were measured in terms of data quality checking skills, problem solving skills, competence in RHIS tasks, confidence levels for RHIS tasks, and motivation.

The study population included health information officers, health facility managers, maternal and child health programme managers, and staff involved in data collection at facility and district levels.

Data collection on individual behavioural factors

Table 1 and Figure 2 are excerpts of questions used to assess whether personnel involved with data collection are equipped with the necessary skills to perform RHIS tasks. Personnel were asked by trained interviewers to rate their confidence levels in performing RHIS tasks (Table 1); they were then given a self-administered basic competence test (Figure 2) based on the themes in Table 1, which were scored and analysed. Participants were given the freedom to spend as much time as is needed to finish the test; there were no time restrictions.

Confidence in RHIS tasks

Table 1- Excerpt of RHIS tasks questionnaire

On a scale of 0 to 100%, please rate your confidence in accomplishing the following activities. (For example, if you are very confident select 100%)										
Rate your confidence for each situation to a percentage from the following scale										
	0	**10**	**20**	**30**	**40**	**50**	**60**	**70**	**80**	**90**	**100**
SE1. I can check data accuracy										
SE2. I can calculate percentages/rates correctly										
SE3. I can plot data by months or years										
SE4. I can compute trends from bar charts										
SE5. I can explain findings & their implications										
SE6. I can use data for identifying gaps and setting targets										
SE7. I can use data for making various types of decisions and providing feedbacks										
Source: Adapted from Aqil et al (2010)										

Competence in RHIS tasks

Problem Solving Skills

Please solve the following problems about calculating rates and interpreting information.

C1. The estimated number of pregnant women in sub-district K is 340. Antenatal clinics have registered 170 pregnant women. What percentage of pregnant women attended antenatal clinics in sub-district K?

Source: Adapted from Aqil et al (2010)

Figure 2- Example of RHIS competence questions

Results

Background characteristics

A total of 177 responses were expected from the 58 health facilities and 2 district offices. However 16 facility managers were unable to take the assessment resulting in a response rate of 91%. Table 2 presents the background characteristics of respondents and shows the corresponding levels of confidence and competence for RHIS tasks. The number and percentage of respondents according to characteristic are shown in columns (b) and (c) respectively. About 35% of the respondents are data capturers and Health information officer, while 46% are facility managers (FM)/deputy facility managers/operation managers (OM), most of whom are nurses. The respondents range from 20 to above 55 years of age with half of them in the 20-39 age groups. In terms of education, 39% of the respondents claim they have a diploma while 34% claim they completed high school. Females accounted for 77% of the personnel surveyed, while 58% claim they had no training in health information system related tasks in the last 6 months preceding the survey. Almost half of the participants claim they have been employed for more than 5 years before the survey, while 18% have been on the job for less than a year.

Behavioural factors

Overall levels of confidence (69%) were not commensurate with the overall levels of competence (30%). The association between the background characteristics and levels of key behavioural factors (confidence and competence) were evaluated using a χ^2-test. Table 2 shows that competence is positively associated with education (P=0.008), job category (P=0.002) and age (P=0.049). In contrast, confidence levels were similar across all categories with the exception of sex (P=0.050). Job category was associated with both education level and age (data not shown). Thus further analysis has been done stratified by job category. Figure 3 shows the average scores for each behavioural factor for each job category. The average levels of knowledge of RHIS rationale and data quality checking skills were 22% and 36% respectively. However, when assessed by job category, it can be seen that clinical/managers have a better understanding of RHIS rationale. While 81% of respondents claim their confidence levels in checking data quality is above 50%, only 32% displayed above 50% competence. Clinical/managers and data capturer have more skills in checking data quality (42%) compared to others. Motivation and confidence levels were high across all participants at 74% and 69% respectively; clinical/managers have more ability to solve problems (32%). Competence was found to be significantly correlated with data quality checking skills (R^2=0.52, P<0.0001), confidence levels for RHIS tasks (R^2=0.28, P<0.0001), knowledge of RHIS rationale (R^2=0.37, P<0.0001), and problem solving skills (R^2=0.26, P=0.0009). However there is no correlation between competence and motivation (R^2=0.06, P=0.4557). Using multiple linear regression analysis, data quality checking skills (P<0.001) and knowledge of RHIS rationale (P=0.0276) were found to be predictors of competence in RHIS tasks after adjusting for education and age. Overall, 44% of the variation in competence could be explained by these variables.

Skills assessed in terms of confidence and competence

Elements assessed for RHIS tasks confidence and competence levels were compared by job category. Figure 4 shows that across all elements, respondents in all job categories reported higher confidence levels compared to displayed competence levels. Data captures and clerks displayed the least competence

Table 2 - Percentage distribution of respondents' background characteristics by HIS tasks confidence and competence levels

Background characteristics	N 161 (b)	% (c)	RHIS tasks Confidence (%)	RHIS tasks Competence (%)
Education				
<=Grade 10	7	4	57.6	2.9
Matric	54	34	67.6	25.6
Diploma	63	39	67.7	30.7
Bachelor	24	15	77.6	39.3
Post Graduate	7	4	79.1	58.7
Missing	6	4	59.7	17.0
***P*-value**			**0.159**	**0.008**
HIS training in last 6 months				
No	94	58	66.8	27.4
Yes	67	42	71.9	32.4
***P*-value**			**0.658**	**0.912**
Job title				
Clerk	32	20	61.2	13.0
Data capturer	33	21	71.0	27.0
Health information officer	22	14	78.9	38.2
Clinical/Manager*	74	46	68.3	35.8
***P*-value**			**0.072**	**0.002**
Sex				
Male	37	23	80.9	34.7
Female	124	77	65.4	28.3
***P*-value**			**0.050**	**0.167**
Age				
20-24	18	11	78.9	29.5
25-29	31	19	69.1	26.4
30-34	16	10	72.9	26.0
35-39	18	11	69.2	25.5
40-44	23	14	66.7	37.1
45-49	19	12	66.3	28.1
50-54	15	9	62.7	27.3
above 55	19	12	69.0	35.4
Missing	2	1	38.5	24.8
***P*-value**			**0.270**	**0.049**
Years of employment				
<1	29	18	70.7	25.0
1-2	7	4	74.3	17.4
2-3	16	10	67.4	26.9
3-5	30	19	74.0	36.6
>5	79	49	66.2	30.6
***P*-value**			**0.458**	**0.886**
Province				
KwaZulu Natal	71	45	73.0	28.2
Western Cape	90	55	80.0	22.9
***P*-value**			**0.400**	**0.880**

*Facility Manager (FM), Operation Manager (OM), Nurses, HIV/AIDS, STI & TB (HAST) Programme Manager (PM).

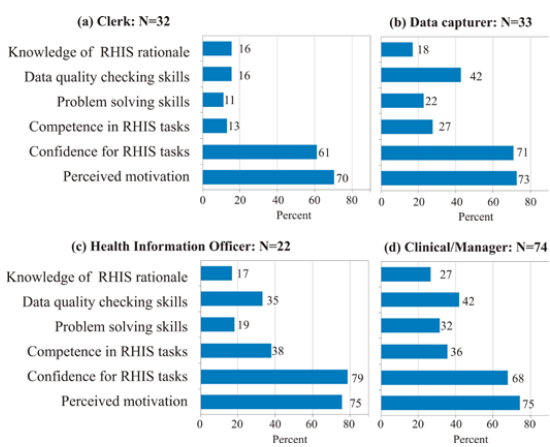

Figure 3- Behavioural factors by job category

across all elements. Competencies for interpreting data and data use were low across all job categories (Figure 4). Overall, 61% of respondents reported they can interpret findings but the assessment indicates that only 14% could do so. In addition, 69% reported that they can use information to identify actions but the competency assessment found that only 14% could actually do so (data not shown). Health information officers and clinical staff/managers displayed higher skills in calculating indicators and plotting data.

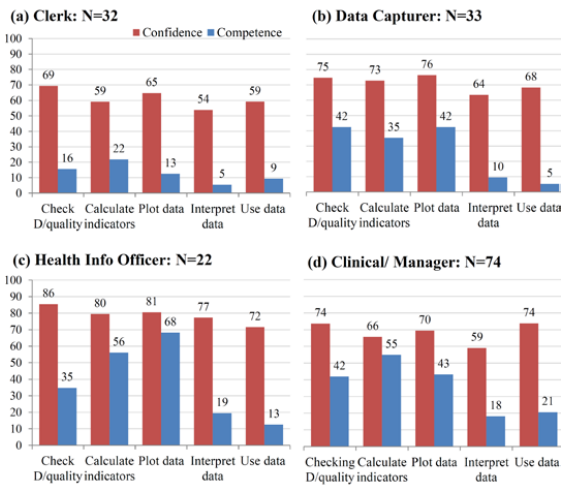

Figure 4– Average confidence and competence levels for RHIS tasks by job category

Discussion

The initial results of this evaluation highlight the need for improved RHIS knowledge and skills amongst personnel working with health information. Although the personnel are reasonably motivated they lack sufficient RHIS knowledge and skills. The study show that personnel confidence and motivation are relatively high but this is not reflected in their competence in RHIS tasks. There was no correlation between motivation and competence and only a slight positive correlation between confidence and competence. Low levels of knowledge of RHIS rationale, data quality checking skills and problem solving skills were observed. Particularly low levels of skills to interpret data or use data were observed, even among health information officers, clinical staff and facility and programme managers.One of the limitations of this study is the sample size. The study focuses on priority districts with high HIV prevalence, where important lessons can be learnt for monitoring HIV programmes in maternal and child health, and where improved information could potentially make an impact on health care delivery and health outcomes. However, as only two districts which may not be representative of other districts were included in the study, the study cannot be generalized. Poor RHIS skills at ground level can result in poor quality data being collected at the facility level. The study has shown that the average competence level for RHIS tasks is low at 30%. If information personnel at facility level are adequately equipped with necessary skills, and know the importance of the data they collect, chances are it will impact on data quality, since much attention will be given to data error detection at the onset of the data collection process. Unfortunately this is not the case in this study, which shows the average ability of health personnel to check data quality to be only 36%. This finding is consistent with studies conducted in other settings [21-26].The lack of knowledge about RHIS rationale is disturbing. This evaluation found the average knowledge of RHIS rationale to be 22% indicating a lack of understanding of the importance of health information. Similarly, more than half of the respondents claim they had no RHIS related training in the last six months prior to the survey. It is expected that training as well as levels of education will be positively correlated with competence; however, this is not the case with training. The study shows that RHIS training was not found to have a substantial impact on competence in RHIS tasks (Table 2). This finding refutes a recent study [30] which used a data collection and feedback training intervention to improve the quality of routinely collected data. There is perhaps a need to reassess the content of RHIS training to include components that would strengthen data interpretation and data use at all levels of the health information system.Most health facilities have a clerk or data capturer to compile their monthly data. The average level of RHIS tasks competence in these two categories was 13% and 27% respectively, and the highest level was found in Information Officers, but this was only 38% (Figure 4). This finding illustrates that low RHIS competence is not limited to the lower levels of the health system. On the other hand, the lowest levels were among the clerks. It is not clear whether the evaluation is appropriate for them. The key skills that they would need are good attention to detail, good administrative skills and accuracy. Perhaps there needs to be some discussion about whether the tool is appropriate for all levels of personnel. The study has highlighted the deficiencies in numeracy skills among personnel involved with data collection at both the facility and district levels; these deficiencies can be attributed partly to inadequate numeracy skills in nurse trainings. Nurses are the ones who are responsible for completing the registers from which all our routine health data comes. This evaluation found an average RHIS competence level of 36% among nurses, corroborating findings from past studies that have identified nurses' inadequacies in numeracy skills [27-29]. The studies in the United Kingdom and Australia looked at both undergraduate and qualified nurses. These studies found that nurses lack the necessary numeric skills to solve basic mathematical problems that are needed to perform daily clinical functions that include drug administration and compiling daily statistics from patients' registers/records. One of the studies [28] looked at the curriculum of undergraduate nursing students in Australia and discovered that mathematics is not a required pre-requisite for entry into the nursing degree programme, and that nursing students are not trained in numeracy skills during their degree programme. This problem is not unique to nurse trainings, but has been identified as a cause for concern by the South African minister for Basic Education, who acknowledged the yearly low pass rate of learners in numeracy related subjects [31]. This notwithstanding, numeracy training should be made mandatory for all nurses; skills in basic mathematics should be considered a prerequisite for all prospective nursing students. In addition, basic numeracy skills should be considered a compulsory requirement when recruiting health information personnel. Regular on-the-job RHIS training, tailored to meet the needs of information personnel should also be encouraged.

Conclusion

Personnel appear to be reasonably motivated and feel confident about RHIS tasks, but lack skills and knowledge about RHIS and its use. The investigation reveals a considerable deficiency in their competence to use and interpret information. Institutional capacity to train personnel on data collection processes and data use and interpretation should be encouraged. Basic numeracy skills should be a mandatory requirement when recruiting health information personnel as well as clinical and health facility and programme managers. Further analysis of

these data is needed to better understand the behavioural aspects related to the routine health information systems processes and performance.

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