

Preliminary results of strengthening the national death registry information system

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Abstract

Peru has low coverage of deaths with a cause of death (54%) and a poor-quality registration of causes of death, as about 30% of causes of death are classified as poorly-defined or not very useful for the formulation of public policies. In response to these problems, the Ministry of Health together with other government agencies, with the support of the Bloomberg Philanthropies Data for Health Initiative, is implementing the National Death Registry Information System (SINADEF). The objective of this article is to describe the process of strengthening the mortality information system in Peru, focused on the implementation of SINADEF. The activities that have been carried out are described in the following areas: a) Management of the mortality information system, b) Process standardization, c) Use of information and communication technology, d) Coverage of deaths with medical certificate, e) Improvement of the quality of information, f) Development of studies, and g) Monitoring of processes. Since the implementation of SINADEF in August 2016 until July 2018, 28,407 users of the SINADEF application have been created and a total of 122,411 deaths have been registered. The quality of data recording, including the cause of death, has been improved, while low coverage of deaths with a cause of death still persists.

Keywords: Health information systems; Mortality; Causes of death; Death certificate; Vital statistics

Introduction

Health information systems are defined as an organised effort to collect, process, report, and use information and knowledge on health to influence the formation, implementation, and evaluation of health policies and interventions as well as health research (1). There is ample

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evidence that health information systems in many countries do not perform as expected, especially with regards to the quality and use of information. This fact is attributed, among other factors, to health systems' irregular and fragmented evolution, administrative and financial constraints, and a poor culture of information use for decision-making (2). On the other hand, health system responsibilities can be divided across different government agencies, which requires greater coordination efforts for effective exchange and use of information (3).

One of the most important sources of information in health is the information system on vital statistics: births and deaths, better defined as the Civil Registry and Vital Statistics (RCEV) system (4). In Peru, the RCEV system is managed by three government agencies: the Ministry of Health (MINSA), the National Registry of Identification and Civil Status (RENIEC) and the National Institute of Statistics and Informatics (INEI). Thanks to the integrated work of these agencies with support from other government entities, the information system of births (CNV) has been transformed and consolidated, making it an efficient system providing timely and quality information about births in Peru (5).

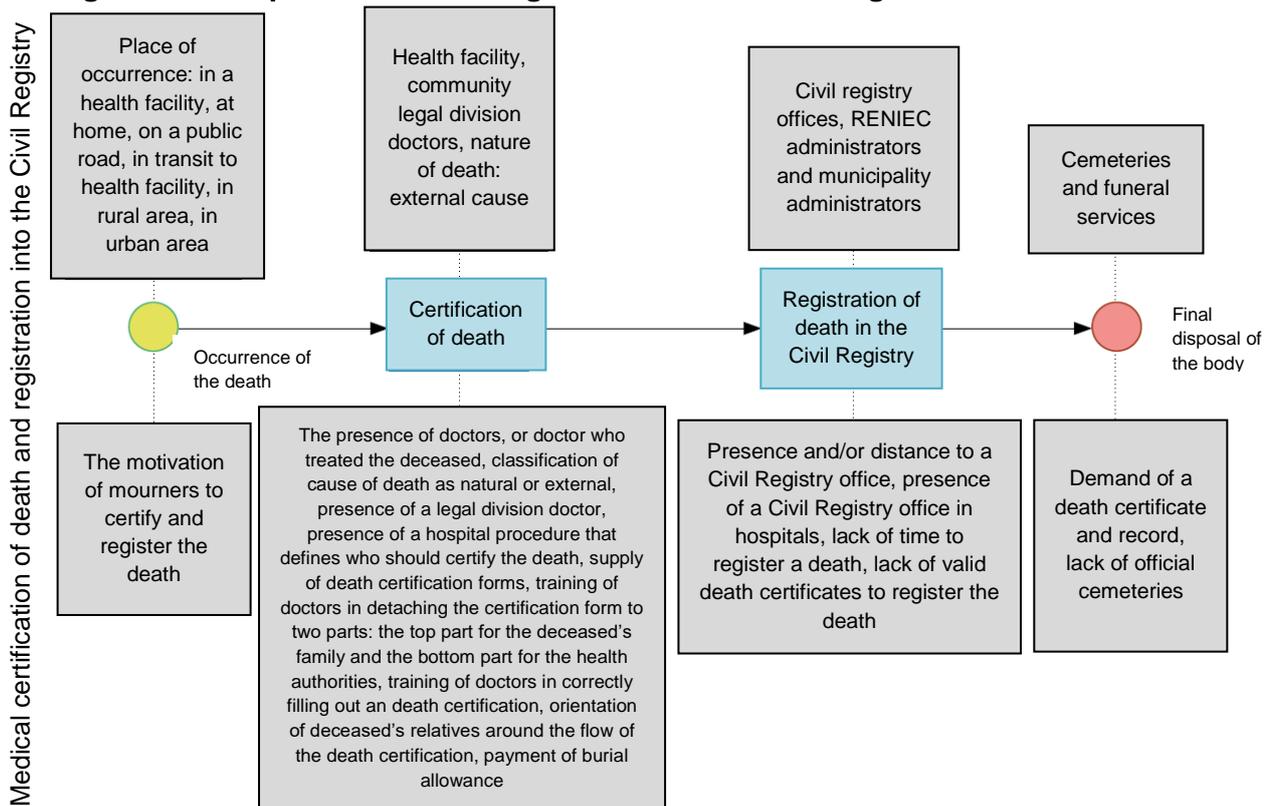
As part of the efforts undertaken to implement health sector reform (6), based on the policy of building an information system closely oriented around and integrated with government management of the health sector, a national plan to extend the implementation of Telehealth and the CNV in the health sector was proposed (7). With the lessons learned from the implementation of the CNV, MINSA and RENIEC undertook the development and implementation of the National Death Registry Information System (SINADEF), an application that allows doctors to complete death certificates (CEDEF) in real time, immediately after verifying that a death has occurred.

Beyond the implementation of a new technology for death registration, SINADEF offered an opportunity for reviewing the process of the RCEV system, from the occurrence of death in different contexts until the death is registered in the civil registry, paying special attention to the gaps and barriers limiting adequate coverage and quality of information on causes of death (Figure 1).

At this juncture, in 2015 Peru (through MINSA and INEI) was invited to participate in the Bloomberg Philanthropies Data for Health Initiative (D4H). The Bloomberg D4H Initiative is funded by the Bloomberg Philanthropies Foundation and the Australian government (8), and it supports 20 countries and cities in Southeast Asia, Sub-Saharan Africa, Latin America and the Western Pacific in strengthening civil registration and vital statistics (CRVS) systems. D4H proposed a set of interventions to improve practices of certification and registration of vital events. In Peru's case, D4H has catalysed the process of strengthening the CRVS system; undertaking implementation of SINADEF, supporting the development of standards and promoting its use, and identifying barriers that limit the certification and registration of deaths and proposing incentives to help overcome them. Furthermore, D4H has trained doctors in how to correctly fill out death certificates (CEDEF) and statisticians in the use of the International Classification of Diseases (ICD-10); and implemented tools to automate the coding of cause of death, with the goal of improving the quality and use of data in the health sector.

The objective of this article is thus to describe the process of strengthening the mortality information system in Peru, centred around the implementation of SINADEF as a service that grants value to the citizen.

Figure 1. Principle barriers limiting the certification and registration of death in Peru



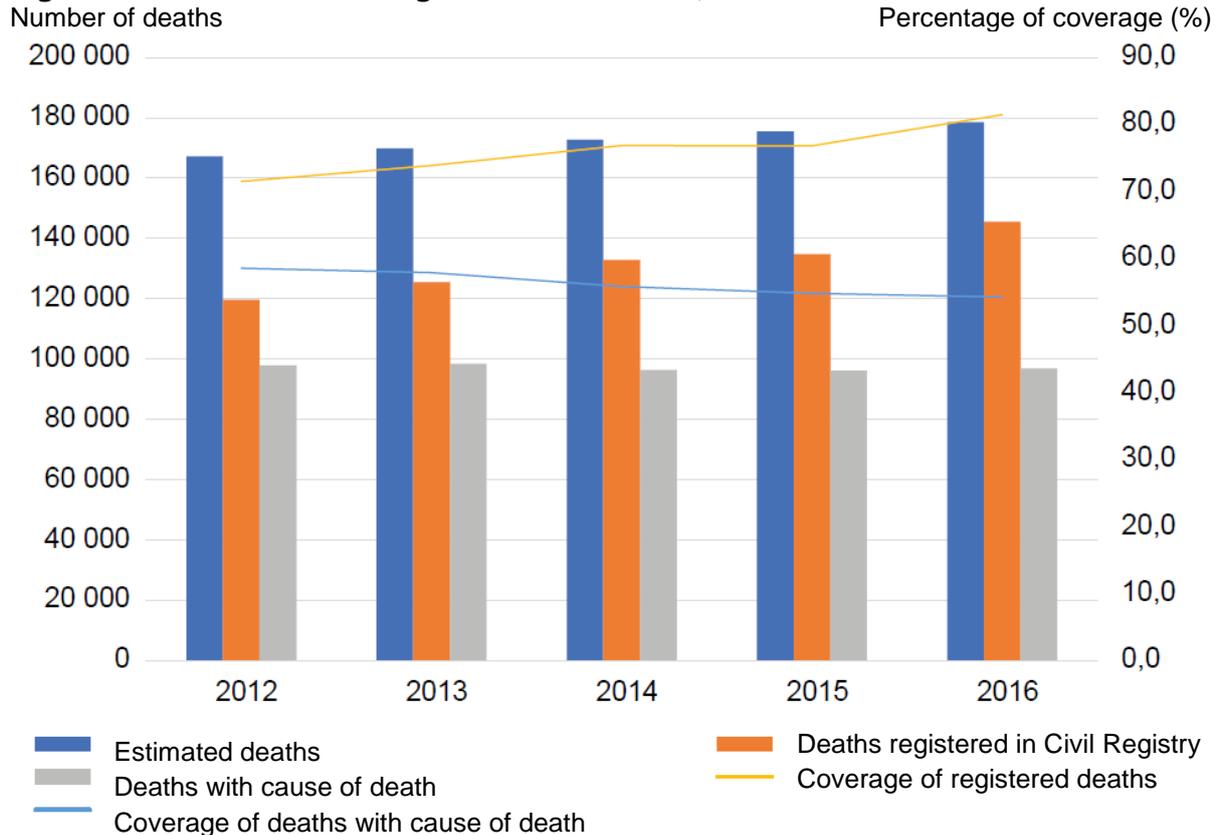
Source: own elaboration

The coverage and quality of information on deaths in Peru

The mortality component of Peru's CRVS system is operated by three government agencies. MINSA is responsible for the normativity of medical certificates of death and the management of the information system for producing statistical reports on deaths (9); RENIEC is responsible for the management of registering deaths in the Civil Registry (10); and INEI is responsible for statistical estimates and the official report on deaths in Peru (11).

Figure 2 presents death estimates produced by INEI, the deaths registered in the Civil Registry by municipalities and offices by RENIEC; and the deaths with causes of death, as part of the statistical information on deaths from death certificates completed by doctors and compiled by MINSA, of the entire health sector. As shown in the figure, between 2012 and 2016, the coverage of registered deaths in the Civil Registry has increased, shortening the gap with estimated deaths; whereas the coverage of deaths with a cause of death has decreased, widening the gap with regard to estimated deaths. To register a death in the Civil Registry, it is required to present a death certificate; therefore, the number of deaths with a cause of death must at least reach the number of deaths registered in the Civil Registry.

Figure 2. Evolution of coverage of deaths in Peru, 2012-2016



Source: Instituto Nacional de Estadística e Informática (INEI); own production of the figure by the authors

The causes of this low coverage can be explained by the lack of supervision of the collection process of death certificates in paper form. According to national rules, the doctor should detach the paper form and submit only the certificate (the upper part of the form) to the family of the deceased and save the statistical report of death (bottom part of the form), to be delivered to a health facility or health correspondence (9). What happens in the majority of cases is that the doctor delivers the full form (death certificate and statistical report) to the family of the deceased, because this is what other government and private agencies (mainly insurance agencies) require, to verify that the cause of death was not, for example, a traffic accident that should be paid for by *Seguro Obligatorio de Accidentes de Tránsito* (SOAT), - which provides mandatory insurance for traffic accidents - to avoid the double payment of benefits, the upper part does not provide complete information about the cause of death. This is in the condition that health management makes additional efforts to retrieve those reports and enter them into the information system. This situation has been aggravated by the decentralisation process, limiting the supervisory functions of MINSA (6).

In addition to low coverage, the information contained in paper forms have data quality limitations. Naghavi *et al.* reported that Peru, together with Oman, Egypt, and Georgia, is among the countries with a high proportion (more than 45 percent) of causes of death with ICD-10 'garbage' codes, that is, having a 'poorly defined' or 'unhelpful' cause (12). In the same sense, a study evaluating the CRVS systems of 148 countries reported that Peru had a Vital Statistics Performance Index (VSPI) of 49.9, classified as 'medium', that can be attributed to low coverage, under-registration of deaths, poor death certification practices

and the lack of a formal coding system (use of the International Classification of Diseases of Diseases and Related Health Problems 10th edition, ICD-10), and concluded that the detail and quality of their mortality data have little utility for national policy making and are also not available (13).

Interventions to strengthen the CRVS system

In a workshop for identification of CRVS-strengthening activities, which convened officials from INEI, MINSA, RENIEC, and the principal government agencies linked to the CRVS system, participants discussed the principal problems of the CRVS system and proposed the development of activities in the following areas: a) management of the Mortality Information System, b) standardisation of processes, c) use of information and communications technology, d) coverage of medically certified deaths, e) improve of quality of information, f) development of studies and g) monitoring of processes.

Management of the mortality information system

On the 25th of April 2016, the Ministerial Resolution RM 280-2016/MINSA was published, approving the Administrative Directive N°216-MINSA/OGTI-V.01: that establishes the Procedure for Certification of Deaths. The directive marks a point of initiation for the CRVS-strengthening process by regulating the use of SINADEF for online certification of the death and a new paper form of the death certificate which incorporates the use of bar codes to increase the security of information from the moment of data entry into the information system.

On the other hand, inter-institutional coordination between INEI, MINSA, and RENIEC was strengthened; activating a Convention Framework of Interinstitutional Cooperation among these entities, which aims to integrate the efforts to strengthen CRVS. Similarly, a subcommittee was activated to monitor the management of mortality information.

Standardisation of processes

A workshop on enterprise architecture was organised, with the participation of civil registrars and statistical technicians responsible for managing death certificates, who together made process maps from the occurrence of a life event (birth of death) until the official publication of the death report in different contexts, such as a death that occurs in a hospital or at home. This tool allowed for visualising the process as it happens in reality, and for comparing it with the ideal according to standards.'

A product of this process was the creation of a Technical Guide for the correct filling out of the death certificate, which was approved by the Ministerial Resolution RM 214-2017 / MINSA in April 2017 (15). In this guide, the scope of the Administrative Directive on certification of deaths is specified and flows for the production of death certificates are recommended for various circumstances in which a death occurs, identifying some regulatory gaps that must be addressed in future updates of the rule.

Use of information and communications technology

SINADEF is a web-based information application, developed by RENIEC, hosted and administered by MINSA, which is the owner of the data bank (9).

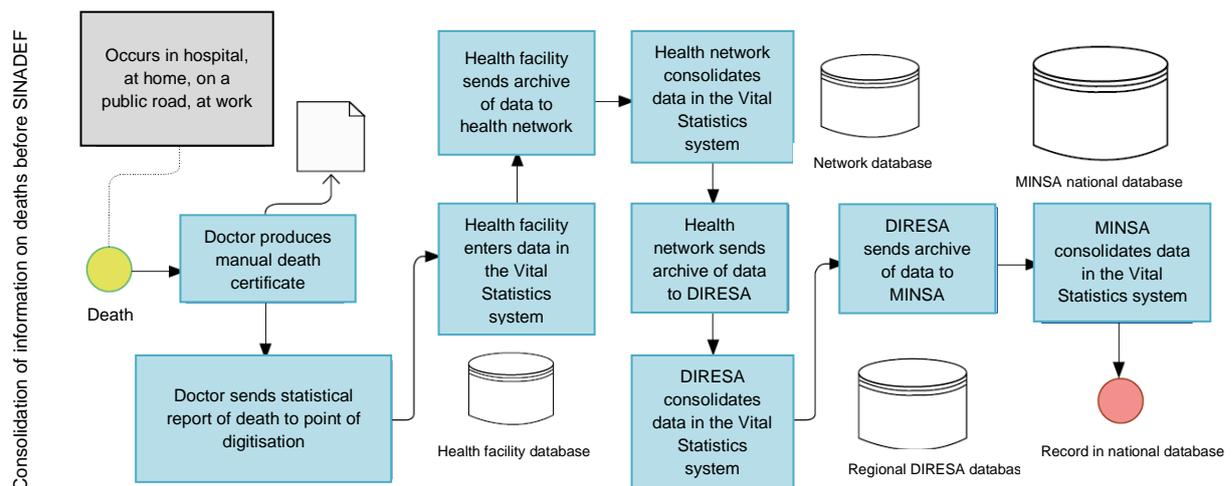
It allows the doctor to prepare the death certificate in real-time and for the statistical technician to transcribe the statistical data when a doctor or other health worker prepares a death certificate in paper form.

SINADEF unites, strengthens, and improves other interventions. These are important milestones in the implementation process: the first workshop addressed to the directors of main hospitals of the Lima and Callao health sectors in June 2016 and the development of the first online death certificate, carried out in the Central Morgue of Lima on 15 August 2016.

Figure 3 shows the collection process, storage and sending of death data until 2016, when the Vital Events system was used, and later, using SINADEF. This change allowed MINSA to recover the rectory of the death information system. The old system had multiple isolated databases at each digitisation point, the information was dispersed and its consolidation into a national database took at least 18 months. With the new system, all of the information is entered using the same web application, and it is stored in a single database.

Figure 3. Flow of consolidation of death certificate information in the national database

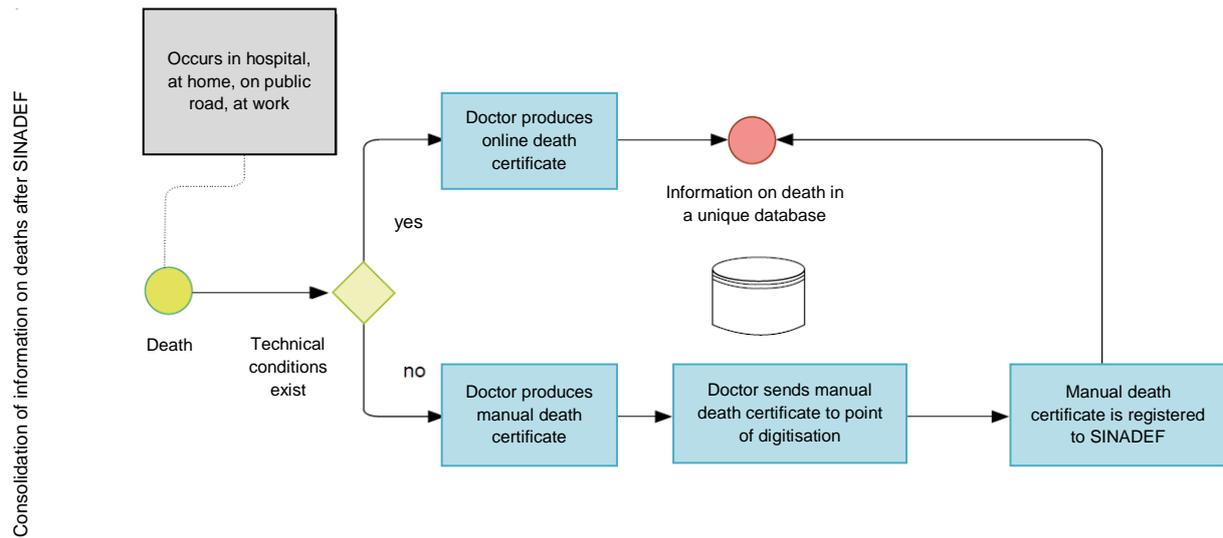
A. Before implementation of SINADEF



Source: own elaboration

DIRESA: Dirección Regional de Salud (Regional Health Management)

B. After implementation of SINADEF



Source: own production

From August 2016 to July 2018, 28,407 users of the SINADEF application have been created, and a total of 122,411 deaths registered (76,350 online and 46,061 manually). From the beginning of the implementation process, each month the number of deaths with online certification surpasses the registration of the previous month, in July 2018 reaching a total of 7,303. This amount corresponds to 49.2 percent of deaths per month estimated by INEI and 76 percent that MINSA had been reporting in the past five years (Figure 4).

With SINADEF, registration is timely and of superior quality since it validates the identity of the deceased and the doctor, through the National Identity Document number, facilitates the registration of the place of death, of usual residence, of a hospital, etc. It also allows for selection from a menu of the marital status, degree of instruction, occupation, and ethnic group of the deceased and the treatment provider. Regarding the registration of the causes of death, the application follows the international cause of death model proposed by the World Health Organization (16), which allows the doctor to write up to 300 characters for each injury or disease that is part of the sequence of causes of death and to search for the corresponding ICD-10 code.

Other information and communications technology applications that have been added are: the development of a mobile application that contains the Technical Guide for correct filling out of the death certificate and practical exercises on 'case presentations' that support training the doctor in the registration of causes of death; and the implementation of IRIS, an application developed by the German Institute of Medical Information and Documentation that allows you to automatically code the causes of death and select the basic cause of death (17) from the diagnoses that doctors write in the death certificate.

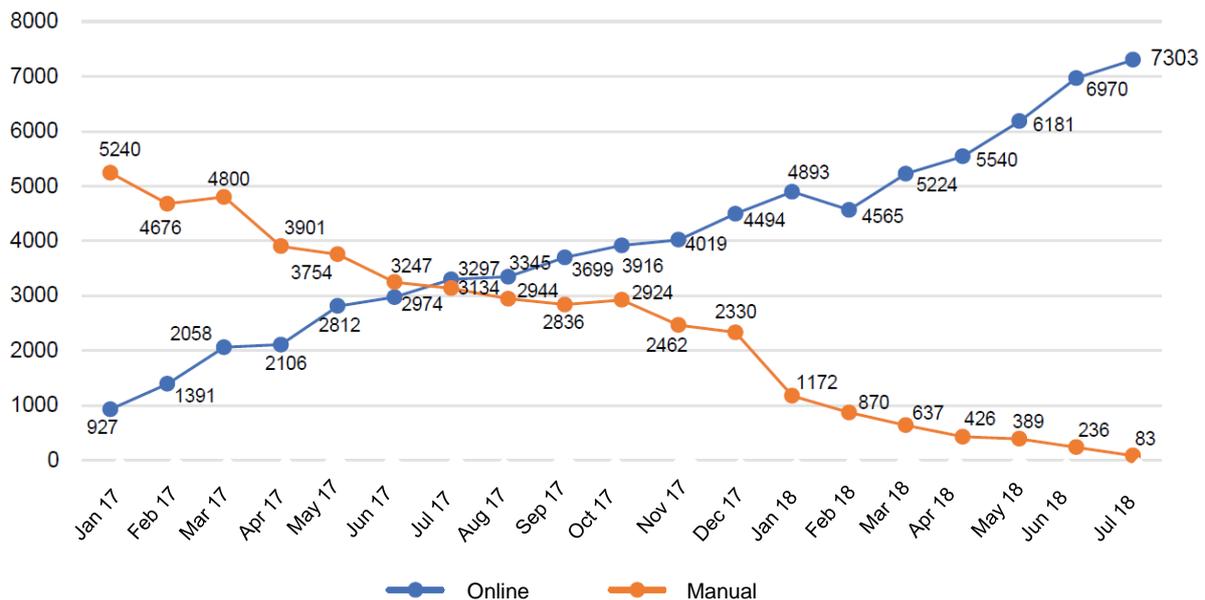
Coverage of medically certified deaths

For SINADEF implementation activities at the national level, the regions and provinces with the lowest coverages were given priority. On this basis, two decisions of the General Office of Information Technology of MINSA strengthened this intervention: the restriction of the distribution of paper death certificates in the hospitals that had technical conditions (internet), so that doctors would instead certify deaths online; and the replacement of the old Vital Statistics system by the SINADEF application.

On the other hand, difficulties were identified in distribution and issuance of death certificate forms. It was verified that the access to services of issuing a death certificate, and the subsequent registration of death in the Civil Registry, especially in the case of members of *Seguro Integral de Salud* (SIS - Comprehensive Health Insurance) or the *Seguro Social* (EsSalud - Social Security), which is highly valued by its users. A high percentage of death cases have a death certificate; however, the distortions in the flow of the statistical report of the death limit its entry into databases.

Figure 4. Death certificates online ('en línea') and in paper format (manual), Peru, January 2017 – 2018

Number of death certificates



Source: SINADEF, own production

On these results, a proposal was made for incentives aimed at promoting the use of SINADEF and increasing its coverage, which includes: accelerate the implementation of the system; link the payment of burial allowance of the SIS with online certification of death through SINADEF; stimulate the use of SINADEF in the civil registries of the municipalities; link the issuance of the death certificate to the previous registration of the manual death certificate; and promote the use of SINADEF in end-users such as the Pension 65 Program of the Ministry of Development and Social Inclusion (MIDIS), EsSalud, private insurance, etc.

All of these actions are in the process of negotiation and implementation. An example of progress is the issuance of Supreme Decree DS 002-2019-MIDIS that establishes the actions that RENIEC must carry out in compliance with the eleventh provision Final Supplement to Law 30693, Budget Law of the Public Sector for Fiscal Year 2018, that in annex 7 specifies the actions necessary for the integration of death registration processes of online certification and death records (18).

Improving quality of information

The quality of information on deaths fundamentally depends on the filling out of the death certificate by a doctor. Various studies at the international level report errors in the registration of causes of death in the death certificate (19). One study conducted in the Ica region found that 28 percent of death certificates had errors, with the most frequent errors being: illegible letters (19.7%), inappropriate sequence of causes (32.1%), ill-defined or not useful causes (17.2%) and incorrect ICD-10 coding (9.2%).

The training plan for doctors began with a 'training of trainers' workshop on how to correctly fill out death certificates. This included ten doctors who travelled to the main national hospitals in the country, holding conferences addressed to their peers about the correct filling out of the death certificate. At present, this training has been carried out in 184 establishments of health and medico-legal divisions. Additionally, doctors who carried out the *Servicio Rural Urbano Marginal en Salud* (SERUMS) 2017 and 2018 were trained, and those who obtained school fees. On the other hand, a training workshop was held that included 31 university professors of Public Health or Legal Medicine courses of 25 medical schools, in order to include and standardise the teaching of correct death certification in undergraduate courses. In addition to face-to-face training, a virtual course on correct death certification was organised and carried out with the Medical College of Peru (23) and included 1386 participants.

This result of this process was 6660 professionals trained, 5275 doctors trained directly through face-to-face events and 1386 doctors trained through a virtual course.

Other important aspects in the quality of information are: the classification of causes of death, the analysis of information, and demographic estimates for the calculation of indicators. To meet these needs, a 80-hour training course on mortality coding using ICD-10 was held, and was attended by 32 statistical technicians from MINSA, EsSalud, and INEI, and was conducted by an expert from the Mexican Centre for the Classification of Diseases. In addition, a training workshop was held on the use of ANACONDA (Analysis of Causes of National Deaths for Action), a computer application that allows for evaluation of the quality of mortality statistics and indicates areas of probable weakness of the datasets (24); as well as another workshop on population demographic estimates at the sub-national level, which was conducted by professors at the University of Brasilia.

Development of studies and monitoring of processes

In the framework of the strengthening of the mortality information system, several studies have been developed (and will be published soon). In addition, a dashboard to monitor the SINADEF implementation process has been developed and is available on the MINSA website.

Two studies were carried out on the quality of death certificates. One was on online certification of deaths nationwide, which shows that the time between registration of the cause of death and the death improved by 66 percent; and another study carried out in two hospitals in Lima compares the quality of registration of causes of death, showing an improvement in registration up to 45 percent before and after the certification trainings (25, 26).

Currently, a project is underway to test the use of a verbal autopsy questionnaire to help ascertain the causes of death of people who die without receiving medical attention or when the death certificate is filled out by a health professional who is not a doctor, as allowed for by national legislation, and how this compares to other countries (27).

Challenges and perspectives

The process of strengthening the mortality information system is underway and has not yet been completed, and there are already positive changes that have potential to multiply in the coming months and years. Table 1 summarises the benefits that can already be seen in terms of the quality of information.

Coverage problems that continue to persist derive from the use of paper forms, so it is necessary to carry out processes of actively searching for deaths: those that occurred without the presence of a doctor, those that can occur at home or those that have been buried without a death certificate. The continued production of a death certificate on paper, which can be stored in hospitals or other health facilities, as well as in civil registry offices or RENIEC at the local level, will continue to be effective for improving coverage.

The benefits of SINADEF implementation transcend the health sector and the higher level of management of the public sector. For example, it assures the doctor that amending a death certificate will not falsify it, or at least if this occurs, the doctor will have a more practical way to verify it; this allows the relatives of the deceased to obtain copies of the lost certificates, provide access to social programmes, the SIS, EsSalud and the offices of human resources of public and private organisations to verify the survival of the beneficiaries, etc.

Another benefit is the integration being achieved by the database of deaths due to external cause, carried out by the medico-legal division at the national level and that has caused more dependencies to be added by the Public Ministry on the use of SINADEF. Also, large hospitals that have limitations for the use of this information may access the exploitation of

this data, generating a feedback that we hope will improve the quality of this information, but principally, the quality of care and health of the population.

Among the main tasks pending in the process of institutionalising the strengthening of the mortality information system are: to carry out political advocacy at the executive level to extend the use of SINADEF until the level of the rural districts recedes from the urban centres; to link the payment of burial allowance to the production of death certificates through SINADEF; link the transcription of the death certificate on paper to SINADEF at the rural district municipality level in localities with limited internet access; institutionalise teaching from the undergraduate level of medicine on correct death certification; implement the use of the verbal autopsy tool for the certification of deaths in areas where there are no doctors or where the doctor has not attended to the deceased prior to death; etc.

Through the Regional Health Management, MINSA and regional governments, together with RENIEC, INEI, and other public sector organisations and supported by the Bloomberg D4H Initiative, are making an enormous effort to strengthen mortality information systems with the purpose of generation information to guide the formulation of public policies and the decision-making process in general. However, this will not be used appropriately or with sufficient confidence if not attention is paid to the coverage and quality or data, so it is necessary to consolidate progress that is being made.

Table 1. Benefits of the national mortality information system with respect with quality of information

Criteria	Before SINADEF (until 2016)	With SINADEF (from 2017 onwards)
Coverage	2016: 54.2 percent	2017: NA
Opportunity	The database is available after 18 months of the year ending	About 40 percent of the database is available online
Transparency	Limited access to information on causes of death	Interface to check the number of deaths and to monitor the implementation of SINADEF
Quality of data	Data without validation (identification of deaths, districts, EESS, etc.	Links to databases (identification of people, EESS, ubigeos)
Quality of cause of death	Illegible letters, technicians transcribe and reinterpret what the doctor writes, coders without ICD-10 coding are coding the basic cause of death	Doctors directly write the causes of death, coders have been trained in ICD-10 and also allows for Iris application - a program that automatically codes the cause of death

Source: own production

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