

INSTITUTO NACIONAL DE ESTADISTICA



## **Death Statistic according to Cause of Death**

Methodology

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## I Background

The deaths and late foetal deaths statistic according to cause of death have their own identity although they come under the remit of vital statistics which refer to births, marriages and deaths which have occurred in Spain and which make up one of the most traditional statistics elaborated by the National Statistics Institute (INE). The first volume was published in 1863 by the National General Board of Statistics and contains data on the period 1858 to 1861 which were obtained from parish registers. Since then uninterrupted information on demographic phenomena has been published in Spain during 1871-1885 when the civil register was implemented and from which successive data for these statistics was obtained.

The classification of deaths according to cause of death goes back to information from 1861-1870, thereby giving rise to what is currently known as the deaths statistics according to cause of death. This first classification only has five groups for causes and it was only as of the 1900 publication that the 14 group and 99 heading classification for causes of death by Dr. Bertillón, started to be used in Spain. This distribution was revised the same year during the first international conference for the revision of the causes of death classification in which a ten-year revision system was also approved.

The first three revisions were supervised by Dr. Bertillón. The next two were coordinated by the National Statistics Institute and Organisation for Hygiene of the League of Nations which were adopted in Spain in 1931 and 1941 respectively.

As of the 6th revision and up to the 10th, in force currently, responsibility for its preparation was given to the Provisional Committee of the World Health Organisation and was implemented in our country in 1951, 1961, 1968, 1980 and 1999 respectively and was known as the International Classification of Diseases (ICD).

Since its origin, the deaths statistic according to cause of death has been enriched with new classifications. Therefore, variables such as age, sex and province of registration were incorporated in 1903. However; the modifications which occurred as a consequence of the last reforms of the vital statistics as a whole are notable.

In 1957, with the introduction of the new civil register, the INE proposed a new collection system to deal with the growing demand for demographic-health information concerning death. For these purposes, some new statistical death and abortion gazettes which were more complete than the previous ones entered into force which were limited to collecting those data that appeared in the civil registry books. However, not all variables introduced could be used due to there being a high percentage of lack of response as a consequence of the difficulty some informants had in filling in completing them.

Due to these difficulties, in 1975 a new reform was carried out which considered three main aspects: The simplification of these bulletins, the change of some concepts and modification of results tables.

The most important conceptual variation is that which affects the statistical significance of live birth. Traditionally for vital statistics the legal criteria of *live birth* was used which is covered in article 30 of the civil code. *A foetus will only be classified as alive if it had a human like appearance and lived for twenty-four complete hours outside the mother's womb.* Consequently, in the deaths group, live births and deaths before 24 hours were not included as these were registered as abortions in the civil register according to the previous definition.

Although the legal criteria are still maintained unaltered, as of 1975 births and deaths statistics have been adjusted to internationally recognised demographic concepts. As of this moment, a live birth is considered to be any foetus that is biologically born with life and therefore a death is counted as a foetus that is born alive and dies afterwards independent of the hours lived.

This change in criteria does not substantially influence global deaths figures but it does considerably modify some specific mortality tasks (infant, neonatal, perinatal, etc.) in such a way that prior to 1975 these health indicators were giving a skewed version of the real situation.

Subsequent to this reform, in 1980 the statistical birth and abortion bulletins were revised into a single birth bulletin where data on live births and deaths before 24 hours were obtained.

Lastly, and carrying on the process of modernisation of Vital Statistics begun in 2007, a series of Death Statistics reforms affecting both forms and the obtaining of information circuit that came into force in 2009.

The objectives of said changes were as follows:

1. To improve the quality of information on causes of death, adapting the means of collection of said variables to the recommendations of the WHO and Eurostat. With this objective in mind, the two documents are brought together in those dealing with causes (the Medical Death Certificate and the Statistical Death Register) in a single form: CMD/BED.
2. Introduce ICT in the information collection process. In the case of deaths with Judicial Intervention, a web application is implemented in order to directly record information in the database to replace the document submitted previously to the Civil Registers (MNP52), thereby obtaining a greater degree of confidentiality in the transmission of sensitive information, such as cause of death, particularly in the case of external causes. In the case of CMD/BED, they are adapted to an optical character reading format, thereby streamlining the information capture process.

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## Legal regulations

On the subject of deaths, there is a specific regulation in the legislation on the Civil Register and its supplementary rules and those being developed.

Art. 5 of Civil Register Law 20/2011 provides for all acts with access to the Civil Register being noted, and art. 325 of the Civil Code sets out the compulsory nature of being recorded in the corresponding Civil Registers of the life events of the person. Thus all deaths must be recorded in the Civil Register of the municipality where the death occurred.

The National Statistics Institute, pursuant to article 20 of the Regulation of the Civil Register Law, approved by a Decree of 14 November 1958, receives from those in charge of Civil Registers, via their Provincial Delegations, bulletins containing births, marriages, deaths or other recordable events.

Furthermore, article 274 of the Regulation of the Civil Register Law indicates that "the staff who attended to the deceased in his or her last illness or any other who recognises the body will immediately send the Civil Register the death certificate in which, besides the name, surname (...) it will appear that there are unmistakable signs of death, its cause and, with the accuracy that its recording requires, date, time and place of death"

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## II Objectives

The deaths statistic according to cause of death constitutes one of the most important sources of health information.

Deaths are a consequence of a host of biological causes which may be economic, health-related or social. Therefore, it is necessary to have information available not only on the number of deaths that occur in a country over a certain period but also on all those circumstances which surround the event to facilitate action on the part of health administrations and the rest of society's forces.

This fact together with the scarce availability of reliable and exhaustive indicators to evaluate the level of the population's health has meant that demand for this statistic is still increasing. Its main objectives are the following:

1. To provide information on mortality by dealing with the basic cause of death according to the ICD, its distribution by age groups, sex and other classification variables.
2. To ascertain late foetal deaths by dealing with the cause of death according to the ICD.
3. To measure perinatal mortality thereby providing a basis with which to obtain indicators that facilitate evaluating the coverage and quality of health services.

4. To make it possible to construction historical series to study the evolution of the prevalence of certain causes of death as well as other studies which meet the requirements for information needs established by the health administrations.
5. To make territorial comparisons on the behaviour of mortality by causes of death groups.
6. To supply a basis with which to construction health indicators recommended by international organisations.

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### **III Variables: Definitions and concepts**

The variables studied are deaths and late foetal deaths occurring in the reference year. Data provided will be in absolute values and in gross rates. Similarly, standardised rates and potential years of life lost are provided as derived indicators.

The classification variables are the basic cause of death according to the International Classification of Diseases in its 10th edition (ICD-10), and according to socio-demographic variables: age (or weeks of gestation), sex, nationality, and place of residence.

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#### **Death**

As set our earlier, for the purposes of this statistic death is considered to be the death of any live person independently of the hours they have lived.

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#### **Late foetal death**

from a theoretical perspective, a late foetal death is death before complete expulsion or extraction of a viable product of conception from its mother. This viability is precisely what serves to differentiate late foetal deaths from abortions. Traditionally, the World Health Organisation (WHO) has identified the viability of the foetus with those births that weighed at least 500g or with a gestational age of at least 22 weeks or size of 25cm from crown to heel.

Bearing in mind this lack of international uniformity as to weight, the difficulty in obtaining exact weights for all foetuses after expulsion and especially the fact that in Spain there is an obligation to communicate foetal deaths of more than 180 days registration to the civil registry (art. 45 of Law of 8 June 1.957), means that for the purposes of this statistic, the criteria of considering a late foetal death to be a dead foetus with more than six months gestation has been adopted. Nevertheless, those viable foetuses of at least 6 months gestation which are declared in the civil registry are incorporated into the statistic.

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## **Cause of death**

Cause of death is understood to be the set of all diseases, morbid states or lesions that cause death or contribute to death and the circumstances of the accident or violence which produced these lesions.

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## **Basic cause of death**

Disease or lesion that started the chain of pathological events which directly led to death or the circumstances of the accident or violence which produced the final lesion.

Of the four causes of death which should appear and which the statistical bulletin should be informed about (immediate, intermediate, initial or fundamental and other processes), the one known as basic cause is selected to be coded. This generally coincides with the initial or fundamental case and only in doubtful cases does one resort to selection rules established by the WHO in the 10th revision of the ICD for their determination.

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## **IV Collection and treatment of information**

The information is obtained either via an administrative act (recording of the death or birth in the Civil Register) or a judicial act (communication of the burial order by the Court dealing with the case not due to natural causes). Information is collected via the following documents: Statistical Birth Bulletin (BEP), Medical Death Certificate/Statistical Death Bulletin (CMD/BED) and Judicial Statistical Death Bulletin (BEDJ).

Everybody resident in Spain has the obligation set out in law to fill out questionnaires for the declaration of births, marriages and deaths to the civil registry. In the case of death which occurred after the first 24 hours of life, it is necessary to complete the CMD/BED. In the case of a late foetal death or a live born who died before 24 hours of life, since there is no official abortion certificate, the certification is incorporated to the BEP text for Notification to the Registry.

In cases of accidental or violent deaths involving the Court, statistical information is gathered via the Judicial Statistical Death Register (BEDJ).

The CMD/BED consists of a front page corresponding to the Medical Certificate, on which information pertaining to the cause of death appears, and which is completed by the certifying doctor in case of death not involving a court. The second page, which corresponds to the Statistical Bulletin, is completed by the notifying party, or otherwise by the person in charge of the Civil Registry, and the registration details by the person in charge of the Civil Registry.

Once the part corresponding to the Medical Certificate has been completed by the doctor certifying the death, the funeral home or the family submits the CMD/BED at the Civil Register of the municipality where the death occurred in order to register the deceased.

The SBB are available in maternity hospital centre departments. The CMD/BED is distributed by Official Colleges of Doctors, not the INE, to pharmacies, funeral homes, etc.

The INE, in its dealings with Civil Registers, takes it upon itself to adopt the appropriate measures in order to guarantee coverage, quantity and timeliness of the information received from the latter, as well as to guarantee and generate from it, monthly files for recording each demographic phenomenon (deaths, marriages and births).

The Civil Register sends the batch to the INE Delegation during the month in which it was received, where revision, filtering, OCR scanning, coding and recording work for the demographic variables is started. As of 1994 the cause of death is also included for the SBB. This information is used for immediate update of other statistical files.

Subsequently, in the INE Central services, the files obtained from the recording are contrasted with those for recording deaths and births taken from the Civil Registers that have been computerised and are supplied to the INE by the General Directorate of Registries and Notaries of the Ministry of Justice.

As of 1983, the INE has been establishing collaboration agreements with autonomous communities. Currently, these agreements include the coding process and recording of health variables for deaths which occurred within their territorial remit.

Therefore, the INE provide autonomous communities with the monthly information via a secure website where it is possible for them to perform the process of encoding and recording of health variables.

It is necessary that the INE coordinates the coding work of all autonomous communities by advising and providing its technical support as well as carrying out a continued follow up with the objective of ensuring the homogeneity of criteria. Similarly, the recording process carried out by autonomous communities should fulfil the format and regulations established by the INE.

The treatment of the cause of death in the process for the elaboration of results tables is carried out exhaustively by studying all cases of possible incompatibilities between this and the rest of the demographic information. The primary data source is used, the statistical bulletin in such a way that reliability is as high as possible.

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## **V Scope of the statistic**

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### POPULATION

This includes all deaths that occur in the country independent of the place of origin of the death. Deaths of Spaniards outside Spain are not included.

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### GEOGRAPHICAL

The deaths statistic according to cause of death covers the whole country.

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### TEMPORAL

The reference period is annual although information is provided by month of death.

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## **VI Publication of results**

The complete results on this statistic have been disseminated online ([www.ine.es](http://www.ine.es)) in the section *Inebase/Sociedad/Salud/Defunciones* depending on the Cause of Death as of 1999. This contains 4 groups of tables on a national, autonomous, provincial level and different mortality indicators (standardised rates and potential years of lost life).

For the first 3 groups, tables are structured in the following order: general, child, perinatal mortality tables and finally late foetal deaths,

8 tables are provided on general mortality on a national level. The first contains information on deaths according to cause of death (detailed list of the ICD-10) classified by sex and age groups. The following use the reduced list of causes of death for their tabulation by offering absolute and relative figures. Classification variables are age groups, sex, month of death, size of the municipality, nationality and place of residence.

20 tables are provided on general mortality on an autonomous level. The reduced list of causes of death is used for the tabulation. The first contains data from all autonomous communities classified by sex and age groups. The following contain deaths from each autonomous community of residence classified by provinces, sex and age groups.

On a provincial and provincial capital level a table on general mortality is included classified by province or capital of residence, sex and reduced list of causes of death.

For the tables relating to child mortality, perinatal mortality (minors 1 week old) and late foetal deaths, specific mortality lists are used. These tables are classified nationally according to specific age brackets (in the case of late foetal deaths weeks of gestation are considered). Data are offered by sex and place of residence on an autonomous and provincial level.

In additions, beginning with the data from the year 2005, specific tables are published regarding deaths by suicide on national, Autonomous, provincial and provincial capital levels.

8 tables are provided on a national level; the last two with relative figures. The classification variables are sex, age, method employed, size of municipality of residence or of death, Spanish or foreign nationality and month of death.

12 tables are provided on Autonomous and provincial levels, classified by place of death or residence, sex, age, method employed and month of death.

Lastly, a table is offered, classified by provincial capital of death and sex.

Similarly, series from this statistic are available in the TEMPUS database which can be accessed on Internet ([www.ine.es/inebase](http://www.ine.es/inebase)).

On the other hand, the microdata anonymous file is also available once the data supply commitment conditions are signed.

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## VII Standardised rates

A fundamental objective for the statistical analysis of the mortality of a country is to be able to make comparisons between different geographical areas which meet the phenomenon under study in a different way.

Up to 1985 data was only published on proportional mortality, in other words mortality according to cause by 1000 deaths, as well as gross rates or the equivalent, deaths according to cause by 100,000 inhabitants. The indicators offer a summary of the frequency with which the phenomenon of mortality appears in the general population.

On a global scale, these rates have a descriptive value which is of undisputed interest given that they provide a measurement of the evolution of the phenomenon over time.

Gross mortality rates present however, a significant limitation when making comparisons between different groups that have different age structures, as is the case of the different autonomous communities.

Under these circumstances gross mortality rates may be reconstructed based on a common age and sex structure or on common mortality. Standardised rates may be obtained by the direct method in the first case and by the standardised mortality ratio in the second case.

This latter method, although it offers advantages for greater ease of calculation and giving lower standard errors than those provided by the direct method when

low incidence and/or small population characteristics are applied, has the disadvantage that it only permits - through its own definition - establishing comparisons between each one of the different rates obtained with the one corresponding to the standard population but nor with each one of the remaining ones.

As the objective is to make comparison possible for mortality by cause (ICD chapters) between autonomous communities, the direct method has been used.

With the objective of verifying if the standardised rates from different autonomous communities are significantly different from a statistical point of view, variation coefficients have been calculated in all cases. In this way, the interpretation of these rates may vary for low incidence causes of death and autonomous communities with small population such as for example would be the case of Ceuta and Melilla for the cause of death, *congenital malformations, deformities and chromosomal anomalies*.

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### Methodology for calculation of standardised rates

From the 1999 data the national population referring to 1 July 1999 is considered as the standard population (total, men and women).

The standardised mortality rate by cause  $j$  for autonomous community  $k$  for sex  $l$  is given by:

$$TES_{kl}^j = \sum_i \frac{M_{kil}^j P_{il}^s}{P_l^s}$$

where:

$M_{kil}^j$  represents the specific mortality rate by cause  $j$  in age group  $i$ , community  $k$  and sex  $l$ .

$P_{il}^s$  is the standard population in age group  $i$  and sex  $l$ .

$P_l^s$  is the standard population in all age groups and sex  $l$ .

Consequently, the number reflects the number of deaths expected to occur in the standard population if this population were subjected to specific mortality rates by cause  $j$  in community  $k$  and sex  $l$ .

As a measure of variability of each standardised rate, its corresponding variation coefficient has been obtained.

$$C.V.^j_{kl} = \frac{S}{TES_{kl}^j}$$

$S^2$  is the variance of the standardised rate and the following is obtained:

$$S^2 = \sum_i \left[ \frac{P_{il}^s}{P_i^s} \right]^2 \cdot S^2 (M_{kil}^j)$$

where variance of the specific rate  $M_{kil}^j$  is:

$$S^2 (M_{kil}^j) = \frac{1}{P_{kil}} M_{kil}^j (1 - q_{kil}^j)$$

$P_{kil}$  is the population in age group  $i$ , community  $k$  and sex  $l$ .

$q_{kil}^j$  is the estimated probability of death by cause  $j$  in age group  $i$ , for community  $k$  and for sex  $l$ . The following is obtained:

$$q_{kil}^j = \frac{n_i M_{kil}^j}{1 + (n_i - a_{kil}) M_{kil}^j} \cdot \frac{D_{kil}^j}{D_{kil}}$$

$n_i$  is the longitude of the  $n$ th age interval.

$a_{kil}$  is the average number of years lived in the  $n$ th age interval by deaths in age group  $i$ , in community  $k$  and for sex  $l$ .

$D_{kil}^j$  is the number of deaths by cause  $j$  in age group  $i$  in community  $k$  and for sex  $l$ .

$D_{kil}$  is the number of deaths in age group  $i$  in community  $k$  and for sex  $l$ .

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## VIII Potential lost years of life

Both gross and standardised mortality rates which facilitate making comparisons between different groups are affected by the major weight represented by deaths at an elderly age which does not facilitate evaluating the incidence of deaths at young ages.

From a health system point of view, the effect mortality has is different if it occurs at elderly ages. Therefore, it is necessary to measure premature mortality by means of an alternative indicator which detects the causes of death which could theoretically be avoided and which lead to a reduction in life expectancy of individuals.

Potential lost years of life (PLYL) has been selected as a measure of mortality which could theoretically be avoided. This bears in mind the years a person has to live if they die at an age which is not the habitual age for dying which has been theoretically set for this group.

The calculation of this indicator has been made for the 1-69 age interval which means on the one hand leaving to one side deaths at higher ages and on the other hand, child mortality due to causes of death of those dying under 1 year which are in general more specific and require a separate study.

## Methodology for calculating potential years of life lost

For the calculation of PLYL the ICD chapters have been considered which refer to the national total and each one of the autonomous communities.

Results are expressed as:

- Total PLYL by cause j in Community k and sex l.

$$APVP_{kl}^j = \sum_i D_{kil}^j a_i$$

- Percentage of PLYL attributable to cause k in community k and sex l.

$$\frac{APVP_{kl}^j}{APVP_{kl}} \cdot 100 = \frac{\sum_i D_{kil}^j a_i}{\sum_i D_{kil} a_i} \cdot 100$$

- Adjusted rate (direct method) of PLYL by 1000 inhabitants by cause j in community k and sex l.

$$\sum_i a_i \cdot \frac{D_{kil}^j}{P_{kil}} \cdot \frac{P_{il}^s}{P_{l(1-69)}^s} \cdot 1000$$

- Average N° of PLYL attributable to cause j in community k and sex l.

$$\frac{APVP_{kl}^j}{D_{kl}^j} \frac{\sum_i D_{kil}^j a_i}{\sum_i D_{kil}^j}$$

where:

$D_{kil}^j$  is the number of deaths by cause j in age group i in community k and with sex l.

$D_{kil}$  is the number of deaths in age group i in community k and with sex l.

$D_{kl}^j$  is the number of deaths by cause j in community k and with sex l in all age groups.

$a_i$  is the number of remaining years from age i to the age limit considered.

$P_{kil}$  is the population in age group i from community k and with sex l.

$P_{il}^s$  is the standard population (national population referring to 1 July 1999) in age group i and sex l.

$P_{l(1-69)}^s$  is the standard population 1-69 with sex l.