Assessment of the investigation of deaths from ill-defined causes in the state of Bahia in 2010

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Abstract *The investigation of deaths from ill-defined causes (DIDC) has been a strategy of health services to reduce the proportion of these events. This study aimed to estimate the adherence of municipalities to the use of recommended forms in the investigation of DIDC and the impact of these investigations on the reduction of these deaths in the Mortality Information System. The use of the Investigation of Death from Ill-defined Cause (IOCMD) and Verbal Autopsy (VA)forms and the proportion of reclassified underlying cause of death following investigations were analyzed in a probabilistic sample of 27 municipalities of Bahia state, and its capital Salvador, in 2010. Of the 27 municipalities, approximately 50% used the recommended forms to investigate DIDCs. Of the 1,092DIDCs in the sample, 53.1% were investigated: in 40.5% of the cases, only the IOCMD form was used; in 15.3%, only the VA form was used; and both forms were used in 14.3% of the cases. The investigation of DIDCs reduced the percentages of these deaths from 16.5% to 9.9% and proved to be more effective when performed using the recommended forms.*

Key words *Health evaluation, Cause of death, Information systems, Vital statistics, Mortality registries*

Introduction

The percentage of deaths from ill-defined causes (DIDC) is an important indicator to evaluate the quality of mortality information systems[1-3]. Data on causes of death are fundamental to the knowledge of the epidemiological profile of the population and is decisive to guide the activities of planning and evaluation of health actions[1]. The ideal method for generating good quality mortality data is through a death information system that records the information certified by doctors on the causes of death of all deaths[4].

In Brazil, the collection of data on deaths and their causes has been carried out in a standardized manner throughout the country since 1976, through the Mortality Information System (SIM), which is a universal information system on deaths, developed and managed by the Ministry of Health (MoH). Despite recognition of the importance of monitoring information on deaths and the substantially increased completeness and quality of information in recent years, SIM's quality among Brazilian regions[2,5,6] are still unequal.

In 2010, 1,136,947 deaths were reported to the SIM, and 8.6% of these deaths' underlying cause was classified under Chapter XVIII – Symptoms, signs and abnormal clinical and laboratory findings, not elsewhere classified – codes R00-R99[7]. This proportion had varied substantially between states and regions: from 5.7% in the South to 13.5% in the North, and from 1.5% in the Federal District to 19.9% in the state of Acre.

A study comparing the 1980-1991 and 2000-2010 periods concluded that there was a 53% reduction in DIDCs in the country as a whole, and the proportions of DIDCs declined from 72% in 1991 to approximately 25% in 2010 in the North and Northeast regions[5]. Nevertheless, despite the significant decline of DIDCs in recent years, states in the North and Northeast still show a level above the 10% limit recommended by the MoH[8], to make possible the use of information on the cause of death to understand changes in mortality patterns and their impact on different population groups.

As an alternative to improve the quality of information, the active search for deaths and the investigation of DIDCs are an essential strategy adopted by the MoH[9-11]. Among the different investments made by the MoH to improve vital statistics in the country, the implementation of the program "Reduction of the percentage of DIDCs", implemented in 2004 and focused in the North and Northeast regions with standardized methodology for the investigation of DIDCs, established a goal to reduce the proportion of these deaths to less than 10%.

In 2005, part of this Program was the use of the "Investigation of Death from Ill-Defined Causes" (IOCMD) form for data collection in health services, other health information systems and death committees in a standardized and organized way, collecting data systematically to facilitate the reasoning in determining the cause of death. In 2008, the use of the "Verbal Autopsy" (VA) form of the World Health Organization[12] adapted to the most prevalent causes in Brazil, with translation and adaptation of the language considering regional differences of the country was proposed to make the results comparable nationally and internationally. The VA form should be used to conduct household investigations, through the collection of information from relatives or caregivers of the deceased about the circumstances, signs and symptoms of the disease that led to death[8].

A three-phase study was conducted to introduce the VA form in the country, namely: Phase 1: adaptation and adequacy of the Portuguese version of the manual and e VA forms of the Ministry of Health of the Republic of Mozambique to local language, with a test of 25 DIDCs from urban and rural areas; Phase 2: Implementation of an Instrument Pilot Project, with the participation of 15 priority states, in order to verify the adequacy of the manual and the adapted forms, totaling 271 deaths investigated; and Phase 3: VA incorporation of changes suggested in the previous phase. The participating states selected at least one municipality and applied the VA method in all DIDCs, totaling 1,444 deaths investigated[13].

Studies in Ethiopia, India and China indicate that the VA method facilitates the clarification of the underlying cause of death in approximately 80% of the investigated deaths[14,15]. Similar results were observed using the VA form adapted for Brazil[9,16]. Since 2009, IOCMD and VA forms have been routinely implemented as part of death surveillance activities in the country, especially in the North and Northeast regions[8].

In 2010, approximately 30,000 DIDCs were reported to the SIM as investigated, and the results of these investigations led to a 20% decrease in DIDCs in official statistics[7]. Worth noting is the state of Bahia, in the Northeast, which showed, in 2010, DIDC proportions of 19.1% and 13.3%, before and after the investigations, respectively. Therefore, the state of Bahia was selected to eval-

uate the situation of the investigation of DIDCs and the use of the recommended forms for the definition of causes of death.

Since the implementation of the IOCMD and VA recommended forms for the investigation of DIDCs and incorporation of these data into the SIM, only one study[16] of the Program's performance evaluation has been published to date. This study aimed to estimate the adherence of the municipalities of Bahia to the recommendation of the Ministry of Health to investigate DIDCs, evaluate the use of the forms recommended in the investigation of these deaths and the impact of investigations on the percentage reduction of DIDCs in the Mortality Information System.

Methods

This is a cross-sectional observational study on a probabilistic sample of 27 municipalities in the State of Bahia, besides its capital Salvador, Brazil, conducted in 2010. This state was selected because it is the largest and most populous state in the Northeast region and is one that evidenced the highest percentage of DIDCs before and after the investigations, among the states of the Northeast region of the country[7].

The Bahia State Department of Health uses the regional division of the state in nine macro-regions for data collection, critique and data analysis[17]. The definition of the sample was made in two stages. Step 1: Based on the geographical proximity and characteristics of the macro-regions, three groups of macro-regions were considered for the state of Bahia: South cluster that encompasses the Southwest, South and Extreme South macro-regions; North-west cluster that encompasses the North, Central-North and West macro-regions; and the Eastern cluster that encompasses the Central-East, East and Northeast macro-regions. Thus, we ensured the representativeness of all practices of data collection and verifications recommended in the various macro-regions. In Step 2, a stratified uniform sampling was performed according to the 2010 Demographic Census of 2010[18] and a probabilistic sample of municipalities was stratified by population size (less than 20 thousand inhabitants; 20 thousand to less than 100 thousand; 100 thousand inhabitants and over) that were selected by random sampling within each of the three clusters of macro-regions, ensuring the same percentage of municipalities of each grouping in the population and sample. Thus, for each macro-region group, four municipalities were selected randomly in the first stratum, three municipalities in the second stratum and two municipalities in the third stratum, totaling 27 municipalities. The municipality of Salvador was chosen because it is the capital of the state. The results referring to the municipality of Salvador will be shown separately since the methodology of investigation of DIDCs and definition of the underlying cause were performed differently than the other municipalities of the sample.

In each municipality, all DIDCs of residents that occurred in 2010 were selected and are the sample units of this study. DIDCs were considered to be all those in which, in the block "Conditions and causes of death" of the Death Certificate (DC), a cause of Chapter XVIII – Symptoms, signs and abnormal clinical and laboratory findings, not elsewhere classified – ICD-10 (codes R00 to R99) was registered as the underlying cause. Field logistics and research instruments were previously tested in a pilot study conducted in the state of Alagoas, in the Northeast region.

Data were collected in two weeks, in September 2012, by four teams of previously trained interviewers and supervisors, consisting of professionals with higher education in health. The visits to the sampled municipalities were scheduled with managers responsible for the municipal information system, who previously separated all DCs due to IDCD in 2010 and respective investigations in order to organize and streamline fieldwork. So, in the selected municipalities, all eligible DCs occurred in 2010 and the respective forms used in the investigations were identified. Death information was recorded in a standardized form for each DIDC, as follows: DC number, name of the deceased, date of birth, date of death, original underlying cause (registered in the DC, i.e. before the research activities), whether the death had been investigated and what form was used in the investigation.

All forms used in the investigation of DIDCs were photographed for later entry and analysis. Investigated death was defined as one with a completed form of investigation and attached to the DC. Deaths were classified as reclassified when the original DIDC was replaced, before the investigation, by an underlying cause not belonging to Chapter XVIII of ICD-10, after the investigation[10]. The identification of the underlying cause reclassified in post-investigation was performed when it was written with a different letter or highlighted and placed on the copy of the DC or one of the completed forms of investigation.

The investigation activities of DIDCs are regulated in a specific Manual for this purpose[8], which recommends what kind of form should be usedin each specific situation. The first form to be used in the research activities should be the IOCMD, since it allows the collection of information in an organized and systematized manner in the different health services, such as the primary health units and the Family Health Strategy (ESF), hospitals, the Death Verification Service (SVO in Portuguese) and the Forensic Institute (IML).If this information did not allow the cause of death to be identified, the VA form should be used for home-based investigations, seeking information on the signs and symptoms of the deceased in the period before death and observed by caregivers or relatives. As a result of the analysis of the completion of the VA form, a physician can conclude on the sequence of events that led to death. Thus, it is expected that the use of the recommended forms allows a better reclassification of DIDCs, leading to a more significant impact on their reduction, besides data comparability. It was therefore considered that the investigation was performed using recommended forms when the IOCMD or the VA questionnaire were used separately or together.

Regarding data obtained in the field research, the following indicators were selected to estimate the municipalities' adherence and to evaluate the impact of the investigations: 1) adherence to the investigation forms: percentage of municipalities that used the forms recommended by the MoH among the sampled municipalities; 2) percentage of DIDCs: calculated as the quotient of DIDCs over deaths from all causes; 3) percentage of deaths investigated: calculated as the quotient of deaths investigated over total DIDCs; 4) percentage of deaths investigated with a reclassified underlying cause: calculated as the quotient of the number of forms with a defined underlying cause over the total of completed forms; 5) use of forms in the investigation: percentage of deaths investigated by type of form used in the investigation among the total number of deaths investigated and percentage of deaths reclassified by type of form used in the investigation.

Besides data collection in the field survey, the final SIM/MoH database was analyzed in order to verify the concordance between these data (SIM/MoH data) and the data collected in the municipalities (research data) and broaden the understanding of some of the information / variables that are released in the SIM/MoH. To that end, a deterministic crossover of DIDCs was made

available in the SIM/MS databases and identified in the field survey using key variables such as DC number, the name of the deceased, date of birth, date of death, age at death and mother's name.

In the SIM database, the underlying causes of death are shown in two ways: the original ('CAUSABAS_O' field), referring to the underlying cause recorded in the original DC, which is completed at the time of death; and the final underlying cause ('CAUSABAS' field), referring to the cause determined after the investigation. The investigated DIDCs are reported in a field called 'TTPOS': yes – investigated, no – not investigated or blank – no information. All deaths with original DIDCs declared as investigated in the 'TTPOS' field were defined as deaths investigated. It was considered that there was a reclassification of the post-investigation underlying cause when there was a replacement of the DIDC in the 'CAUSABAS_O' field with the underlying cause not belonging to chapter XVIII in the 'CAUSABAS' field. The variable 'Place of death' (field of variable 'LOCOCOR') refers to the physical area of death: hospital, other health facilities, home, public road, others or unknown.Concerning deaths investigated, the Source of investigation field (FONTEINV) informs the sources used for the investigation of DIDCs: maternal or child death committee, home visit/interview with the family, health facility, medical records, related to other databases, SVO, IML, other sources, multiple sources and unknown.

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Results

According to data from the SIM/MoH, in 2010, 7,734 deaths from all causes in the sample of 27 municipalities were reported, of which 1,275 (16.5%) have initially been due to IDC, ranging from 10.6% in the East cluster to 20.6 % in the North-West and South clusters. Among municipalities, this percentage ranged from 55.6% in the North-West cluster/stratum 1 to 4.7% in the

East cluster/stratum 1. Municipalities with a percentage of DIDCs below 10% in stratum 1, East and South clusters, and stratum 2, North-West cluster are also worth highlighting. Only 5 of the 27 municipalities in the sample did not perform any investigation of DIDCs. Of the 1,275 deaths originally by IDC, 47.5% were investigated (Table 1).

According to field research data, of the 1,275 deaths originally due to IDC in the SIM/MoH database, 20% (n = 256) were not located in the municipalities during data collection. On the other hand, 73 deaths that were not included in the SIM/MoH were found. Thus, 1,092 DIDCs were found in the field research. Of the 27 municipalities in the sample, only 15 investigated DIDCs using the recommended forms, and another four investigated using non-standardized-forms, totaling 19 municipalities that investigated DIDCs in 2010. Of the 1,092 deaths, 53.1% (n=580) were investigated, with the North-West cluster having the highest percentage of investigations, both regarding the SIM/MS and field research data (Table 1).

Regarding the reclassification of deaths, data from SIM/MoH revealed that 83.6% (n = 506) of the deaths investigated were reclassified. Thus, the percentage of remaining DIDCs fell to 9.9% in the municipalities of the sample. Regarding research data, the underlying cause was reclassified in 73.4% of the cases investigated and the percentage of remaining IDCs dropped to 8.6%, where the East cluster had the lowest percentage of remaining IDCs and the South cluster had the highest percentage (Table 2).

The analysis by population stratum showed that the highest percentage of DIDCs occurred in the municipalities of stratum 1 (26.8%), which also showed the lowest percentage of investigations: 35.5% according to data of the SIM/MoH and 48.3% according to field research. Therefore, we found that field research showed higher investigation percentages than those obtained from SIM/MoH data, especially for strata 1 and 2 (Table 1). The percentage of reclassification of the deaths investigated was higher than 80% in all strata considering data from the SIM/MoH, and field research data evidenced 58.8% for stratum 2 and higher than 70% in strata 1 and 3. We also found that the percentage of the remaining DIDCs remains high (18.5%) in stratum 1, whereas strata 2 and 3 proportions evidence acceptable levels, that is, close to 10 % (Table 2).

Figure 1 summarizes the main findings regarding the percentage of DIDCs before the investigation activities, investigations carried out, reclassification and remaining DIDCs as per SIM/MoH and field research data. After compiling the SIM/MoH and the field research data, the total number of DIDCs before the investigations was 1,348 (17.4%), with 53.7% of deaths investigated, 80.9% of those deaths reclassified and 9.8% of remaining DIDCs.

The identification of which form was used in the research activities was only possible through the data obtained in the field research since this information is not available in the SIM/MoH. A total of 318 IOCMD forms and 172 VA forms were used for the 580 DIDCs investigated and located in the field research: the IOCMD form was used in 40.5% (n = 235) of the cases, with reclassification of the underlying cause in 71.1% of deaths; the VA form alone was used in 15.3% (n=89) of the cases, and 94.4% of the deaths were reclassified; and the IOCMD and VA forms were used together in 14.3% (n = 83) of the cases, with 86.7% of reclassification. Approximately 30% of the investigations were performed using non-standardized forms and 59.5% of the causes of death were reclassified. Of the 580 deaths investigated, 73.4% (n = 426) of the underlying causes were modified (Figure 2).

Although the SIM/MoH database has a variable that allows the verification of whether the death was investigated and the source of the investigation, we were unable to identify the forms used in these activities. However, cross-checking the data from the SIM/MoH with the research data facilitated the analysis as to which form was used, the source of investigation and place of death. We observed that approximately 70% of the deaths investigated used the IOCMD form and 75% of the deaths using only the VA form occurred at home. This percentage was 80.7% when the IOCMD and VA forms were used together, and 90% in the case of non-standardized forms. Regarding the source of investigation entered in the SIM, worth highlighting is the fact that in approximately 60% of the cases where only the VA form was used, records evidenced that the investigation was registered in "multiple sources". Also, 36% of deaths had no death record or investigation (Table 3).

Concerning the municipality of Salvador, investigations of DIDCs were carried out in the IML of the capital, through search and transcription of causes of death reported in the necropsy reports in the so-called "DC alteration sheet" that basically reproduces the Block V - Conditions and death causes of the DC for later modification

Table 1. Distribution of deaths from ill-defined causes and deaths investigated by municipalities of the sample, cluster and population stratum, according to the Mortality Information System (SIM) database of the Ministry of Health and field research. Bahia, 2010.

Municipality	Population stratum	Death from all causes - SIM/MoH*	Death originally from ill-defined causes - SIM/MoH*		Death originally from ill-defined causes - Research**	Death from ill-defined causes investigated - SIM/MoH*		Death from ill-defined cause - Research** Investigated	
		n	n	%	n	n	%	n	%
Cluster East									
Municipality 1	1	43	2	4.7	2	0	0.0	0	0.0
Municipality 2	3	907	113	12.5	111	69	61.1	55	49.5
Municipality 3	2	164	12	7.3	5	5	41.7	3	60.0
Municipality 4	3	1088	80	7.4	16	47	58.8	0	0.0
Municipality 5	2	446	34	7.6	2	24	70.6	0	0.0
Municipality 6	2	289	25	8.7	12	5	20.0	3	25.0
Municipality 7	1	45	11	24.4	7	2	18.2	2	28.6
Municipality 8	1	51	21	41.2	20	4	19.0	9	45.0
Municipality 9	1	137	38	27.7	38	19	50.0	15	39.5
		3170	336	10.6	213	175	52.1	87	40.8
Cluster North-West									
Municipality 10	3	611	117	19.1	103	81	69.2	100	97.1
Municipality 11	1	70	27	38.6	36	27	100.0	36	100.0
Municipality 12	1	9	5	55.6	5	0	0.0	2	40.0
Municipality 13	2	164	77	47.0	69	67	87.0	68	98.6
Municipality 14	2	143	37	25.9	36	24	64.9	24	66.7
Municipality 15	3	569	65	11.4	54	30	46.2	24	44.4
Municipality 16	2	72	5	6.9	2	1	20.0	0	0.0
Municipality 17	1	76	7	9.2	10	3	42.9	8	80.0
Municipality 18	1	48	23	47.9	26	3	13.0	13	50.0
		1762	363	20.6	341	236	65.0	275	80.6
Cluster South									
Municipality 19	2	107	30	28.0	8	2	6.7	0	0.0
Municipality 20	1	36	2	5.6	0	0	0.0	0	0.0
Municipality 21	3	1269	230	18.1	215	54	23.5	54	25.1
Municipality 22	2	344	115	33.4	112	32	27.8	38	33.9
Municipality 23	1	145	29	20.0	28	0	0.0	0	0.0
Municipality 24	1	104	36	34.6	41	23	63.9	31	75.6
Municipality 25	3	570	78	13.7	81	64	82.1	71	87.7
Municipality 26	1	86	27	31.4	27	0	0.0	0	0.0
Municipality 27	2	141	29	20.6	26	19	65.5	24	92.3
		2802	576	20.6	538	194	33.7	218	40.5
		7734	1275	16.5	1092	605	47.5	580	53.1
Population Stratum		n	n	%	n	n	%	n	%
Stratum 1		850	228	26.8	240	81	35.5	116	48.3
Stratum 2		1870	364	19.5	272	179	49.2	160	58.8
Stratum 3		5014	683	13.6	580	345	50.5	304	52.4

* Database of the Mortality Information System of the Ministry of Health; ** Field research database.
Note: Among deaths investigated are inquiries conducted with the State forms, IOCMD form, AV3 form.

of the underlying cause in the SIM. Thus, 1,175 DIDCs were found, of which 79% (n = 935) were investigated and the underlying cause was reclassified in 86.2% (n = 806) of them.

Table 2. Distribution of reclassified deaths from ill-defined causes and remaining deaths from ill-defined causes by municipalities of the sample, cluster and population stratum, according to the Mortality Information System (SIM) database of the Ministry of Health and field research for the municipalities of the sample. Bahia, 2010.

Municipality	Population stratum	Reclassification of the ill-defined causes among the investigated-SIM/MoH*		Remaining deaths from ill-defined causes1 SIM/MoH*		Reclassification of the ill-defined causes among the investigated-Research**		Remaining deaths from ill-defined causes1 Research**	
		n	%	n	%	n	%	n	%
Cluster East									
Municipality 1	1	0	0.0	2	4.7	0	0	2	4.7
Municipality 2	3	39	56.5	74	8.2	29	52.7	82	9.0
Municipality 3	2	5	100.0	7	4.3	3	100.0	2	1.2
Municipality 4	3	43	91.5	37	3.4	0	0.0	16	1.5
Municipality 5	2	21	87.5	13	2.9	0	0.0	2	0.4
Municipality 6	2	4	80.0	21	7.3	3	100.0	9	3.1
Municipality 7	1	1	50.0	10	22.2	0	0.0	7	15.6
Municipality 8	1	4	100.0	17	33.3	8	88.9	12	23.5
Municipality 9	1	17	89.5	21	15.3	12	80.0	26	19.0
		134	76.6	202	6.4	55	63.2	158	5.0
Cluster North-West									
Municipality 10	3	70	86.4	47	7.7	91	91.0	12	2.0
Municipality 11	1	23	85.2	4	5.7	30	83.3	6	8.6
Municipality 12	1	0	0.0	5	55.6	0	0.0	5	55.6
Municipality 13	2	61	91.0	16	9.8	18	26.5	51	31.1
Municipality 14	2	22	91.7	15	10.5	21	87.5	15	10.5
Municipality 15	3	25	83.3	40	7.0	24	100.0	30	5.3
Municipality 16	2	0	0.0	5	6.9	0	0.0	2	2.8
Municipality 17	1	2	66.7	5	6.6	3	37.5	7	9.2
Municipality 18	1	1	33.3	22	45.8	7	53.8	19	39.6
		204	86.4	159	9.0	194	70.5	147	8.3
Cluster South									
Municipality 19	2	0	0.0	30	28.0	0	0.0	8	7.5
Municipality 20	1	0	0.0	2	5.6	0	0.0	0	0.0
Municipality 21	3	48	88.9	182	14.3	44	81.5	171	13.5
Municipality 22	2	27	84.4	88	25.6	34	89.5	78	22.7
Municipality 23	1	0	0.0	29	20.0	0	0.0	28	19.3
Municipality 24	1	23	100.0	13	12.5	24	77.4	17	16.3
Municipality 25	3	54	84.4	24	4.2	60	84.5	21	3.7
Municipality 26	1	0	0.0	27	31.4	0	0.0	27	31.4
Municipality 27	2	16	84.2	13	9.2	15	62.5	11	7.8
		168	86.6	408	14.6	177	81.2	361	12.9
Total		506	83.6	769	9.9	426	73.4	666	8.6
Population stratum		n	%	n	%	n	%	n	%
Stratum 1		71	87.7	157	18.5	84	72.4	156	18.4
Stratum 2		156	87.2	208	11.1	94	58.8	178	9.5
Stratum 3		279	80.9	404	8.1	248	81.6	332	6.6

* Database of the Mortality Information System of the Ministry of Health; ** Field research database. 1- calculated against the total number of death notified to the SIM/MS.
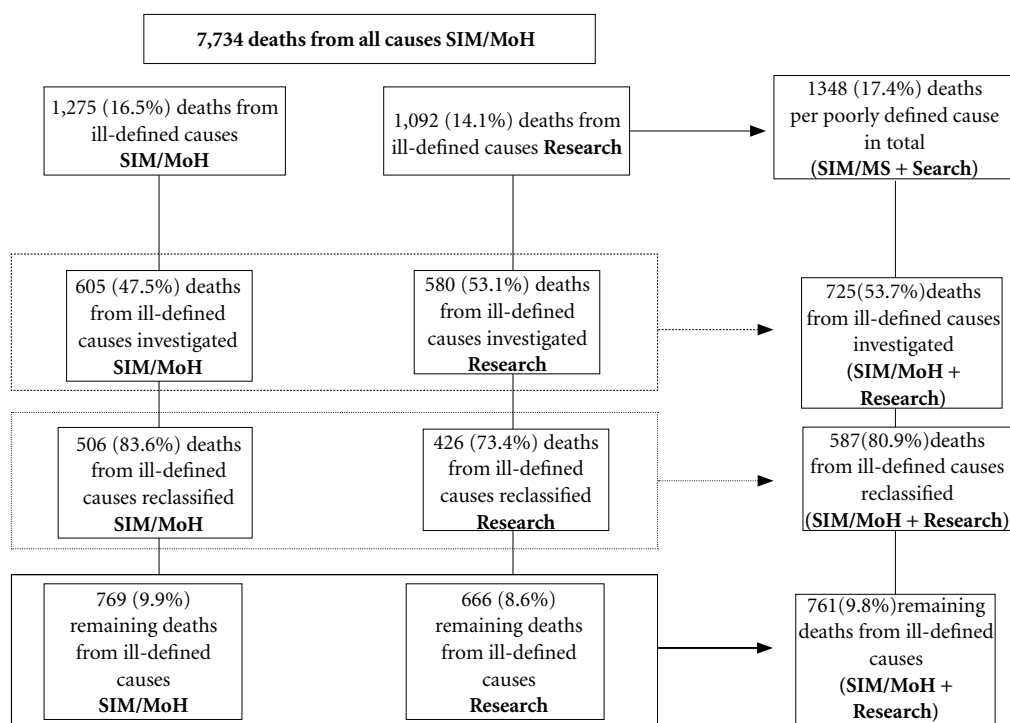
Figure 1. Flowchart of the main findings regarding the percentage of deaths from ill-defined causes before investigations, investigations performed, percentage of reclassification and remaining deaths from ill-defined causes as per SIM/MoH and field research data and after compiling the data into a single database.

Note: Data compiled from the SIM/MoH database and field research data.

Discussion

In the field research, we observed that more than 70% of the municipalities of the sample carried out investigations of DIDCs, but little more than half of the municipalities carried out the investigations as recommended by the MoH, that is, using the IOCMD or WHO adapted VA forms. Of the total number of DIDCs occurred in the municipalities of the sample, approximately 50% were investigated and 30% of the investigations did not occur according to the standards recommended by the MoH, indicating that there is still much to be done regarding the investigations to achieve that which is advocated by the MoH. Notwithstanding this, the investigation of DIDCs allowed the reduction of the percentage of these deaths to the values recommended by the Ministry of Health, that is, less than 10%[8] and were more effective when performed using the recommended forms.

It was observed that the problems in the smaller municipalities were more pronounced, even in the East cluster, whose municipalities are closer to the capital Salvador, and therefore have greater access to health services, showing the importance of carrying out the analysis by population stratum. The municipalities of stratum 1 had a high percentage of reclassification of the deaths investigated, but the percentage of remaining DIDCs remained high in these municipalities, which can be explained by the lower percentage of investigations carried out when compared to the municipalities of the other strata. A study on the characterization and geographic distribution of the quality of death information in Brazil also pointed out that, despite the generalized reduction in the percentage of DIDCs, the differences by municipality size persist, and this percentage is higher in municipalities with less than 20,000 inhabitants[19].

Not coincidentally, the municipalities with the worst data quality and socioeconomic level

Figure 2. Flowchart of field research data from the investigation of deaths from ill-defined causes to the reclassification of the underlying cause of death, by form used to conduct the investigation. Municipalities of the sample. Bahia, 2010.

Note: IOCMD: Death from Ill-defined Causes Investigation form.

are those with the most considerable inequities in health and require the largest investments[2]. This data shows that the incentive to investigate DIDCs can contribute to the improvement of information quality in these places and that financial and human resources investments should be made in smaller municipalities[20].

The percentage of reclassification of the underlying cause after the investigation was approximately 10% higher in the SIM/MoH database when compared to field survey data. It is evaluated that the difference observed may have occurred for different reasons: the first refers to underreported number of investigations carried out in the municipality, since there may be a tendency for not reporting the investigation when it did not result in the definition of a new underlying cause. Another probable cause may have been the difficulty of the researcher in identifying whether a new underlying cause was defined or not, and even what this new cause would be since the IOCMD and VA forms do not contain a section for the selection of the underlying cause and definitive conclusion of the research. This difficulty

Table 3. Deterministic cross-checking of selected variables from the Ministry of Health Mortality Information System (SIM) database and forms used in the investigation of death from ill-defined causes obtained from the field research for the municipalities of the sample. Bahia, 2010.

SIM selected variables	IOCMD only		VA only		IOCMD and VA		Non-standardized forms	
	n	%	n	%	n	%	n	%
Death place of ocurrence								
Home	163	69.4	67	75.3	67	80.7	157	90.8
Health establishments*	48	20.4	19	21.3	12	14.5	10	5.8
Public roads	8	3.4	3	3.4	2	2.4	3	1.7
Unknown	5	2.1	0	0.0	0	0.0	3	1.7
Other	11	4.7	0	0.0	2	2.4	0	0.0
Total	235	100	89	100	83	100	173	100
SIM investigation source								
Home visits	3	1.3	5	5.6	0	0.0	7	4.0
Maternal or Child Mortality Committee	1	0.4	0	0.0	0	0.0	1	0.6
Multiple sources	150	63.8	52	58.4	67	80.7	142	82.1
Health establishments	33	14.0	0	0.0	0	0.0	1	0.6
Investigation/death not entered in the SIM	48	20.4	32	36.0	15	18.1	20	11.6
Other source	0	0.0	0	0.0	0	0.0	2	1.2
Unknown	0	0.0	0	0.0	1	1.2	0	0.0
Total	235	100	89	100	83	100	173	100
Age group of deceased								
Less than 1 year	2	0.9	0	0.0	0	0.0	2	1.2
1 to 9 years	3	1.3	0	0.0	0	0.0	0	0.0
10 to 19 years	3	1.3	0	0.0	3	3.6	0	0.0
20 to 49 years	28	11.9	13	14.6	9	10.8	20	11.5
50 to 64 years	43	18.3	17	19.1	14	16.9	27	15.6
65 years and over	154	65.5	59	66.3	57	68.7	124	71.7
Unknown	2	0.9	0	0.0	0	0.0	0	0.0
Total	235	100	89	100	83	100	173	100

* Health establishments = hospital + other facilities.

was also observed in the study that evaluated the investigation of DIDCs in the state of Alagoas[16]. Therefore, it is necessary to include specific fields in the forms that allow the professional responsible for the SIM to identify whether the data of the investigation have already been registered in the SIM, since some death investigations, as well as deaths and their respective investigations, duly completed and that were not recorded in the SIM, were found.

Investigations using the forms recommended by the Ministry of Health (IOCMD or VA) allowed the reclassification of DIDCs in approximately 80% of the deaths investigated. The reclassification of approximately 70% of the deaths investigated using the IOCMD form alone showed the

potential of this instrument and the importance of seeking information in the health services to improve data collection, since there are easily accessible information that requires a shorter time from health service professionals to complete the form. They also reinforce the importance of sensitizing medical professionals regarding death certification in order to improve the quality of data on deaths, since the information obtained in these forms is often available in the patients' records in hospitals[6]. Therefore, it is also essential to work on improving medical education and its public health awareness as its responsibility and area of action, to improve health conditions and standards of medical services[21]. An interesting strategy to be adopted by the health services

would be, after completing the IOCMD form and defining the new underlying cause, to return to health facilities and make doctors aware of the search of information in the medical records for the full and correct completion of the DC.

In the same vein, the VA form was an essential tool for the definition of the underlying cause of death when no information was found in health services or when it was not enough to reclassify the underlying IDCD, since 90% of deaths investigated had a reclassified underlying cause with the use of VA alone or VA used in conjunction with the IOCMD. This percentage of reclassification was also observed by Campos and collaborators[9] in an evaluation research of the SIM that aimed to investigate the DIDCs in the Northeast area of the state of Minas Gerais using the VA method, and by França et al.[16] in a study that evaluated the process of investigation of DIDCs in the state of Alagoas, in the Northeast region.

The death investigated using the VA form alone deserves attention, since it is recommended that an investigation should be performed first in health services, using the IOCMD form, which allows guiding and organizing the collection of data on DIDCs and allows to gather data systematically, facilitating the reasoning in determining the cause of death[8]. The use of the IOCMD form as the first stage of the investigation should be prioritized to avoid the need to carry out the home investigations that in some cases are more time-consuming and costly.

On the other hand, the use of research forms not recommended by the MS allowed a lower percentage of underlying cause reclassification when compared to the percentage of reclassification obtained using the IOCMD or VA recommended forms. Besides showing diverse content, these forms do not have a standardized application and use, and there are no guidelines for their application and analysis, and this can bias the comparison of data from various municipalities and states, and compromises the quality of data entered in the SIM[8]. Besides, no studies on the adequacy of these forms have been performed. The standardized methodology of investigation of DIDCs proposed by the MoH is a positive result of a careful adaptation process and also the partnership between the MoH and the state and municipal health departments.. The objective is to produce and obtain reliable and comparable mortality statistics, enabling health planning to be based on qualified information.

In interviews performed with professionals responsible for the SIM in municipalities, some of them justified that they used other forms for investigations, because the VA form employed in Brazil was very extensive and time-consuming, which hindered the implementation with relatives, mainly due to the low availability of professionals (data not shown). Thus, in order to better incorporate the investigation of DIDCs using VA form in routineinvestigations, an alternative that has being evaluated by the MoH is the use of shortened VA forms[22] and more straightforward operating procedures, which can produce reliable and timely data on specific causes of mortality, enabling a higher percentage of investigation of these deaths.

Regarding the data entered in the SIM regarding the research source, the importance of correctly filling this variable is highlighted, since, in 60% of the cases in which the investigation was performed using only the VA form, it was informed in the SIM that the research had been conducted from multiple sources. As the system does not allow to independently inform each source in which a particular death was investigated, it is not possible to determine via SIM/MoH which deaths were investigated using the recommended forms or even the sources used, when the investigation is performed from more than one source. Thus, as observed in this study, home investigations may be underreported when they are recorded as "multiple sources". It is essential to know the sources that are being used to investigate DIDCs, since this allows identifying where the information on death is available and what interventions are required to incorporate this information into the DC, avoiding the notification of DIDCs.

It is important to highlight that the underlying cause's definition process can be influenced by several factors such as the correct and full form completion, availability of information in health services and access to health services, characteristics of the deceased, such as gender and age, and method used to define the underlying cause. Regarding the VA form, it is important to say that, like any other instrument, this may not be sufficient to clarify all causes of death, since it was adapted to clarify only the most prevalent causes of death in Brazil[8]. Also, an important consideration to be made is that all deaths with a change in the underlying cause were considered as reclassified, regardless of whether the certification of the new cause was made by a physician or within a maximum period of three months after death, as recommended by the MoH[8]. Thus, regarding the evaluation of investigations of

DIDCs, it is necessary to validate the underlying cause defined after the investigation, in order to verify whether the new underlying cause is correct, which was not object of this work.

Despite reducing the percentage of DIDCs after the investigations in the municipalities of the sample to levels lower than 10%, the percentage of DIDCs reported to the SIM before the investigations deserves attention because it is an essential indicator of the quality of medical care provided and access to health services. It is essential to know the pattern of occurrence of DIDCs since this points to the need for restructuring the health care services provided[3].

The study carried out in the State of Bahia shows the efforts made by the managers at the federal, state and municipal level, and points out the relevance of the analysis of information on DIDCs and the investigation of deaths at the municipal level, allowing the evaluation of improved data on death, the identification of municipalities and clusters in which interventions are still required and that are consistent with local and regional weaknesses in order to improve the quality of data on deaths.

The results of this study corroborate the importance and benefits of using the forms recommended by the MS to investigate DIDCs due to the higher percentage of reclassification observed and, consequently, more significant impact in the reduced percentage of DIDCs. It is hoped that findings shown here may serve as an incentive for health professionals and managers in the municipalities that have not yet adhered to the investigation activities and use of the recommended forms, both in the state of Bahia and in the other states of the North and Northeast, and even in the country. Also, it is essential to standardize the use of forms, as well as their flow and completion and analysis procedures, since data of the investigations are incorporated into the SIM and become part of the vital statistics of the country that serve as the basis for planning in health at all levels.

Collaborators

CC Cunha contributed to the planning the study, collecting and analyzing the data and drafting the manuscript. AMN Vasconcelos contributed to the concept and design of the study and revision of the manuscript. E França contributed to the concept and design of the study, planning the data collection, interpreting the results and drafting the manuscript. MFM Souza contributed to the analysis and interpretation of the results and review of the manuscript.

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