

Review

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Existing NCD Monitoring and Surveillance Systems and its adaptability to Fiji's context: A Systematic Review

Joshua LIGAIRI,¹ Donald WILSON,¹ Isimeli TUKANA,²

ABSTRACT

Introduction: The United Nations high-level meeting of the General Assembly on the Prevention and Control of Non-communicable Diseases passed a political declaration on Non-Communicable Diseases (NCD) prevention and control in 2011, emphasizing the great need for NCD surveillance including in Low-to-Middle-Income-Countries (LMICs).

Method: A review of literature was conducted and set for full text citations published in English dated 1 January, 2007 to 31 August 2019. MESH terms or key words were selected from the following groups of generic terms: the following words “Health surveillance systems” and “NCD monitoring and surveillance system”. The literatures were tabulated according to the authors, date that was published and which journal, the title of the study, the surveillance design and their recommendations. The 13 articles that were identified, only one was conducted in a developing country while the rest were conducted in high income countries.

Results: 60% of the NCD surveillance system reviewed use passive surveillance, 30% uses passive assisted sentinel surveillance and 10% use passive assisted spatial surveillance. Based on countries surveillance system there was an equal distribution on involvement in policy development (33%), behavioural risk associated aggregates (33%) and intergrated health information System (33%). Through intense review, passive assisted sentinel surveillance was mostly practiced and the use of spatial surveillance in this context for interregional comparisons of specified diseases.

Conclusion: There was less evidence on surveillance in LMIC but the following surveillance systems were identified as essential for Fiji's proposed NCD surveillance system. This study suggest that a probable surveillance system that can be adopted by Fiji is a passive assisted sentinel surveillance system enhanced with Spatial data. Further consultation and a feasibility study can be proposed as a way forward for this study findings.

Key Words: surveillance, population health, behavioural modification, non-communicable disease

INTRODUCTION

Non-communicable diseases (NCDs) are chronic conditions with rather slow progression and rarely completely curable. In 2016, 71 % of the global deaths were attributed to NCDs.² The increase of NCDs in low- and middle-income countries (LMICs) is accelerated by population ageing and is driven by rapid and unplanned urbanization and changing lifestyles. About 54 % of NCDs in LMICs and 46% of these deaths occur amongst people under the age of 70, compared to 28 % in high-income countries (HICs).²

Given their devastating health and socioeconomic effects, NCDs have gained increasing attention over the past decade in the international community. The UN High-Level Meeting of the General Assembly on the Prevention and Control of Non-communicable Diseases passed a Political Declaration on NCD prevention and control in 2011, emphasizing the need for NCD surveillance.⁴

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The goal of disease surveillance is to address a defined public health problem and to develop evidence-based measures to protect and promote population health.⁵ It is defined as “the ongoing systematic collection, analysis and interpretation of health data essential to the

planning, implementation, and evaluation of public health practice, closely integrated with timely dissemination of these data to those who need to know.”⁶ There are different types of surveillance designs and are noted as Passive surveillance which rely heavily on readily available data and sentinel surveillance that rely on data reported from sentinel sites or facility. Laboratory based surveillance rely on samples submitted for analysis and also act as sentinel sites. Then we have a periodic - population based survey or active surveillance that mostly focus on a one –off cross-sectional population surveys.

The WHO has assessed the current capacity for NCD surveillance as inadequate in several countries.¹ Evidence from HICs indicates that interventions for most NCDs can be effective and implemented at a rather low cost.⁷ However, the long-term nature and complex disease aetiology of NCDs demand a comprehensive and long-term health-system mediated response. Essential to this goal is accurate and sequential data for planning and evaluation. Therefore, the WHO developed a global action plan for the prevention and control of NCDs, particularly cardiovascular diseases, cancers, chronic respiratory diseases and diabetes.⁷ The action plan identifies six objectives, one of which is monitoring the trends and determinants of NCDs and evaluating progress in prevention and control. In order to attain these targets, the WHO suggests the following policy options: strengthen vital registration systems and cancer registries, integrate surveillance into national health information systems, undertake periodic risk factor surveillance, and strengthen technical and institutional surveillance capacities.^{2,7}

Against this background, the objective of this paper is to identify relevant literatures that highlight the possibility of establishing an NCD surveillance system (NCDSS) here in Fiji entailing strategies from other countries surveillance systems. The dynamics of the NCDSS shall be highlighted in this paper together with a proposed surveillance mechanism based on systems design and best practice.

METHODS

Desk-review was conducted together with on-line literature search using MESH generic terms: the following “Health surveillance systems” and “NCD monitoring and surveillance system”. On-line literature search was narrowed from health surveillance systems to NCD monitoring and surveillance system where the search was further focused to good practice in health monitoring systems. These articles and studies

identified were graded based on their objectives and designs whereas further analysis was conducted for good practice.

A systematic search was conducted and set for full text citations published in English between 1 January 2007 to 31st August 2019. The literature was tabulated by authors, date of publication, journal type, the title of the study, the surveillance design and their recommendations. Further analysis was conducted on the literature towards the country and its existing NCD surveillance design and what are some of the output of the countries adapted surveillance design. The following literature search design was followed through for information search (Figure 1)

Search Result

Of the 10 citations, six articles described or evaluated existing NCD surveillance systems and three supportive documents which are all peer reviewed articles entails the gaps and challenges identified on Surveillance system analysis of Best Practice. One of the articles provides information on how to link and adapt NCD surveillance system concepts from High Income Countries (HICs) to the LMICs.

RESULTS

Of the 10 manuscripts obtained, only one was conducted in a LMICs while the rest were conducted in HICs.

Systems Design

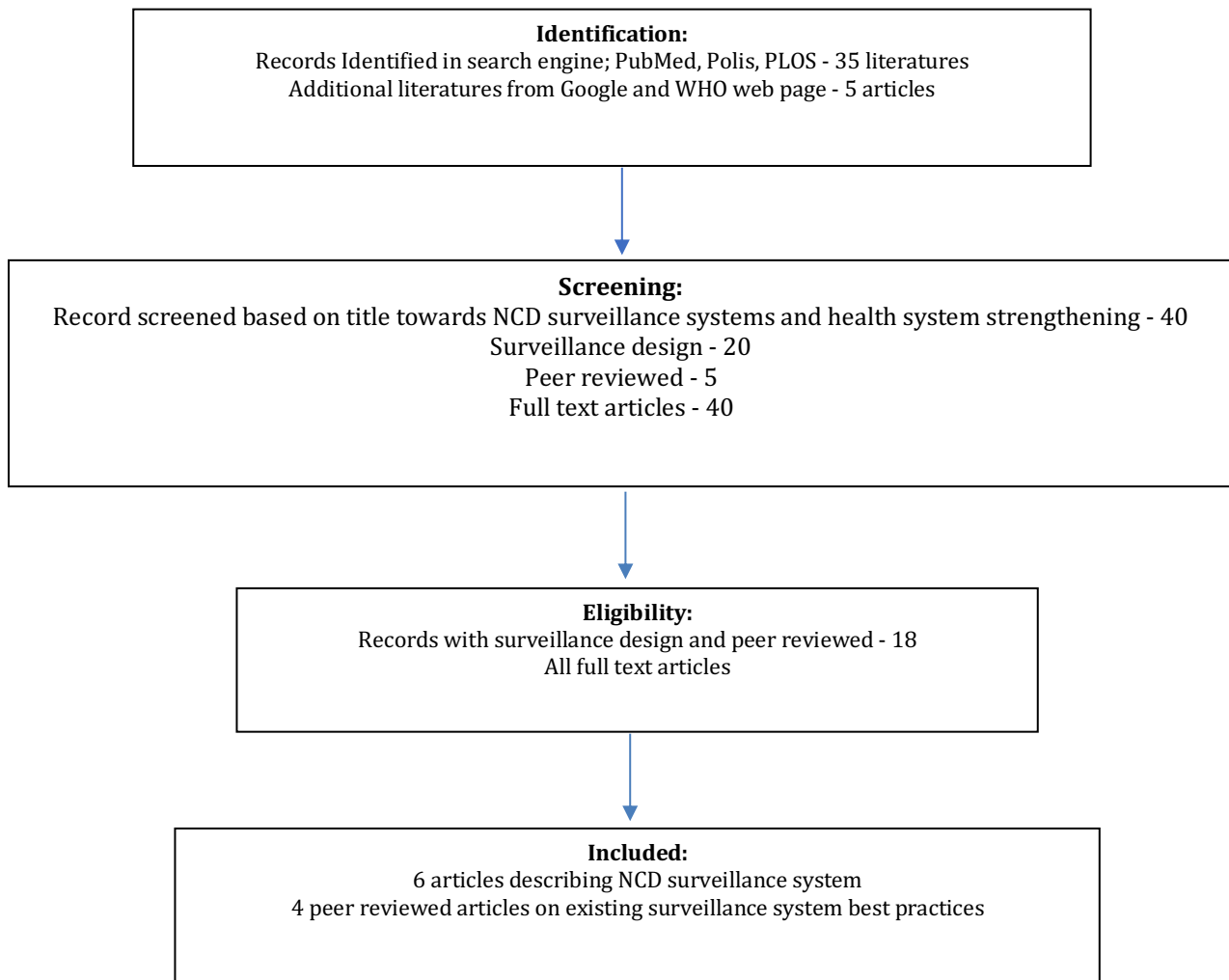
Most of the surveillance systems designs (4 of the 6 assessed) were mixed systems whereas 60% of the surveillance systems under study were Passive assisted Sentinel surveillance. One was a national survey using active surveillance design. The WHO^{1,9,15-20} conducted questionnaire-based surveys among its member countries in 2000, 2005, 2010 and 2013 in order to assess the national capacity for NCD prevention and control. It was found that some progress – mainly in HICs – has been made in the last decade. More countries have developed strategies for combating NCDs and created the necessary infrastructure. However, the implementation process in many countries was assessed as inadequate and strategies often exist mainly on paper. More finding from WHO shows the HICs were 16 times more likely than LMICs to have population based NCD mortality data in their national health information system. However, the quality and completeness of data was not assessed in the survey. Authors^{1,2,4,5} suggest, that major gaps exist in the accuracy, quality,

standardisation of risk factor data, and reporting of NCD outcomes. Furthermore, data were often not linked to socioeconomic information and therefore did not facilitate the assessment of health disparities. Macfarlane¹³ and Nolen *et al.*¹⁴ also rated the quality of health data as inadequate in many LMICs. Macfarlane¹³ identified costly duplications, inefficiencies and inconsistencies between reporting, storage and analysis of data as the main problems. Moreover,

data were unreliable, unrepresentative, and often not analysed and disseminated in a timely manner.

The member states of the WHO South-East Asia office for example stated in their regional meeting in 2012, that health system and poor due to negligence of NCDs over a long time.¹⁵

Figure 1: PRISMA Flow-list diagram summarising the literature search process



A comprehensive framework, robust mortality data and sufficient funding to effectively plan and implement NCD prevention and control programs are missing in most countries in the region.¹⁶

Therefore, the member states may need additional five years to establish robust surveillance systems and generate baseline data for targets of NCD monitoring due to the mentioned problems.¹⁵

Health Surveillance and Monitoring System and Analysis of Good Practice

There are countries that have their own health monitoring and surveillance system especially on NCD's. These countries were analysed and drafted as part of their best practice. These are the examples of the implementation of six country integrated monitoring systems, including the regular collection and evaluation of

measured data, which play a crucial role in informing policy development.

Policy Development

Two countries surveillance system^{4,6} fit in the scope of good practice through their involvement in the reformulation of food product through policies. Both surveillance systems collaborated more on the reformulation food product address food regulations on trans-fatty acid and salt intake. In both surveillance system, inter-sectorial collaboration was the main element of change in initiating the data to policy change.

Behavioural Risk Associated Aggregates

Addressing the behavioural risk components of the country surveillance system was practically being addressed in two ideal surveillance systems.^{8,11} The Italian PASSI and the Vasterbotten Intervention program (VIP) focuses on community-based surveillance system whereas they monitor health behaviour and its associated risk. Furthermore, each system conduct inter region comparison which include spatial surveillance⁸.

Integrated Health information system

An ideal information system is when multiple sources have a queue each on a central system that can integrate information and deliver an output that can generate reliable information for decision making. Two countries' surveillance^{1, 9} profiles highlight the importance of interconnected health information system. Interoperability of this surveillance systems was the highlight of best practice using a unified identifier. The Malta Diabetes Information system captures screening, referral, treatment, drug therapy, admissions and discharge information for Diabetes. The Israel Online Electronic Health Record system sets the benchmark for remote and mainstream data reporting, data sharing and reporting based on best practice.

Various HICs have managed to design and customised their surveillance system to match the disease phenomenon and distribution they like to monitor and survey.

DISCUSSION

After reviewing the literature and going through the existing countries monitoring system it still remain a challenge as to whether Fiji has the capacity to have an NCD surveillance system.

Surveillance Systems Design

The current NCD surveillance system in Fiji is built within the Public Health Information System (PHIS) and the Patients Information

System (PIS). The only NCD surveillance system in Fiji comes in the form of the NCD STEPS Survey which is conducted every 10 years. Birtwhistle suggest that it is possible to have Sentinel surveillance for NCD in primary health care but challenges in including risk factors and social determinants. According to WHO (2017), sentinel surveillance is used when high-quality data are needed about a particular disease that cannot be obtained through a passive system. Selected reporting units, with a high probability of seeing cases of the disease in question, good laboratory facilities and experienced well-qualified staff, identify and notify on certain diseases. Szeles *et al.* 2005, used a passive assisted sentinel surveillance system to study the distribution of cardiovascular diseases, diabetes and liver cirrhosis and shows that having sentinel stations at primary care level are feasible and sustainable, data provide important information for health policy and health service planning and regular contact to reporting units is important. Yiannakoulis *et al.* 2009 study asthma distribution using passive surveillance together with spatial surveillance using Geographic Information System (GIS). The study reveals spatial differences in the asthma prevalence in Alberta and suggests that spatial data in surveillance are important to inform policy makers about disease patterns; however availability of spatial data is a limiting factor in many countries especially in LMICs but would be an advantage if being adopted. Namusisi *et al.* 2011, conducted a pilot study on a passive assisted sentinel surveillance of NCDs with the main focus on Diabetes. He suggested that the use of hospital data is a valuable first step in setting up NCD surveillance systems, whereas risk factor data are important for disease prevention and intervention.

Surveillance Systems Best Practice

Summarising most of the countries monitoring and surveillance system (Table 2 annexed) it shows that the best surveillance system to be adopted for Fiji is a passive surveillance system that relies on readily collated data from primary health care facilities, hospital and with existing data sources. This was supported with the findings by FinRISK Study, 2014 that having continuous population survey will general result for policy action as shown on how their system was able to inflict change on food relation for food reformulation. Similar sentiments were eluded by Balissera S et al 2011 support the use of behavioural risk factors to address the burden of NCD in Italy through the Italian PASSI. Due to Fiji's geographical location and vast distribution of its population to these islands, the inclusion of a spatial surveillance system as an addition to its proposed passive surveillance system would be

and added benefit. More, targeted interventions will be conducted if the GIS system is blended in with the passive surveillance system.

The proposed surveillance system for Fiji will be a Passive assisted Sentinel Surveillance enhanced with spatial surveillance. Based on literature, the passive assisted sentinel surveillance is appropriate for routine collection of data and a focused data collection mechanism based on the priority areas for reporting, Fiji have specialised health facilities like the health centre SOPD clinics and the Diabetes Hub centres who are the targeted sentinel sites for reporting on and of NCD of interest. Whereas in Fiji more discussions are centred in identifying what surveillance strategy is applicable to the small island nation where most of the gadgets and 'clinical toys' used in HICs are inaccessible to these South-seas health systems.

CONCLUSION

Diseases occurring in some of Fiji's communities in epidemic proportions somehow exceeding those rates found in affluent industrialised countries or High Incomed Countries (HICs). The frequency of alcohol and tobacco use and the number of cancers appear to be rising and are also becoming significant health problems. Unhealthy Diet increase consumption of carbonated drinks, high sodium intake, increased sugar intake, physical inactivity and cigarette smoking appear as the most significant factors involved in the development of these chronic non-communicable diseases. Therefore, with all of these risk factors and having a NCD related mortality at 80% of all deaths, it is about time for Fiji to have its own Non-Communicable Disease Surveillance System. A surveillance system that collate, analyse NCD and Behavioural Risk factors to inform policy makers in the Ministry of Health and medical services much sooner rather than relying on the WHO NCD Steps survey. This surveillance system should be able to produce a country yearly NCD status profile to assist the development and respond against Fiji 5 years NCD strategic plans. Fiji have resources and the existing reporting mechanism that can facilitate the need to develop its own Non-communicable disease surveillance system

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Annexes**Table 1.0: Summarises the study designs found suitable for this surveillance system design review (Kroll. M et al, 2015)**

Author/Year	Country	Surveillance Approach	Data source and reporting Unit	Disease under surveillance	Lesson learned
Birtwhistle, 2009	Canada	Longitudinal study with passive and sentinel approach	General practitioners	HTN, DM, Depression, COPD, Osteoarthritis	Sentinel surveillance for NCD is possible for PHC but challenges in including risk factors and social determinants.
Saran et al, 2010	USA	Pilot study for a national surveillance system	Multiple secondary data sets	Chorionic kidney disease (CKD)	Six broad themes, several measures for CKD and several data sources were identified for a pilot phase; active surveillance methods might be Integrated in the future. Identification and acquisition of data sets and integration with other NCD surveillance systems were identified as some of the challenges.
Szeles <i>et al.</i> 2005	Hungary	Cross-sectional pilot study on a passive assisted sentinel surveillance system	General practitioners (n = 73) in four counties (Cohort size: 138,088)	Cardiovascular diseases, diabetes, liver cirrhosis, 4 malignant diseases	Sentinel stations at primary care level are feasible and sustainable, data provide important information for health policy and health service planning, regular contact to reporting units is important.
Yiannakoulis <i>et al.</i> 2009	Alberta, Canada	Study on passive surveillance using secondary data with special focus on spatial surveillance of NCDs using GIS	IPD hospital data, medical claims system (electronic public health insurance registry), hospital outpatient system	Asthma	The study reveals spatial differences in the asthma prevalence in Alberta. Disease distribution depends on case ascertainment algorithms and is aggravated through information inequity. Spatial data in surveillance are important to inform policy makers about disease patterns; however, availability of spatial data is a limiting factor in many countries.
Bollag, 2009	Switzerland	Longitudinal passive assisted sentinel surveillance system (Swiss Sentinel Surveillance Network, ongoing)	General practitioners, internists and paediatricians (total: 150–250 GPs)	Asthma, different communicable diseases	Sentinel surveillance on primary care level is a valid research instrument to analyse asthma incidence and seasonality. Denominator problems occurred since age and sex were only recorded for asthma cases, not all consultations.
Namusisi <i>et al.</i> 2011	Uganda	Pilot study on a passive assisted sentinel surveillance of NCDs	Regional referral hospital (n = 1) (1383 patient records)	Diabetes	Use of hospital data is a valuable first step in setting up NCD surveillance systems, risk factor data are important for disease prevention and intervention.

Table 2.0: summarise the analysis of good practice identified as essential to NCD control (Kroll M et al, 2015)

Country	Program	Method	Analysis of Good Practice
Denmark	Elimination of Trans-fatty acid in Food Products	Monitoring was conducted regularly (biennially) and the results were disaggregated by several characteristics (food groups, age and gender) and applied to policy. The regulation resulted in a decline in the number of products containing more than 2g of TFA from 26% in 2002 to 6% in 2013, showing that the elimination of TFA in food products is achievable through food reformulation	Introducing a regulation on TFA content in food products, monitoring its implementation and using the results to inform policy and practice on its impact, as done in Denmark, is a good example of how to address the alimentary risk factors for NCD.
Finland	Reduction of Salt-Intake	Finland has a long history of developing strategies for reducing salt intake. In 2008-2011, the Government developed regulations to decrease salt content in industry-produced foods, according to which, foods with high salt content had to be labelled “high-in-salt” to inform consumer choice. As a result of the regulations, industry has worked to reformulate products so that their salt levels are below the threshold requiring the “high-in-salt” warning. Since 1982, the salt intake in Finland has been monitored through the FINDIET survey.	The Finnish case is an example good practice in inter-sectoral collaboration and continuous population monitoring: baseline assessment followed by regular monitoring at 5-year intervals, and the integration of the monitoring systems involved (FINRISK) meets the criteria of good practice in health monitoring
Italy	Italian behavioural risk factor surveillance system (PASSI)	In 2007, Italy established PASSI, a surveillance system to monitor health behaviour and associated risk factors, PASSI (41) is an ongoing, multipurpose, community surveillance system. It is supported by the Ministry of Health, coordinated by the National Institute of Health (ISS) and run by the local health units and regional health authorities. Its main areas of investigation are: self-perceived health and quality of life; self-reported symptoms of depression; smoking habits and exposure to second-hand smoke; alcohol consumption; diet and nutritional status; physical activity; risk factors for CVD; cancer screening and vaccination campaigns (through participation in national preventive programmes); road safety; and domestic injuries.	PASSI meets several of the criteria of good practice: it provides ongoing data collection in a flexible, timely manner, allowing intraregional, region-to-region and region-to-nation comparison, and its regional-specific data, including sociodemographic information, offer a sound basis for developing and evaluating public health programmes, including those aimed at reducing social disparities by addressing health risks.

Malta	Diabetes Information System	Since Malta has no formal diabetes register, data pertaining to individuals registered for treatment free of charge were linked hospital-admissions data, the surgical-operations register, and laboratory biochemical data. Following this exercise, all identifiers other than year of birth and gender were dropped from the data set to anonymize the data. This linked data set makes it possible to estimate the incidence of diabetic complications and the indicators of quality of diabetes care as regards the extent and effectiveness of glucose and lipid monitoring in the diabetic population.	The secondary use of health-care data is passive, making it both affordable and sustainable. It is quite difficult for a health register to predict the high-resolution data required and keep up with the breadth of information demanded by health policy. Even if this were possible, it would be very resource intensive to maintain. Therefore, integrating disaggregated data from health registers with secondary health-care-associated data sets permits the same health registers to remain relevant to an ever-increasing, evidence-driven health-policy agenda.
Sweden	Vasterbotten Intervention Programme	In Sweden, mortality from CVD increased steadily in the 20th century; in the mid-1980s it was highest in the county of Västerbotten. Therefore, the Västerbotten Intervention Programme (VIP) was launched – a community programme with the aim of reducing morbidity and mortality from CVD and diabetes. A population-based strategy directed towards the public is combined with a strategy for reaching all middle-aged persons individually at ages 40, 50 and 60 years by inviting them to participate in systematic risk-factor screening and individual counselling about healthy lifestyle habits.	One of the main features of VIP is its ability to collect data on multiple NCD risk factors, making it a diverse surveillance system. It also includes information on the time trends of the collected data and allows data disaggregation by age, gender and socioeconomic features. Visualization of assessment output and data collection at the PHC level makes the system an example of good practice in this area. Lastly, its links with other registers and availability for scientific research make VIP a desirable NCD monitoring system.
Israel	Electronic Health Records for better NCD monitoring and Control	Israel is one of the global leaders in adopting innovative strategies to prevent and control NCD, especially in field of management of people with these diseases. Using online EHR data allows management to monitor the prevalence, incidence and control of most NCD in a precise and timely manner. Furthermore, the interoperability of the system and its user friendliness have enabled the early detection and prevention of complications and the continuity of health care, while containing costs related to the duplication of diagnostic and laboratory procedures.	This example shows the efficiency and cost-effectiveness of using clinical data en masse to ensure better NCD prevention and control. One of the important features of this multi-purpose monitoring system is its interoperability, which adds functionality, integration and real-time monitoring of the data and disaggregation of the indicators by socioeconomic status.