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Pancreatic cancer mortality and associated productivity losses in Spain: A population-based estimate (2013–2022)

Josep Darbà [a,*], Meritxell Ascanio [b], Antonio Rodríguez [b]

[a] Department of Economics, Universitat de Barcelona, Diagonal 696, Barcelona 08034, Spain
[b] BCN Health Economics & Outcomes Research S.L, Travessera de Gràcia, 62, Barcelona 08006, Spain

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ABSTRACT

Background: Pancreatic cancer remains as the cancer type with the poorest prognosis, characterized by rising incidence and mortality rates. This disease imposes a substantial economic burden, including productivity losses resulting from premature mortality.
Objective: This study aims to estimate productivity losses due to premature deaths from pancreatic cancer in Spain during the period 2013–2022.
Methods: Productivity costs were quantified using a simulation model based on the human capital method. Data on mortality rates, average salaries, and employment rates were obtained from the Spanish Instituto Nacional de Estadística for the entire study period.
Results: Between 2013 and 2022, the number of deaths due to pancreatic cancer in Spain increased from 6039 to 7973 and, by 2022, pancreatic cancer became the leading cause of death among digestive system tumours. This rise was accompanied by an increase in Years of Potential Labour Productive Life Lost due to premature death (YPLPLL): for men, YPLPLL grew from 8146 in 2013 to 9650 in 2022, and for women, from 4699 to 6053 over the same period. Consequently, labour productivity losses were estimated at €253.40 million in 2013, rising to €406.20 million in 2022, with a cumulative cost of €3253.97 million during the study period.
Conclusions: These findings provide valuable insights into the societal costs of pancreatic cancer in Spain. Investments in targeted strategies focusing on prevention, early detection, and advanced-stage therapies for pancreatic cancer have the potential to significantly reduce its future economic and health impacts.

Research in Context

(1) What is already known about the topic?

Pancreatic cancer is one of the deadliest malignancies, with rising incidence and mortality rates. Previous European studies have estimated the indirect costs associated with this disease, but there has been limited, up-to-date evidence on its impact on labour productivity loss specifically in Spain.

(2) What does this study add to the literature?

This study provides the first comprehensive, population-based estimation of productivity losses due to premature mortality from pancreatic cancer in Spain over a 10-year period (2013–2022). It quantifies the Years of Potential Labour Productive Life Lost (YPLPLL) and the associated monetary costs, highlighting increasing economic losses in both men and women. The total productivity loss exceeded €3.25 billion during the study period.

(3) What are the policy implications?

Findings underscore the urgent need for public health policies that prioritize prevention, early diagnosis, and improved treatment strategies for pancreatic cancer. Addressing this growing economic burden could support more effective resource allocation and reduce the societal cost of this highly lethal disease.

1. Background

Cancer remains a leading cause of death globally. In 2022, nearly 20 million new cancer cases and 9.7 million cancer-related deaths were reported worldwide. By 2040, these figures are projected to rise to 29.9

* Corresponding author.
E-mail address: darba@ub.edu (J. Darbà).

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million new cases and 15.3 million cancer-related deaths annually [1]. The highest cancer rates are observed in high-income countries, where longer life expectancy, higher education levels, and improved living standards contribute to increased disease detection and survival rates [1]. According to data from the Instituto Nacional de Estadística (INE), in Spain in 2023, cancer was responsible for 30.9 % of deaths among men and 21.9 % among women [2].

Several common cancers originate in the digestive tract. In 2018, gastrointestinal cancers accounted for 26.3 % of all cancer cases and 35.4 % of cancer-related deaths worldwide, including oesophageal, gastric, liver, colon, rectal, and pancreatic cancers [3].

Despite advances in cancer treatment, pancreatic cancer remains the tumour with the poorest prognosis, with a five-year survival rate ranging from 2 % to 9 % [4]. Alarmingly, both its incidence and mortality rates are rising globally. Between 1990 and 2017, the number of cases and deaths due to pancreatic cancer more than doubled, increasing by a factor of 2.3 during this period [5].

Smoking is recognized as the primary risk factor for pancreatic cancer [6]. Declining smoking rates among younger populations in Europe have contributed to reduced incidence rates in individuals under 50, particularly men [7]. However, projections indicate that pancreatic cancer will become the second leading cause of cancer-related deaths by 2030 [4,8]. Therefore, targeted tobacco control measures such as raising taxes or restriction in public spaces are essential to slow down the burden of disease [9]. Other significant modifiable risk factors, such as obesity, diabetes, and alcohol consumption, also contribute to the disease burden [10].

Beyond its clinical impact, cancer imposes a substantial economic burden. A major component of this burden is the loss of economic productivity due to premature mortality, which reflects the value of lost earnings and contributions to society when individuals die before reaching retirement age [11]. In 2018, the total cost of cancer in Europe (including EU-27, Iceland, Norway, Switzerland, and the United Kingdom) was estimated at €199 billion (€378 per capita), including €12.2 billion (€261 per capita) in Spain. Productivity losses due to premature mortality accounted for €50 billion across Europe (€94 per capita), with €3.44 billion (€74 per capita) attributed to Spain—approximately a quarter of the total economic costs associated to cancer [11]. Given the high mortality rate of pancreatic cancer, it is one of the cancers with the greatest productivity losses. Labour productivity costs related to pancreatic cancer in Europe are projected to reach €74.5 billion between 2018 and 2040 [12].

Quantifying these losses is essential for understanding the full economic impact of pancreatic cancer and informing health policy and resource allocation. The human capital (HC) approach is the most widely used method for estimating productivity losses, calculating the reduction in economic output due to premature death by projecting lost earnings until the expected retirement age [13,14].

This study aimed to assess the economic burden of premature deaths due to pancreatic cancer in Spain by estimating productivity losses. The findings highlight the urgency of effective interventions to mitigate both the health and financial consequences of this disease.

2. Methods

2.1. Model and methodology

The productivity costs associated with premature pancreatic cancer mortality were calculated using the HC approach [14–16]. According to this perspective, an individual's labour productivity is reflected in their earnings. The theory suggests that the interruption of a person's work due to death or disability causes a loss to the society in the form of unrealized future productivity. Drawing on HC theory, our group developed a simulation model to estimate the current and potential labour productivity losses resulting from premature deaths caused by pancreatic cancer, excluding unpaid work and leisure time from consideration. The estimation incorporated factors such as the age of death, gender- and age-specific employment rates and wages.

To calculate the Years of Potential Life Lost (YPLL), we multiplied the number of premature deaths in each age group by the average remaining life expectancy for that group. This yielded the total YPLL for "n" individuals, using the formula below, where "L" denotes the average remaining life expectancy for a specific age and gender group:

$$YPLL = \sum_{i=1}^{n} L_i$$

After obtaining the values for the YPLL, we estimated the Years of Potential Labour Productive Life Lost (YPLPLL), focusing on deaths that occurred before the age of 65, which is the legal retirement age. To determine the YPLPLL, the number of deaths in each age group was multiplied by the expected remaining productive years of life for that group until retirement age. The formula presented below calculates the YPLPLL, with "W_u" representing the upper limit of working age, and "W_l" indicating the age at death:

$$YPLPLL = \sum_{i=1}^{n} Wu_i - Wl_i$$

Subsequently, to estimate the labour productivity losses (LPL), the YPLPLL was multiplied by age- and gender-specific wages, adjusted for employment rates from each age group. In the formula for LPL, "S" represents the wage adjusted by age and gender, and "e" denotes the employment rate adjusted for age and gender:

$$LPL = \sum_{i=1}^{n} YPLPLL_i * S_i * e_i$$

2.2. Datasets

Data was collected from the Death Registry of the INE, which provides detailed information on causes of mortality in Spain. This registry includes essential data such as the cause of death, as well as the age and gender of the deceased, serving as a reliable foundation for our study. Our team used this data to determine the number of deaths attributed to pancreatic cancer for each age and gender group [2].

Employment rates were sourced from the Labour Force Survey conducted by INE, while data on remuneration —including monetary benefits— was obtained from the Spanish Structural Wage Survey [17]. The study was based in annual data, and covered a ten-year period, from 2013 to 2022, to ensure the analysis was based on the most recent and comprehensive information available.

2.3. Output

To estimate the indirect costs of productivity loss due to premature mortality, annual salaries adjusted for age and sex were calculated from the age of death up to the retirement age [17]. A 3 % annual discount rate was applied to account for the present value of future income. Sensitivity analyses were conducted to assess the robustness of the estimates: one analysis applied a 0 % discount rate and assumed a 5 % increase in productivity, while another used a 6 % discount rate with a 5 % decrease in productivity (Table 2). Productivity losses were also disaggregated by gender (Supplementary Table 1), and a scenario analysis considered an extended retirement age of 67 years (Supplementary Table 2).

Economic evaluations of productivity losses can inform decision-makers in the allocation of healthcare resources. The HC methodology is the most used approach for assessing indirect costs from productivity losses caused by illness or premature death. This method estimates individuals' potential productivity up to retirement age [14]. Alternatively, the Friction Cost (FC) method, which focuses on the time required to replace a worker, could also have been employed. However, the FC

method depends on reliable data on replacement times [18]. Additionally, other approaches assess different variables, as the willingness-to-pay method, which estimates the monetary value of intangible costs, including suffering and discomfort [19].

3. Results

In this retrospective study analysing the economic impact of premature deaths due to pancreatic cancer in Spain from 2013 to 2022, we estimated the productivity losses associated with these fatalities. Over the study period, there was a significant increase in the number of deaths, rising from 6039 in 2013 to 7973 in 2022—an approximate 32 % increase (Table 1). When results were disaggregated by Spanish regions, the highest number of deaths attributed to pancreatic cancer occurred in Catalonia (1245 deaths per year), followed by Andalusia (1216), the Madrid Community (1049), the Valencian Community (864), and Galicia (527) (Supplementary Table 3). While the overall proportion of pancreatic cancer-related deaths was similar between men and women, differences were evident in premature deaths. Specifically, in 2022, 28.83 % of men and 18.05 % of women died at working age (Table 1, Fig. 1).

This gender disparity was reflected in the YPLPLL, with men accounting for 8146 YPLPLL in 2013 and 9650 in 2022, compared to 4699 YPLPLL in 2013 and 6053 in 2022 for women (Table 1). Age-specific YPLPLL graphs revealed that the highest values for men were observed in the 55–59 age group, while women exhibited peaks in the 50–54 and 55–59 age groups (Fig. 2).

Pancreatic cancer was the second leading cause of death among digestive system cancers in 2022 in Spain, representing 20 % of such deaths (Supplementary Fig. 1). Among working-age individuals, the proportion was comparable at 21 %, but pancreatic cancer emerged as the leading cause of death from digestive tumours in this demographic, highlighting the substantial impact of this disease on the working-age population (Supplementary Fig. 2). By region, Andalusia accounted for the greatest number of YPLPLL (2957.5 per year), followed by Catalonia (2384.5), the Madrid Community (2087.5), the Valencian Community (1766), and the Basque Country (886.5) (Supplementary Table 3).

The economic burden from pancreatic cancer-related mortality was significant. The estimated LPL due to premature death was €253.40 million (plausible range, based on variation coefficients: €252.34–254.46 million) in 2013, rising to €406.20 million (range = €404.49–407.90 million) in 2022. Sensitivity analysis adjusting annual discount rates and productivity values showed a range of estimates from €233.92 million (range = €232.93–234.90 million) to €274.05 million (range = €272.90–275.20 million) in 2013, and from €374.97 million (range = €373.39–376.54 million) to €439.30 million (range = €437.46–441.15 million) in 2022. The total productivity losses attributable to pancreatic cancer over the study period were estimated at €3.254 billion (range = €3.240–3.268 billion), ranging from €3.004 billion (range = €2.991–3.016 billion) to €3.519 billion (range = €3.504–3.534 billion) (Table 2). Differences by sex were substantial: productivity losses among men totalled €2.247 billion (69.1 % of total costs, range = €2.232–2.261 billion), compared with €1.007 billion among women (30.9 %, range = €1.001–1.013 billion) (Supplementary Table 1). Regarding regional productivity losses, Catalonia recorded the highest total, at €55.69 million per year (range = €55.16–56.23 million), followed by Andalusia (€48.36 million, range = €47.79–48.93 million), the Madrid Community (€47.03 million, range = €46.41–47.65 million), the Valencian Community (€34.59 million, range = €34.18–35.00 million), and the Basque Country (€19.93 million, range = €19.70–20.15 million) (Supplementary Table 3). In the scenario analysis assuming a retirement age of 67 years, total productivity losses increased to €4.008 billion (range = €3.992–4.025 billion), representing a 23 % rise compared with the base-case estimate (Supplementary Table 2).

4. Discussion

During the 10-year period from 2013 to 2022, 69,885 deaths from pancreatic cancer were recorded in Spain, including 16,598 premature deaths among working-age individuals. The average yearly YPLPLL was estimated at 14,419, while LPL reached €325.40 million, showing an upward trend.

Previous studies have evaluated the direct and indirect costs of digestive system cancers in Europe [20]. However, this research specifically focuses on the evolution of productivity losses attributed to pancreatic cancer mortality in Spain, providing an estimation of the current trend for this burden. Given that pancreatic cancer remains one of the cancers with the poorest prognoses [21,22], its societal impact through productivity losses is significant.

Recent research has examined productivity losses associated with various cancer types in Spain, including three digestive system cancers: colorectal [23], gastric [24], and liver cancer [25]. The annual mean productivity losses reported for these cancers were €520.6 million, €1274.3 million, and €1431.8 million, respectively. In comparison, annual productivity losses attributable to pancreatic cancer (€325.4 million), corresponded to 62.5 % of the losses from colorectal cancer, 25.5 % of those from gastric cancer, and 22.7 % of those from liver cancer. These findings highlight that, although the economic burden of pancreatic cancer is comparatively smaller at present, its rising incidence and persistently poor prognosis may lead to a progressive increase in productivity-related costs in the coming years.

This study also observed an increasing trend in mortality attributed to pancreatic cancer during the analysed period, consistent with findings from other studies. Notably, pancreatic cancer remains the only major cancer site showing no substantial decline in mortality over recent decades for both sexes in the European Union [7].

This raises an important question: which factors contribute to the persistent rise in pancreatic cancer mortality and, consequently, to the associated productivity losses? A Spanish study analysing mortality trends from 1952 to 2012 reported an annual 4 % increase until the

Table 1
Measures of deaths and years of potential labour productive life lost (YPLPLL).

Year	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022
Number of deaths										
males	3169	3199	3311	3434	3590	3745	3700	3824	3921	4006
females	2870	3088	3095	3355	3278	3375	3613	3603	3742	3967
% deaths at working age										
males	28.31	28.95	28.33	29.91	29.30	29.03	29.16	28.48	28.44	28.83
females	19.09	19.33	17.25	18.09	18.52	18.61	18.38	18.54	17.74	18.05
% deaths pancreatic cancer vs all tumours										
males	4.68	4.75	4.89	5.00	5.24	5.49	5.45	5.69	5.78	5.90
females	6.63	7.18	7.09	7.57	7.32	7.59	8.01	7.92	8.17	8.46
YPLPLL										
males	8146	8378	8569	9306	9346	9331	9152	9222	9200	9650
females	4699	5416	5022	5526	5511	5139	5492	5419	5617	6053

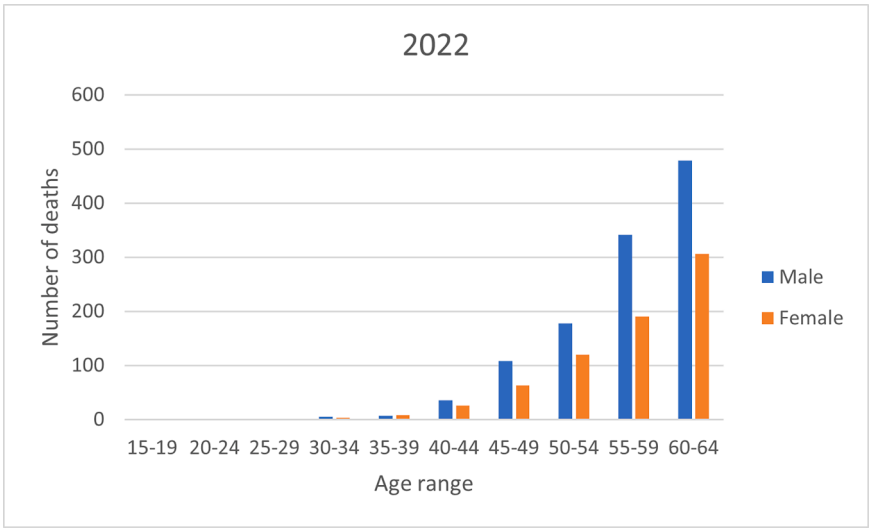

Fig. 1. Number of deaths per age group in 2022.

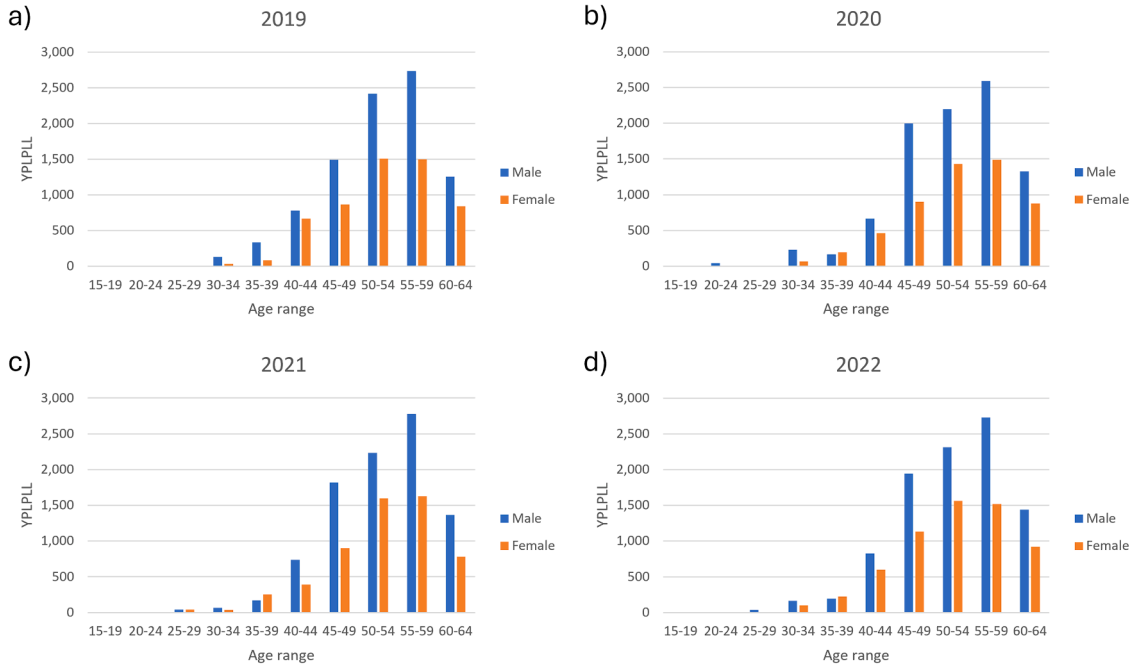

Fig. 2. Years of potential labour productive life lost (YPLPLL) per each age groups (a) Year 2019 (b) Year 2020 (c) Year 2021 (d) Year 2022.

Table 2
Productivity losses due to pancreatic cancer (in millions €) (sensitivity models).

Year	Premature mortality costs (baseline)	Premature mortality costs (0 % discount rate, +5 % productivity)	Premature mortality costs (6 % discount rate, −5 % productivity)
2013	253.40	274.05	233.92
2014	275.02	297.43	253.87
2015	281.39	304.33	259.76
2016	313.99	339.58	289.85
2017	326.35	352.95	301.26
2018	333.68	360.88	308.03
2019	347.13	375.42	320.44
2020	351.80	380.47	324.75
2021	365.00	394.75	336.94
2022	406.20	439.30	374.97
Total	3253.97	3519.17	3003.78

1980s, after which the rate of increase moderated, paralleling changes in major risk factors, particularly tobacco consumption, among both men and women [26]. A subsequent study confirmed this pattern, noting that although smoking rates have declined since the 1980s, other risk factors—such as obesity and diabetes—have become more prevalent. Additionally, the main risk factors for pancreatic cancer were more common among socially disadvantaged groups [27].

Age is another well-established risk factor; thus, Spain's ageing population contributes to the rising incidence and mortality of this disease. Furthermore, the asymptomatic course of pancreatic cancer makes early diagnosis challenging, and the most effective detection methods, such as MRI and EUS, remain costly and sometimes invasive. Therefore, screening is recommended only for high-risk populations, although the definition of high risk varies across expert organisations and no population-wide screening is currently recommended [28]. Overall, compared with other cancer types, pancreatic cancer is often

diagnosed at an advanced stage, limiting therapeutic options and reducing survival prospects. Consequently, strengthening prevention strategies targeting modifiable risk factors remains essential to mitigate future disease burden and associated productivity losses.

The rise in deaths, especially among the working-age population, significantly affects productivity. Previous studies have estimated indirect costs in other countries, such as Sweden, where indirect costs reached €99 million in 2018, comprising 79 % of total disease costs, and are projected to increase to €190 million (84 % of total costs) by 2030 [8]. Another study evaluated morbidity- and mortality-related indirect costs across 31 European countries in 2018, estimating €18.9 million and €206.8 million, respectively, for Spain [20]. These findings underline that most productivity losses are driven by mortality. The most recent study estimated the indirect costs of productivity losses caused due to pancreatic cancer across Europe in 2020, employing both the HC and FC approaches. These were estimated at €3184 million and €109 million, respectively [29].

Despite these estimates, there has been limited data regarding the current evolution of indirect costs, particularly for Spain. This study provides updated insights into the trends of this key cost driver for pancreatic cancer, addressing a critical gap in recent data. As a retrospective study, this research analysed pre-existing data from past events. The HC method was considered appropriate, as it aligns with the structure and data availability of the Spanish labour market. The INE database includes robust and disaggregated information on employment rates and average wages by age and sex. These data allow for the estimation of the mean productivity value of individuals in the formal labour market according to demographic characteristics.

However, the methodology employed introduces several limitations that may have influenced the results. The INE database does not provide data on unpaid activities such as caregiving, household work, volunteering, or leisure, which can be substantial in some demographic sectors, especially women or older adults. There is ongoing debate regarding the inclusion of unpaid work in health economic evaluations, as it is often excluded even in diseases where its contribution to productivity losses may be substantial, such as rheumatoid arthritis [30]. Although several national guidelines recommend incorporating unpaid work, there is still no consensus on the most appropriate method for its valuation. Conversely, some guidelines suggest excluding these costs from base-case analyses due to the complexity of their estimation [31]. Though, two main approaches have been proposed to address this gap: the opportunity cost approach, which values unpaid work based on forgone wages, and the replacement cost approach, which values it according to the cost of purchasing equivalent services. To comprehensively assess total individual productivity, both the value and time invested in unpaid activities should therefore be considered [14].

In addition, the database does not include data required to quantify productivity losses related to morbidity, such as information on absenteeism or reduced productivity due to illness. Consequently, productivity losses arising from morbidity are not captured in this analysis [32]. According to Hofmarcher et al., morbidity-related productivity losses in Spain were approximately a 25 % of mortality-related costs [11]. Based on these findings, and comparing them with our results, morbidity costs associated with absenteeism between 2013 and 2022 could be estimated at around €813 million, although the Hofmarcher study did not provide site-specific data for pancreatic cancer.

The HC approach assumes that wages serve as a direct proxy for worker productivity. This assumption may not hold true in sectors characterised by high wage disparities, informal or part-time employment, and where labour market dynamics such as compensation mechanisms are relevant [14]. Moreover, the HC method assumes that lost productivity cannot be compensated, which generally leads to an overestimation of total productivity losses [33]. In contrast, the FC method adopts the employer's perspective and only accounts for productivity losses during the period required to replace the absent worker, after which production is assumed to return to its previous level [34]. Consequently, these two approaches produce markedly different results. The INE database lacks information on worker replacement times, preventing estimation of productivity costs using the FC method [18]. Though, Hanly et al. estimated that the HC/FC ratio for premature mortality costs in Europe was 29.3 for pancreatic cancer [29]. Applying this ratio to our study would yield an estimated total productivity loss in Spain of approximately €111 million for the period 2013–2022.

Finally, the database lacks information on deaths stratified by socioeconomic level, preventing the assessment of disparities in outcomes across different social contexts. This limitation is particularly relevant, as previously noted, since several risk factors for pancreatic cancer are more prevalent in socially disadvantaged groups [27]. Consequently, it is not possible to evaluate how socioeconomic inequalities may influence mortality patterns or to quantify their specific contribution to productivity losses.

To aid the interpretation of results, several additional analyses were performed. A sensitivity analysis was conducted to assess the effect of varying the discount rate (0–6 %) and productivity levels (−5 % to +5 %) on the estimated costs. While the overall cost patterns remained consistent across scenarios, the difference between the lowest and highest estimates reached approximately €500 million, underscoring the influence of these parameters on the results.

Productivity losses were also examined by gender. The estimated losses for men were approximately twice those for women. This difference can be partly explained by the higher number of deaths and earlier mortality among men; in fact, the proportion of deaths occurring during working age was notably higher in men (28.9 %) than in women (18.4 %), leading to higher YPLPLL and productivity losses. However, this factor alone does not fully account for the disparity. Labour market data show that women generally have lower employment rates and salaries, resulting in lower estimated productivity losses. Moreover, the model does not capture non-market productivity, such as caregiving and household work—activities that, in the Spanish context, are more frequently undertaken by women. Although these contributions are not monetised, they play an essential social and economic role. Consequently, while higher productivity losses were expected among men, total losses for women are likely underestimated due to the exclusion of informal and unpaid work.

Finally, a scenario analysis assuming a retirement age of 67 years was undertaken. The base-case analysis used a retirement age of 65 years, consistent with the current minimum legal threshold in Spain [35]. However, according to Spanish legislation, from 2027 onwards retirement at 65 will only apply to individuals with at least 38 years and 6 months of contributions; otherwise, the statutory retirement age will increase to 67 years. Under this alternative scenario, total productivity losses rose from €3253.97 million to €4008.49 million, representing an 18.8 % increase. This result is expected, as most pancreatic cancer–related deaths occur during the final years of working life, and extending the working horizon adds substantially to the potential loss of productivity. Nonetheless, actual retirement behaviour varies by sector, employment type, and personal circumstances, including early retirement and part-time work among older adults. While this scenario illustrates the potential effect of policy changes on economic outcomes, future analyses incorporating these variations would better capture real-world labour patterns.

In summary, indirect costs resulting from productivity losses are a critical factor in determining the financial burden of cancer. Health economic studies often adopt a healthcare perspective, focusing on direct healthcare costs while overlooking the contribution of productivity losses to the total burden [36,37]. This perspective may lead to an underestimation of overall disease costs. Nevertheless, productivity costs are challenging to estimate, and the most appropriate methodology remains a topic of debate [38,39].

Assigning an economic value to human life based on productivity raises important ethical concerns. Approaches such as the HC method implicitly link an individual's societal worth to their market income,

thereby undervaluing groups with lower wages, unpaid labour, or limited workforce participation, including women, older adults, and individuals in informal employment. This can perpetuate social and economic inequalities and overlook intrinsic human value beyond economic contribution. Such valuations risk framing health interventions primarily in terms of financial return rather than human well-being, dignity, or equity. Broader measures of societal benefit, including quality of life, social inclusion, and fairness in resource allocation should be considered in addition to monetary approaches to develop ethical health policies.

Pancreatic cancer remains one of the most formidable challenges in clinical practice. The biological characteristics of these tumours make early detection difficult, and by the time of diagnosis, the disease is often at an advanced stage [4,21]. Furthermore, current treatments are insufficiently effective, particularly for patients who have already developed metastases [40]. The evidence supporting pancreatic cancer's emergence as a leading cause of cancer-related mortality is overwhelming [5,22,40]. Consequently, the prevention of risk factors plays a crucial role in mitigating the incidence of this disease [41]. Additionally, advancing research into early detection methods and treatments for advanced-stage cancer is essential to improve prognoses in the future [21,40].

The findings of this study reveal that the economic burden of pancreatic cancer is steadily increasing over time, driven by rising mortality and associated productivity losses. To mitigate this growing impact, several public health actions are recommended.

1. Strengthen prevention strategies: Efforts should focus on reducing exposure to modifiable risk factors such as tobacco use, obesity, unhealthy diet, and physical inactivity. Recommended measures include stricter regulations on tobacco consumption by raising taxes or restricting use in public spaces, public education campaigns promoting healthy lifestyles, and policies that encourage balanced nutrition and regular physical activity. Legislative support for the implementation of such programs would further enhance their effectiveness. Importantly, these prevention measures are not specific to pancreatic cancer and should be implemented regardless, as they simultaneously reduce the burden of multiple chronic diseases and improve population health more broadly.
2. Improve early detection: Given the high cost and invasiveness of current diagnostic tools, screening programs should target high-risk groups to ensure cost-effectiveness. Based on the age-specific YPLPLL patterns observed in this study, regular screening is recommended for individuals aged 45–59 years, where premature mortality and productivity losses are greatest. Improved diagnostic accuracy at these ages could significantly enhance survival outcomes and reduce societal costs.
3. Support innovation and research: Because effective treatments remain limited, investment in research on targeted therapies, artificial intelligence, and deep-learning technologies is essential to improve both screening precision and treatment efficiency. Funding initiatives that prioritize innovation in pancreatic cancer detection and therapy would contribute to more sustainable and cost-effective disease management in the future.

Overall, this article provides valuable data for economists and policymakers to guide resource allocation effectively. By focusing efforts on targeted interventions, it is possible to improve population health outcomes and overall quality of life.

5. Conclusion

This study demonstrates that the rise in pancreatic cancer-related deaths over the last decade in Spain correlates with a significant increase in indirect costs due to productivity losses. While the incidence of most cancer types is decreasing, pancreatic cancer remains an exception. Projections suggest it will become one of the deadliest types of cancer in the coming years. These findings emphasize the escalating economic burden of pancreatic cancer and underscore the urgent need for targeted strategies focusing on prevention, early detection, and late-stage treatments to reduce its societal and financial impact.

Statements and declarations

Ethics approval and consent to participate

Ethics committee approval and patient consent were not required for this study.

Consent for publication

Not applicable.

Availability of data and material

The data that support the findings of this study are available from the Spanish national statistics institute at http://www.ine.es.

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CRediT authorship contribution statement

Josep Darbà: Writing – review & editing, Supervision, Methodology, Conceptualization. **Meritxell Ascanio:** Writing – review & editing, Validation, Supervision, Methodology, Formal analysis, Conceptualization. **Antonio Rodríguez:** Writing – original draft, Visualization, Validation, Formal analysis.

Competing interests

The authors declare that they have no competing interests.

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Not applicable.

Supplementary materials

Supplementary material associated with this article can be found, in the online version, at doi:10.1016/j.healthpol.2026.105564.

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