Assessing the completeness of death data and its impact on life expectancy gender gap, case of Albania

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Abstract

Estimates of completeness of death registration are crucial to estimate the usual resident population in the country as well as to produce estimates of life tables and population forecasts. Moreover, timely and reliable data on deaths are fundamental for informed decision-making in the health sector. Measurements of completeness of death registration provide timely and locally relevant feedback on system performance and can guide interventions to strengthen and improve Civil Registration System of Vital Statistics performance over time. This paper aims to give an overview of the estimates of the completeness of death data in Albania, detailing it further considering the age, sex characteristics by applying indirect method using official data. All the studies done so far, show that on national level there is an under coverage of the total number of deaths, which depending on the approach used, figure out an improvement of the death registration in Albania over the years. However, the findings of our analysis considering the age and sex dimensions show that still there exists an under coverage of female deaths, more evident in older ages. The adjusted life expectancy showed an improvement in the life expectancy gender gap. The results of this paper can be used to derive adjusted sex-age specific death rates, as far as the results allow doing so, in order to provide more accurate calculation of life expectancy, mortality and population forecasts.

Keywords: death registration, death data completeness, indirect techniques, under coverage of death data, life expectancy

Introduction

Estimates of completeness of death registration are crucial to estimate the usual resident population in the country as well as to produce estimates of life tables and population forecasts. Moreover, timely and reliable data on deaths are fundamental for informed decision-making in the health sector. Measurements of completeness of death registration provide timely and locally relevant feedback on system

performance and can guide interventions to strengthen and improve Civil Registration System of Vital Statistics performance over time. Reliable data from civil registration, the vital events data especially deaths data, are essential for providing qualitative vital statistics, correctly estimating the resident population, producing as well life tables and population forecasts.

Up to 2011, the civil status registration system in Albania was done manually. The so-called Fundamental Population Register (FPR) was a hand written book recording every family with their legal residency in the locality. Regarding the registration of the vital events, births, deaths and marriages, were firstly registered manually in the FPR than in a specific register (births, deaths or marriages) and afterwards in a dedicated questionnaire which was used for statistical purposes.

According to the results of the assessment of the Albanian Demographic Information System done by Lerch and Warnner (2008), the quality of the death coverage was low but close to 90 percent. Underreporting was the result of a wide range of problems which were related to the procedures of the data collection. Reasons for this underreporting found out from this assessment were related to economic advantages (pension still available) that family members could have if they would have not reported the death of a family member. Secondly, financial penalties are imposed in any case of late reporting of a death. This certainly discourages people from finally reporting the death. Another reason could be the problems occurred during the data transfer from civil status offices to statistical office through paper forms.

A project for the modernisation of the Civil Registration System was initiated by the Statistics Norway in 1999. The project proposal released in 2001 included a pilot project funded by the Norwegian Ministry of Foreign Affairs. The main objective of this modernisation was (1) to obtain an accurate list of voters for elections and (2) to elaborate a civil status registration system. Saying that, from 2011, all the vital events data were registered and transmitted electronically. After the modernisation of the civil registration system, coverage and quality improvements in vital registration have been noticed; however there are still gaps in data quality issues.

So far, several approaches have been developed to assess the quality of vital events data. Focussing on death data completeness, which is defined as the proportion of death events recorded by the civil registry during a reference period out of the total events estimated to have occurred during the same time period, there are several methods which derive the estimate of the excepted deaths. Each approach has its own specificities, data needs, assumptions and statistical methods.

This paper shows the application of the indirect methods in the Albanian case in order to assess the completeness rate of death data. These methods require data on age distribution of population between two consecutive censuses, along with information on annual registered deaths by age group for each intervening year between the

censuses. These methods rely on complete data from both population censuses, however techniques have been developed to measure and adjust the census completeness. The methodology behind these methods is based on the assumption of the stable population, or to some extend flexible to stability assumption.
The period considered to assess the death registration data refers to 1989-2011, which do not consider the modernisation of the civil status registration system (CSRS). The impact of the modernisation of the CSRS will be assessed after having the results of the 2023 Population and Housing Census.

Data sources

By utilizing official data provided by the Institute of Statistics of Albania and employing population data from the last three censuses (1989, 2001, and 2011), the analysis aims to check the death completeness rate going further to derived adjusted life expectancies for each gender. The series of the death and net migration data by age group and sex for the intercensal period 1989-2001 and 2001-2011 were necessary for the application of these methods. Some statistical adjustments of the data used have been made prior application of the methods in order to achieve the best results respecting the requirements and assumptions of the techniques used.

Assessment of census completeness

Until 1989 census there have been done assessments on the death completeness in Albania by employing these indirect techniques. Since these techniques rely on the census data, the assessments are preceded by census coverage evaluation and other data adjustment relating to age misreporting.

In Albania have been conducted 12 population and housing censuses, where the first one dated on 1923. Starting from 2001 census of population and housing were fully based on international recommendations on census taking, following the same methodology and definition, which allowed international comparability.

In 1992, Van der Pol used indirect methods to assess the census coverage as well as death registration completeness in Albania from 1955 census to 1989. The method developed by Hill was used applying CENCT procedure from MORTPAK-LITE (United Nation, 1988) to the Albanian data from the censuses and death registration data. The censuses checked are the 1955, 1960, 1969, 1979 and 1989. It should be mentioned that the two main assumptions implied by these methods are that the population is closed to migration and that the coverage factors do not vary with age. The first assumption can be very well applied in Albanian population of this particular period, as the country was cut off from both West and Eastern Europe, and there were no movements of people in or out of the country. With regard to the second assumption it is very difficult to judge. However, it was assumed that the coverage factor does not vary with age. The estimates of the completeness cover different combinations of age-groups, starting with ages 5, 10, and 15, and ending with 60, 65, and 70.The estimate with the least mean square error is taken as the best estimate of the completeness.

The analysis has been further completed assessing the coverage of the last two censuses 2001 ad 2011. The difference with the analysis done on the previous censuses is that after 89' the Albania population was not a closed one. In order to make these techniques more applicable is was necessary to adjust the data before applying them. Since the international migration is the main component that drives the changes in the Albanian population, prior adjustment of the data was important. Also even the census data have been adjusted before application of the techniques.

For assessing the 2001 and 2011 censuses coverage we took care to adjust the population of the 2001 and 2011 by considering the effect of the international migration before applying the technique, while the age misreporting was not a problem in these two censuses. The distribution of the net migration by age group and sex was used to adjust the respective census population in order to satisfy the assumption of the stability (closed population).
The results for the Albanian data are shown in Table 1:

Table 1. Census coverage assessment

		CENSUSES		
			Male	**Female**
1955-1960		best estimate	0.9923	0.9951
		range	0.9920-1.0047	0.9944-1.0046
1960-1969		best estimate	0.9943	1.0153
		range	0.9914-1.006	1.0107-1.0153
1969-1979		best estimate	0.9946	0.9918
		range	0.9934-0.9998	0.9829-0.9939
1979-1989		best estimate	0.9938	1.003
		range	0.9938-0.9978	1.0030-1.0156
1989-2001		best estimate	0.9189	0.9947
		range	0.9189-2.7797	0.9928-1.0362
2001-2011		best estimate	0.9773	0.9852
		range	0.9189-0.9946	0.2320-0.3126

Note: The Best Estimate is the value with the least mean square error.

Looking at the results given in table 1 and 1.1, it can be said that the relative coverage of the censuses has been relatively complete for the whole period, except the completeness of 2001 relative to 1989 among males, which is relatively low compared to other estimates.
However, it is clear that there is no trend in the completeness of one census compared to the previous one. In general for male population there is under-enumeration coverage of one census to the previous for the whole period. While for female population it varies.

The results show that the quality of the census coverage is good to allow the application of the indirect methods for the completeness of death registration. The male under coverage in the 2001 census is high compared to other censuses, for this reason the application of the indirect methods for death registration completeness has to be carefully interpreted.

Table 1.1 The relative enumeration completeness in percentage

		CENSUSES		
			Male	**Female**
1955-1960		best estimate	-0.77%	-0.49%
1960-1969		best estimate	-0.57%	1.53%
1969-1979		best estimate	-0.54%	-0.82%
1979-1989		best estimate	-0.62%	0.3%
1989-2001		best estimate	-8.11%	-0.53%
2001-2011		best estimate	-2.3%	-1.5%

Death data completeness

The goal of this analysis is to check the quality of mortality data. The previous section concluded that the quality of census enumeration was good enough to apply different indirect methods to check the completeness of death registration, since there are evidences that the indirect methods for death completeness assessment are extremely sensitive to census enumeration errors, especially in the higher age groups (Wunsch, 1984).

In 1992, Van der Pol, checked the accuracy of death data during 1955-1989 period, where a number of different factors were considered. As previously mentioned, Albania was completely isolated from the outside world for the period until 89'. This implies that the general assumption on a closed population to migration, can very well be applied to the Albanian case. Apart from that, it was also shown that the census enumeration in Albania was relatively complete and good enough to apply different methods which check the quality of death registration.

We complemented this analysis with the assessment of the death data completeness during the period of the last two censuses. The technique that was followed for these censuses was Bennett-Horiuchi and Hill, which is flexible to stability assumption. For the last two censuses the Bennett-Horiuchi method is applied twice; the first time using the age structure till the age of 60 and the second time till the age of 80, this was done because it has been noticed that there are quite differences between these two estimates (Van der Pol, 1992). The intercensal deaths 1989-2011 by age group and sex were available, as well as the stock of the net migration by sex and age group for the period under study were applied to adjust the 2001 and 2011 census population. The results from the application of these methods are given in Table 2. The calculations of the Bennett-Horiuchi and Hill methods were obtained by using the MORTPAK package (United Nations, 1988), where respectively the BENHR and CENT programs were used.

The results show that the completeness of the registration of the male deaths is better than that of female deaths. It is important to stress out that the completeness rate is surprising and out of line during 1989-2001 among males, since it is very probable that males aged 70 years and over in 1989 census were severely under enumerated (section 3).

Looking at the last two censuses 2001 and 2011, applying the BENHR and CENCT technique show that the death completeness is as well higher compared to females. On average there is a surplus of about 7% of deaths among males. This can be explained through the higher census under-coverage in 2001 among males.

Table 2. Assessment of the deaths data completeness during the period of the last two censuses

Census		**Male**	**Female**
Methods			
1989-2001			
BENHR	60+	1.242	0.850
	80+	1.340	0.899
Average		1.291	0.875
2001-2011			
CENCT		0.997	0.900
BENHR	60+	1.059	0.933
	80+	1.153	0.945
Average		1.070	0.926

The death completeness rate has been increased over time. The death completeness rates for the period 1989-2001 and 2001-2011 have been derived taking the average of the best estimate from the CENCT procedure and the two values from the BENHR method.

Table 2.1 Completeness of deaths registration		
Censuses	**Male**	**Female**
1955-1960	0.850	0.750
1960-1969	0.950	0.830
1969-1979	1.138	0.994
1979-1989	0.990	0.965
1989-2001	1.291	0.875
2001-2011	1.070	0.926

The death completeness rates by sex and age groups derived by the BENHR methods, show that these rates are lower among females, which are more plausible than values exceeding unity among males. However, there is a low chance that reported deaths

could exceed true deaths, the reason for this upward bias of completeness rate among males, could be due to under-enumeration in the 2001 census.

It is obvious that the problem with the under completeness of death registration is among females, but it is higher among older age groups. Considering the period of the last two censuses the lower completeness rate shows up among older females.

In the period 2001-2011 the completeness of the death registration is higher among all age groups compared to the previous period, but still there is a relatively low completeness rate among females aged 75+. There are about 15 to 20 percent of the total deaths of the female population aged 75+ that are missing.

Table 3. Assessment of the deaths data completeness during the period 2001-2011, migration adjusted

	2001-2011	
	Male	**Female**
5	1.144	0.968
10	1.147	0.975
15	1.156	0.971
20	1.173	0.983
25	1.122	0.951
30	1.080	0.915
35	1.104	0.928
40	1.128	0.940
45	1.166	0.965
50	1.166	0.961
55	1.135	0.925
60	1.133	0.903
65	1.179	0.909
70	1.268	0.906
75	1.338	0.850
80	1.423	0.809
median completeness	1.152	0.934

Adjusted life expectancy and gender gap

Looking at the adjusted life expectancy for males calculated by BENHR, it is observed that the life expectancies lie between those of the official values of respective periods 2001-2022 and 2011-2019 respectively.

The BENHR technique estimates a higher life expectancy for males among all the age groups for the inter-censual period compared to 2001-2002.

This technique allows the adjustment of the age specific death rates, to come up then to the adjusted life expectancy, which resulted higher than that of 2001-2002.

Furthermore, the improvement in life expectancy among all age groups for the 2011-2019 period suggests progress in death registration quality and coverage, as well as the overall reliability of the 2011 census data. This improvement reflects positive

developments in data collection and reporting, which can be attributed to efforts to strengthen civil registration systems and enhance the accuracy and completeness of vital statistics.

The observation that the adjusted life expectancies lie between the official values for the respective periods, as well as the higher life expectancy estimates for all age groups compared to 2001-2002, suggests positive trends and improvements in mortality and death registration.

Table 4. Adjusted male life expectancy

	Official e_x	Bennet - Horiuchi e_x	Official e_x
	2001-2002	2001-2011	2011-2019
	Male		
5	69.6	71.1	72.3
10	65.9	66.2	67.4
15	61.0	61.3	62.5
20	56.2	56.5	57.6
25	51.5	51.8	52.8
30	46.8	47	48.0
35	42.2	42.2	43.2
40	37.5	37.5	38.5
45	32.8	32.8	33.9
50	28.2	28.3	29.4
55	23.7	23.8	25.0
60	19.3	19.4	20.8
65	14.9	15.3	16.8
70	11.0	11.6	13.1
75	7.4	8.4	9.7
80	5.0	5.7	6.9
85	3.0	3.4	4.9

From 2011 the vital events in Albania started to be electronically registered, which increased the quality of the vital data and statistics along with the death data. On the other side the last census in Albania that of 2011, was accompanied by a post enumeration survey, which assessed its quality.

Table 5. Adjusted female life expectancy

	Official e_x	Bennet - Horiuchi e_x	Official e_x
	2001-2002	2001-2011	2011-2019
	Female		
5	75.1	72.9	75.8
10	71.1	68.1	70.9
15	66.3	63.2	66.0
20	61.4	58.4	61.1
25	56.6	53.6	56.2
30	51.9	48.8	51.3
35	47.2	44.1	46.4
40	42.4	39.3	41.5
45	37.7	34.6	36.7
50	33.1	30.1	32.0
55	28.5	25.6	27.3
60	24.1	21.3	22.7
65	19.7	17.2	18.3
70	15.9	13.7	14.0
75	12.5	10.7	10.2
80	10.1	8.2	6.9
85	8.6	6.3	4.3

On the contrary, the female adjusted life expectancies for the inter-censal period 2001-2011 by age groups show lower values compared to 2001-2002, due to the under completeness of death registration during this period. The BENHR and CENT techniques followed to assess the death completeness in the period of the last two censuses show an under completeness of female deaths. This technique allows the adjustment of the age specific death rates, to come up then to the adjusted life expectancy, which resulted lower than that of 2001-2002.

For the upcoming 9-years period 2011-2019, the life expectancy shows an improvement among all females aged up to 70 years old, whereas for females aged over 75 years old the life expectancies have decreased compare to 2001-2011 period. This deterioration in life expectancy among females aged 75+, probably resulted from the impact of migration, since it is well known and explained earlier that Albania population still experience high rate of net migration. This decrease in the life expectancy could be due to death registration of the elderly females returned in Albania after 2011.

The in depth analysis on migration between the last two censuses 2001-2011, shown a higher proportion of females that emigrated during this decade, differently from migration patterns of 90' that were mostly males migrated for economic reasons, during 2001-2011 the number of females increased as a result of family reunification.

Table 6. Gender gap in adjusted life expectancy

	Gender gap in ex		
	Official	**Bennet - Horiuchi**	**Official**
	2001-2002	2001-2011	2011-2019
5	5.5	1.8	3.5
10	5.3	1.9	3.5
15	5.2	1.9	3.5
20	5.2	1.9	3.4
25	5.2	1.8	3.4
30	5.1	1.8	3.3
35	5.0	1.9	3.1
40	4.9	1.8	3.0
45	4.9	1.8	2.8
50	4.9	1.8	2.6
55	4.8	1.8	2.4
60	4.8	1.9	2.0
65	4.8	1.9	1.5
70	4.9	2.1	1.0
75	5.1	2.3	0.5
80	5.1	2.5	0.0
85	5.6	2.9	-0.6

The adjusted life expectancy by Bennet – Horiuchi shows small gender gap life expectancy among all ages compared to the official ones. The gender gap of the adjusted life expectancy varies from 1.8 to 1.9 years among age groups 5 to 69 years old, while for older (70+) age groups the life expectancy gender gap widens. This indirect method based on last two census data, shown a higher life expectancy among males, while a lower one among female, narrowing so the gender gap in life expectancy.

So it is important to consider the completeness rate of death data for this important indicator when analysing the gender differences. Biologically, females are expected to live longer but due to improvements in lifestyle, health system this gap it is expected to narrow.

Conclusions

This paper focuses on estimating the completeness of death data in Albania, particularly with respect to age and sex characteristics. It highlights the under-coverage of total deaths at the national level and indicates some improvement in death registration over the years. However, it also reveals that there is still under-

coverage of female deaths, particularly among older age groups. This finding underscores the importance of addressing gender disparities in death registration. Furthermore, the calculation of adjusted life expectancy using the indirect methods, demonstrate an improvement in the gender gap. By considering the age and sex dimensions and accounting for under-coverage, more accurate calculations of life expectancy, mortality rates, and population forecasts can be derived. These findings have implications for refining public health strategies and policies, as well as ensuring better health outcomes for all population groups.

The impact of the death completeness rate on the gender gap in life expectancy can be significant. If the death completeness rate is lower for a particular gender, it can distort the calculation of life expectancy. If deaths among women are more likely to be underreported or not accurately recorded compared to men, it can lead to an artificially higher life expectancy for women, thus widening the gender gap.

The over completeness of deaths among males indicates that a higher proportion of male deaths were accurately recorded and reported compared to the actual number of deaths that occurred, or a under coverage in the previous census. On the other hand, the under completeness of female deaths suggests that a lower proportion of female deaths were captured in the official data, resulting in an underestimation of female mortality.

These findings underline the importance of addressing gender biases and disparities in death registration processes. It's crucial to ensure that deaths of both males and females are accurately recorded and reported to obtain reliable and representative mortality data.

To improve the completeness of death registration, efforts can be made to enhance the coverage and accessibility of vital registration systems, provide training and support to healthcare professionals responsible for reporting deaths, and raise awareness among the public about the importance of timely and accurate death registration.

By addressing the over completeness of male deaths and the under completeness of female deaths, more accurate estimates of life expectancy can be derived, leading to a better understanding of gender-specific mortality patterns and more informed decision-making in public health and policy interventions.

Overall, the research presented in the paper contributes to the understanding of the completeness of death registration in Albania, specifically in relation to gender disparities and age-specific patterns. By addressing these issues and improving the accuracy and coverage of death registration data, policymakers and researchers can make more informed decisions and develop targeted interventions to promote population health and well-being.

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