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As cases of cancer with a high survival may be more easily identified by the registries, those with high case fatality rates are more likely to remain undiagnosed or untreated (Regal and Hook, 1991), providing a good model to address the ability of cancer registries to achieve high levels of completeness. The survival of gastric cancer patients is low (Crew and Neugut, 2006), and the northern region of Portugal [North Region Cancer Registry (RORENO), 2010] presents the highest gastric cancer incidence and mortality rates in Western Europe (Lunet *et al.*, 2004). Therefore, we estimated the completeness of gastric cancer registration in the north of Portugal (specifically in the district of Porto), during the time period 2001–2006. We compared the estimates obtained from three different quantitative methods – ‘capture–recapture’ (Robles *et al.*, 1988), ‘death certificate (DC) and mortality/incidence’ (Ajiki *et al.*, 1998; Parkin *et al.*, 1994; Parkin and Bray, 2009) and the ‘flow method’ (Bullard *et al.*, 2000; Montanaro *et al.*, 2006). As DCs are not routinely available to cancer registries in Portugal, and no information on all the potential causes mentioned in the DC as immediate or contributory causes or significant conditions contributing to death could be obtained, we further addressed the implications of using suboptimal DC information (underlying cause of death instead of a mention of cancer in any field of the DC).

of Porto between 2001 and 2006. The vital status at the end of 2006 was assessed by linkage with the National Health System Database, which includes up to date information on the citizens' vital status, but no information on the cause of death. A list of the underlying cause of death of all the individuals dying between 2001 and 2006, and living in Porto at the time of their death, was obtained from the Northern Health Sub-Region (ARS-Norte) for manual inspection.

Completeness of registration was obtained by estimating the number of gastric cancer cases that were not registered by RORENO, including those that were alive by the end of 2006 as well as those who were dead before the end of 2006 but with gastric cancer not mentioned as the underlying cause of death. We considered two alternative scenarios in data analysis: first, assuming that the information on the underlying cause of death allowed the identification of all DC with a mention of gastric cancer, which is expected to yield a lower bound estimate of the completeness; second, assuming that all gastric cancer patients registered before death and known to have died had a mention of gastric cancer in the DC, which is expected to yield an upper bound estimate of the completeness.

The overall estimates for completeness of gastric cancer registration ranged between 82.9 and 96.4% under the worst and best case scenarios, respectively (Table 1). The three quantitative methods yielded similar conclusions, with the most precise estimates being obtained with the capture–recapture method. The flow method showed that no meaningful improvements in completeness can be expected in this setting after a period of 3 years since diagnosis.

The present work is the first application of quantitative methods in the assessment of completeness of cancer registration in Portugal, and provides valuable information to support improvement of the procedures towards a more effective case ascertainment. We were able to show the applicability of these methods in a setting with suboptimal DC information and the impact of the lack of direct access to complete information from DC by the cancer registry. However, we could only provide lower and upper bound estimates of completeness, and this can hardly be considered as an option to monitor this quality indicator. Furthermore, the collection of the necessary information was too labour intensive; therefore, the routine use of the quantitative methods is not an option until a timely and efficient use of DC information for the purpose of cancer registration is possible.

Table 1 Completeness estimates^a, assuming that the information on the underlying cause of death identifies all death certificates with a mention of gastric cancer (first scenario) and that all gastric cancer patients registered before death and known to have died have a mention of gastric cancer in the death certificate (second scenario)

Method	Men		Women	
	Completeness (%)	95% CI ^b	Completeness (%)	95% CI ^b
First scenario				
Capture–recapture				
Model M ₁ ^c	81.5	(78.3; 84.2)	84.5	(82.0; 87.4)
DC and M/I ratio				
Ajiki <i>et al.</i> (1998)	81.4	–	84.7	–
Parkin <i>et al.</i> (1994)	85.4	–	88.0	–
Flow method				
1 year	71.5	(57.7; 83.5)	83.6	(58.2; 98.1)
2 years	76.4	(63.0; 87.5)	85.1	(63.2; 97.9)
3 years	77.2	(64.5; 87.7)	85.8	(67.8; 97.1)
4 years	77.8	(65.7; 87.9)	89.5	(71.7; 98.9)
5 years	78.0	(66.1; 87.9)	89.6	(73.2; 98.6)
Second scenario				
Capture–recapture				
Model M ₁ ^c	96.7	(95.8; 97.6)	94.4	(92.9; 96.7)
DC and M/I ratio				
Ajiki <i>et al.</i> (1998)	96.7	–	94.3	–
Parkin <i>et al.</i> (1994)	97.1	–	95.2	–
Flow method				
1 year	82.3	(69.9; 91.9)	88.7	(67.2; 99.2)
2 years	88.8	(78.9; 95.8)	91.2	(74.1; 99.4)
3 years	90.3	(81.3; 96.5)	92.7	(77.5; 99.6)
4 years	91.6	(83.4; 97.1)	96.6	(81.2; 100.0)
5 years	92.1	(84.5; 97.3)	96.9	(82.6; 100.0)

CI, confidence interval; DC, death certificate; M/I, mortality/incidence.

^aDeath certificates (DC) stating gastric cancer as the underlying cause of death were identified for 1885 individuals, from which 348 were Death Certificate Only cases. Among the cases registered by North Region Cancer Registry (RORENO) before the inclusion of information from DC, 2024 were reported dead before the end of 2006 in the National Health System Database, from which 1182 had a DC with gastric cancer as the underlying cause of death.

^b95% confidence interval.

^cUnder the assumption that RORENO and DC sources are not independent, by using a log-linear model with a temporal effect to overcome the dependency between sources.

Despite these limitations, our results quantify the potential for improvement in cancer registration completeness in this setting, and define the minimum lag to be respected between diagnosis and the publication of valid incidence estimates.

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Conflicts of interest

There are no conflicts of interest.

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