DANISH MEDICAL JOURNAL

Original Article

Validity of the Pancreatic Cancer Registry in Southern Denmark

Cara Manmeet Bhuller[1], Michael Bau Mortensen[1, 2], Henriette Engberg[3] & Claus Wilki Fristrup[1, 2]

1) Division of Hepato-Pancreatic-Biliary Surgery, Odense Pancreas Centre (OPAC), Department of Surgery, Odense University Hospital, 2) Danish Pancreatic Cancer Database and Danish Pancreatic Cancer Group, 3) The Danish Clinical Quality Program and Clinical Registries (RKKP), Denmark

Dan Med J 2025;72(3):A08240545. doi: 10.61409/A08240545

ABSTRACT

INTRODUCTION. The Danish Pancreatic Cancer Database (DPCD) uses data from the Danish National Patient Registry (DNPR) and includes patients with pancreatic carcinomas, duodenal and ampullary cancers. Due to the aggressive nature of pancreatic cancer, some patients never receive diagnostic work-up at a hepato-pancreatico-biliary centre. The aim of this study was to explore the validity of the registration of the pancreatic cancer diagnosis for patients living in the Region of Southern Denmark reported in the DNPR but not included in the DPCD.

METHODS. This study is a descriptive analysis of a historical cohort of patients registered with a diagnosis of pancreatic cancer (DC 25.0-25.9, DC 24.1, DC 17.0, excluding DC 25.4) from 1 July 2019 to 30 June 2022, in the DNPR but with no registration in the DPCD.

RESULTS. We identified 155 patients with a relevant diagnosis in the DNPR who were not included in the DPCD. A total of 62 patients (40%) represented potentially valid cases of pancreatic cancer, whereas 73 patients (47%) had pNET and 20 patients (13%) had an entirely different diagnosis. Only seven patients (11%) of the potentially valid pancreatic cancer group and 4.5% of the total study cohort had a histology-verified diagnosis of pancreatic cancer. The DNPR contained (93/944) 10% with an incorrect diagnosis of pancreatic cancer and 6% with an uncertain diagnosis.

CONCLUSIONS. This study demonstrates a high level of completeness for the DPCD in the Region of Southern Denmark. Invalid registration of the pancreatic cancer diagnosis is an important limitation in using the DNPR, which is the only data source for identifying patients with pancreatic cancer in Denmark.

FUNDING. None.

TRIAL REGISTRATION. Not relevant.

Approximately 1,050 patients are diagnosed with pancreatic cancer (PC) in Denmark annually [1]. Early symptoms of PC are often non-specific, such as general malaise, abdominal discomfort and nausea [2]. A clinical presentation with more classical symptoms, such as jaundice, is typical in the later stages of the disease when cure is no longer possible. PC has a grave prognosis, with a three-year survival rate of 15% in Denmark [3]. Although surgery remains the only curative option for PC, only 25% of patients qualify for a surgical procedure at disease presentation [4].

The Danish Pancreatic Cancer Database (DPCD) was established in 2011 and reports on PC-related treatment, morbidity and mortality in Denmark [3]. The DPCD reports exclusively on pancreatic carcinomas, duodenal and ampullary cancers. The DPCD inclusion criteria encompass accurate diagnosis codes for PC, alongside contact

with a pertinent, highly specialised hepatic-pancreatic-biliary (HPB) surgical or oncological centre. The exclusion criteria include biopsy results from the National Pathology Registry with pancreatic neuroendocrine tumours (pNET) without concomitant pancreatic carcinoma or cholangiocarcinoma. Incorrectly reported diagnoses can be extracted manually by clinicians reporting to the DPCD. pNET are excluded from the DPCD as they have a very different cellular profile and carry a better prognosis.

Due to the aggressive nature of PC, some patients may never undergo diagnostic workup at a hepatic-pancreatic-biliary (HPB) centre. Although national cancer registries within Scandinavia have excellent reporting patterns and completeness of data, Kilander et al. [5] showed that the Swedish Cancer Registry was only 53% complete for pancreatic and biliary cancers. This was because 44% of the patients were only reported in the Swedish National Patient Registry but not in the Cancer Registry. The study showed that patients reported in the patient registry often did not have a histology-based diagnosis and that diagnosis was either based on clinical suspicion or radiological findings [5].

Cancer registration within the Danish Cancer Registry is automatically made from diagnoses within the DNPR, with codes for tumour-node-metastasis (TNM) staging and source of diagnosis (clinical, radiological or histological) [6]. The DPCD collects data based on the World Health Organisation (WHO) International Classification of Diseases, 10th version (ICD-10) diagnosis registrations within the Danish National Patient Registry (DNPR), with validation against the National Pathology Registry as well as manually by the four reporting HPB centres [3].

The primary objective of this study was to identify and describe the discrepancy cohort between the DPCD and DNPR data regarding PC patients in the Region of Southern Denmark. More specifically, we aimed to determine whether patients reported solely in the DNPR had PC and, if so, whether they were affiliated with the regional HPB centre and what type of treatment they received.

Methods

This was a descriptive, quality-control project of a historical cohort of patients registered with a PC diagnosis (DC 25.0-25.9, excluding DC 25.4), ampullary cancer (DC 24.1), or duodenal cancer (DC 17.0) within the Region of Southern Denmark from 1 July 2019 to 30 June 2022.

The DPCD is based on data from the DNPR but automatically excludes patients based on several criteria, such as biopsy with neuroendocrine tumours (NET) or cholangiocarcinoma and no evaluation at an HPB centre. The four reporting surgical centres carry out further manual validation of the included patients, ensuring the accurate inclusion of diagnoses. This study collected data from the DPCD on both the included and excluded cases but focused only on the excluded patients.

We evaluated the individual medical records of these patients for the following variables: age, sex, final diagnosis, contact with an HPB centre (multidisciplinary team (MDT)), comorbidity, treatment, affiliation with specialised palliative care (SPC) unit, overall survival after PC diagnosis and place of death. The evaluation of medical records concluded on 15 February 2024.

A total of 944 patients living within the Region of Southern Denmark were registered with a probable diagnosis of PC in the DNPR between 1 July 2019 and 20 June 2022. Among these, 789 patients with a PC diagnosis were included in the DPCD. The discrepancy cohort of 155 patients comprised our study population.

Ethics

As this was a quality-control study, no ethics approval was sought. The study was approved by the Department of

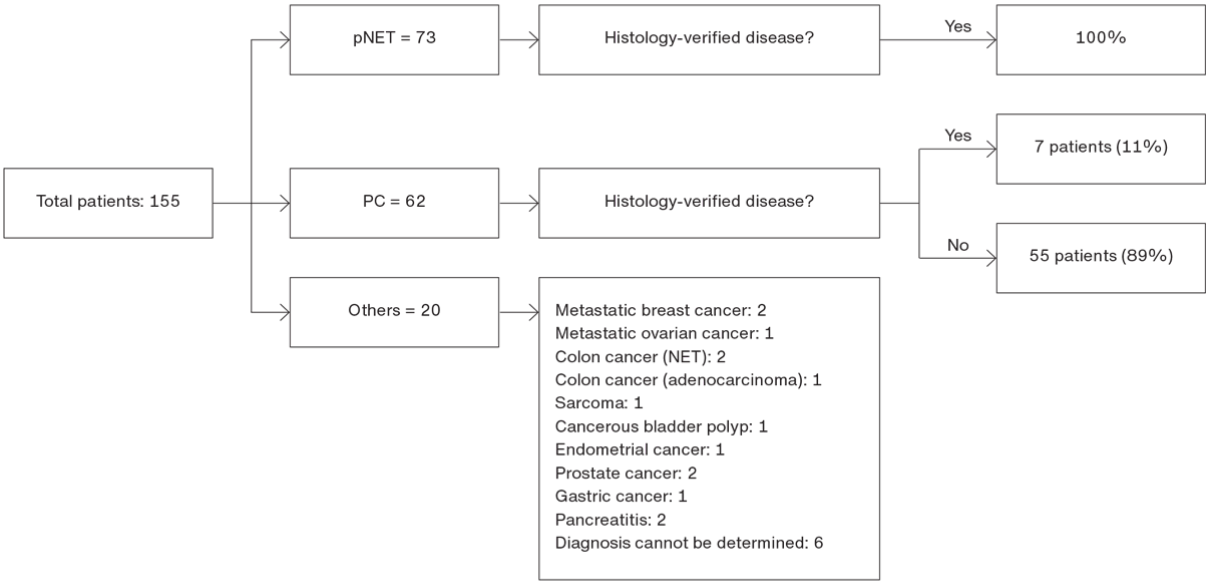
Surgery's Research Council at Odense University Hospital (OUH). Each data entry into patient journals was recorded in the electronic patient journal, and the allocated project number was added to the patient's electronic journal. All data were stored on a secure server at the OUH. Only authors could access this with a login and unique password.

Trial registration: not relevant.

Results

Examination of patient records for the 155 patients in the discrepancy cohort revealed that 73 patients (47%) had histology-verified pNET. These patients had a relevant affiliation with various gastroenterology departments across the region. Twenty patients (13%) had a different, non-PC diagnosis or a final diagnosis could not be established (**Figure 1**). Six of the 20 patients who were coded "final diagnosis could not be established" had no radiology or histology findings suggestive of a PC diagnosis. These were coded as such because neither the radiology report nor the scan suggested a PC diagnosis. Supplementary Table III shows that patients with pNET had a considerably greater number of contacts with the healthcare system than PC patients did, and most of these were incorrectly coded as DC 25.9 (malignant neoplasm of pancreas, unspecified).

FIGURE 1 Final diagnoses of the study population.



NET = neuroendocrine tumours; PC = pancreatic cancer; pNET = pancreatic neuroendocrine tumours.

The remaining 62 patients (40%) represented potentially valid PC cases. **Figure 2** shows the median overall survival (mOS) of pNET and PC patients. For PC patients, the mOS is 0.8 months (95% confidence interval: 0.5-1.1). The sex distribution was 30 men and 32 women with a median age of 83.5 years (range: 59-91 years). Among the 62 patients, 34 (34/62: 55%) were discussed at the regional HPB MDT, whereas the remaining 28 (45%) never had an affiliation with the regional HPB centre. Twenty-five patients (40%) were considered unfit for active treatment by the referring hospital, whereas 19 (31%) opted out of further treatment. Thirteen patients (21%) were deemed unfit for surgical or oncological treatment at the HPB MDT. Only seven of the 62 probable PC patients had a histology-verified PC diagnosis (**Table 1**). Survival after PC diagnosis ranged from 3 to 365 days (median 229 days). Only one patient was a candidate for upfront surgical intervention at the diagnosis but declined all treatment due to significant psychiatric comorbidities.

FIGURE 2 Kaplan-Meier survival plot for patients with pancreatic neuroendocrine tumour and pancreatic cancer.

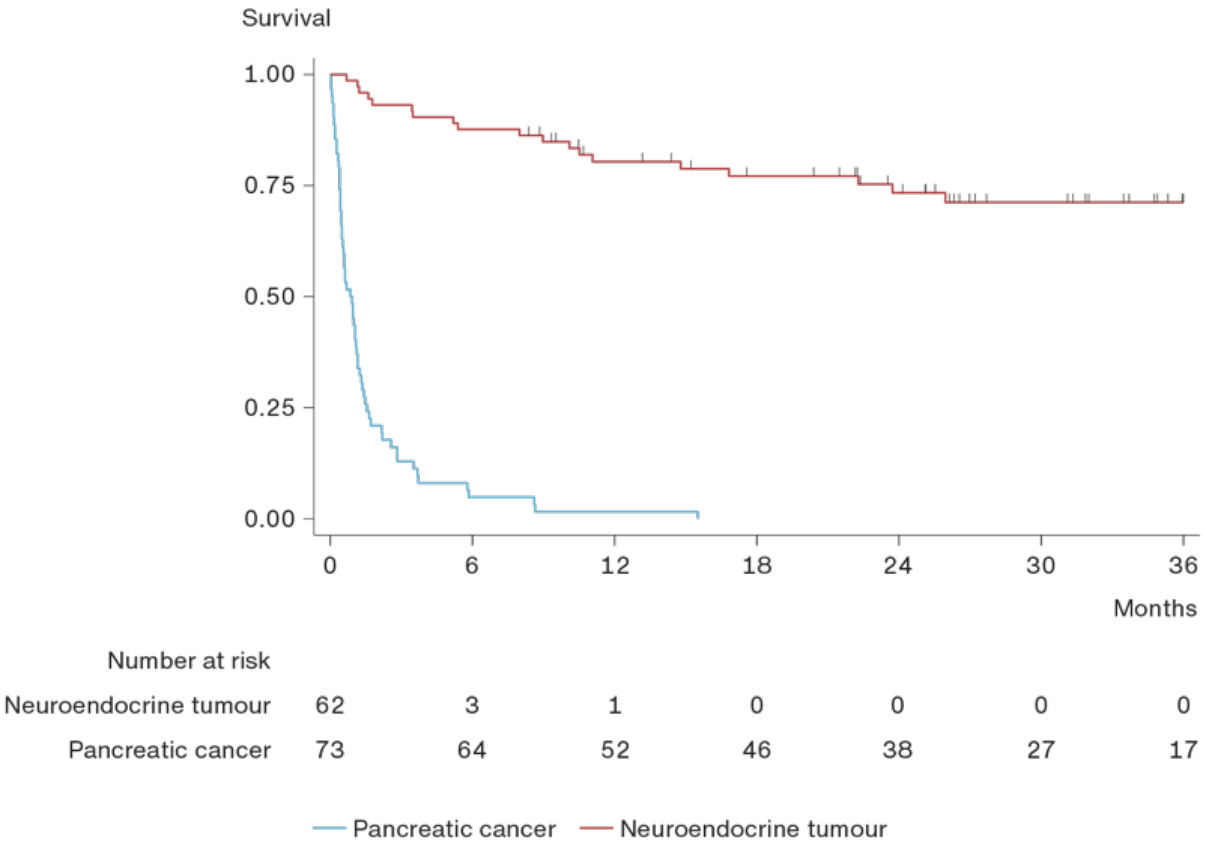


TABLE 1 Diagnosis, multidisciplinary team decision, survival and place of death in the seven patients with histology-verified pancreatic cancer found in the study population.

Patient no.	Histology diagnosis	MDT decision	Survival from diagnosis, days	Place of death
1	Liver biopsy: metastatic PC	Metastatic disease Palliative chemotherapy	288	Hospice
2	Liver biopsy: metastatic PC	Poor performance status Best supportive care	3	Inpatient, medical ward
3	Endoscopic biopsy from duodenum: low-differentiated duodenal cancer, direct spread from pancreas	Not referred	19	Inpatient, surgical ward
4	Endoscopic biopsy from stomach: direct infiltration from PC	Non-resectable T4 disease Referred to palliative chemotherapy but patient declined further treatment	271	Died at home
5	EUS with biopsy: PC	Resectable disease Offered upfront surgery Patient declined further treatment	229	Died at home
6	Liver biopsy: metastatic PC	Metastatic disease Referred for palliative care	19	Inpatient, surgical ward
7	ERCP with stent due to cholangitis EUS × 2 with dysplasia but no malignancy Investigated for miliary tuberculosis but benign biopsy PET-CT × 2 Histology from C6 vertebra with metastatic cancer from GI canal, most likely pancreas	Discussed at MDT 4 × due to inconclusive biopsies After last biopsy, diagnosis revised to PC	365	Moved out of region

ERCP = endoscopic retrograde cholangiopancreatography; EUS = endoscopic ultrasound; GI = gastrointestinal; MDT = multidisciplinary team; PC = pancreatic cancer.

The PC diagnosis in the remaining 55 patients without histology or cytology verification was primarily based on radiological findings, as summarised in **Table 2**. These patients had multiple comorbidities and/or poor performance status, leading to a non-active (symptomatic) treatment decision. Seventeen patients (17/55: 31%) had a concomitant histology-verified other cancer diagnosis (five cases of breast cancer, three colon cancers, three prostate cancers, two rectal cancers, two bladder cancers, one renal cell carcinoma and one multiple

myeloma). Four patients had more than two concomitant cancers alongside a radiological PC diagnosis. Other significant comorbidities included type II diabetes, chronic pancreatitis, ischaemic heart disease, Parkinson's disease, stroke, atrial fibrillation, alcoholic liver disease, hepatitis and dementia. Given the high rate of other cancers, a specific PC diagnosis was difficult to establish in these patients. Twenty-three patients (23/55: 42%) were affiliated with an SPC unit. Palliative chemotherapy was considered but not provided in 28 patients due to patient refusal, missing pathology validation or poor performance status. Thirty-six patients (65.5%) died at home or in a care home. Ten patients (18%) died in a palliative care setting, and nine patients (16.5%) died during an inpatient stay in either a medical or a surgical ward.

TABLE 2 Representation of data according to basis og diagnosis.

Correct diagnosis	Histology-verified	Radiology-based	Clinical diagnosis	Wrongful coding	Total
PDAC	7	54	1	0	62
pNET	71	2	0	0	73
Pancreatitis	0	2	0	0	2
Other benign disease	1	0	0	0	1
Other cancer	6	1	0	4	11
Diagnosis cannot be determined	1	4	1	0	6
Total	86	63	2	4	155

PDAC = pancreatic ductal adenocarcinoma; pNET = pancreatic neuroendocrine tumours.

Thus, seven patients with biopsy-verified PC were identified as missing from the DPCD during the three-year study period. Among the 944 patients in the DNPR, 73 patients (8%) had pNET, 20 (2%) had misclassified cancer and 55 (6%) had an uncertain PC diagnosis.

Discussion

This study identified a cohort of 155 patients with a PC diagnosis in the DNPR who were not included in the DPCD. Only seven (4.5%) of these patients had a biopsy-verified PC, and only one patient would have been offered potentially curative surgery but declined due to comorbidities. Thus, the DPCD correctly identified 789/796 cases (99%) of actual PC in the study period in the Region of Southern Denmark.

The study shows that data extraction from the DNPR overestimates the true incidence of PC, mainly due to incorrect coding of pNET. Disease misclassification was high (73 patients had pNET, and an additional 20 patients had other malignant or benign diseases). PC diagnosis in the remaining patients (n = 62) was primarily based on imaging, and a high proportion had other cancer histories.

Our study showed that 82.5% of the patients in our study population (73 patients with pNET and 55 potentially with PC) had been discussed at the HPB MDT. This finding indirectly shows that although the tertiary centre may apply a correct diagnosis, the initial diagnosis from the referring hospital continued to be registered in the DNPR. Forty-five per cent of the study population did not have an affiliation with the regional HPB centre. Due to the aggressive nature of PC along with the patients' old age (median age: 83.5 years), MDT referral would most likely have been without any clinical consequence for this patient group. However, MDT could, in this case, be used for diagnosis registration, which could, in turn, result in a higher DPCD completeness.

Our study showed that only 42% of the patients without histology-verified disease were affiliated with an SPC

unit. Our findings largely align with those reported by the Danish Palliative Database, which shows that 46% of patients with a cancer diagnosis had an affiliation with SPC in 2023 in Denmark [7]. The Lancet Oncology Commission argues for early palliation at the point of diagnosis [8], which is difficult to achieve with a median survival of a few days. Further studies are needed to understand the challenges associated with allocating palliative care to this population.

Although no registry is complete, the DPCD comes close to full completeness for the Region of Southern Denmark. Registry data require that a population subset is clearly defined. One of the limitations of the DPCD is that approximately 10-15% of cases in the DPCD are based entirely on radiology, and therefore, the DPCD may contain false positives [3]. One of the main obstacles is the intricacy of data integration from various sources, such as hospital records, pathology reports and national databases [9]. This study aided the DPCD registry data by conducting an in-depth investigation of the discrepancy cohort within the Region of Southern Denmark that was previously unaccounted for, thus ensuring further completion of the registry data. Baron & Weiderpass argued that even the best databases may be prone to recording errors and incompleteness [10]. However, linking different registries together ensures the completeness of data. For instance, linking the DPCD to the Pathology Registry ensures that patients with biopsy-verified pNET and/or distal cholangiocarcinoma may be excluded from the Pancreas Cancer Registry.

The main shortcoming of this study is the inclusion of only one region. Although the Danish population is homogenous, and similar results may be expected from the remaining three regions, the dataset would have been strengthened if all four regions had been included.

An inherent problem with diagnosis registration is the use of different diagnosis codes for the same cancer. A Korean study showed that the rates of definite PC diagnosis were highest when the tumour localisation was known [11]. pNET is an umbrella term used for different types of tumours but is only classified as “cancer in the Langerhans islands (DC 25.4)” in the ICD-10. Therefore, these may exist anywhere in the pancreas and may be reported according to localisation rather than histology. A more precise classification system would help clinicians in coding precisely, especially where no histology exists.

In an ideal setting, only patients with histology-verified disease should have a malignant diagnosis. However, this is not always possible, as patients occasionally present 1-2 days before their demise. The HPB MDT at Odense University Hospital comprises surgeons, pathologists, oncologists and radiologists specialising in HPB. As almost half of the patients are not referred to the MDT, diagnosis is made at a peripheral hospital, where the nuances related to assigning a correct diagnosis may not be appreciated.

The referring clinician is responsible for ensuring cancer registration. This may vary from the most junior to the most senior clinician and may, therefore, represent cases where the diagnosis is made incorrectly. An area of improvement could be educating Danish doctors across all grades on correct coding practices for cancer diagnoses and providing referring clinicians with specific guidelines for diagnosis codes.

Conclusions

This study demonstrated a high DPCD completeness regarding the identification and registration of verified PC patients in the Region of Southern Denmark. The DPNR contained 10% with an incorrect PC diagnosis and 6% with an uncertain DNPR diagnosis. This is an important limitation in using the DNPR, which is the only data source for identifying patients with a PC diagnosis in Denmark.

Correspondence *Cara Manmeet Bhuller*. E-mail: cara.manmeet.bhuller@rsyd.dk

Accepted 18 December 2024

Published 14 February 2025

Conflicts of interest none. Disclosure forms provided by the authors are available with the article at ugeskriftet.dk/dmj

References can be found with the article at ugeskriftet.dk/dmj

Cite this as Dan Med J 2025;72(3):A08240545

doi 10.61409/A08240545

Supplementary material: https://content.ugeskriftet.dk/sites/default/files/2024-12/a08240545-supplementary.pdf

REFERENCES

1. NORDCAN. NORDCAN countries. Pancreas. NORDCAN, 2024. https://gco.iarc.fr/media/nordcan/factsheets/94/en/countries/0/pancreas-130-nordcan_countries-0.pdf (Jan 2025)
2. Weble TC, Bjerregaard JK, Kissmeyer P et al. Incidence of pancreatic cancer in Denmark: 70 years of registration, 1943-2012. Acta Oncol. 2017;56(12):1763-8. https://doi.org/10.1080/0284186X.2017.1351036
3. Fristrup C, Detlefsen S, Hansen CP, Ladekarl M. Danish Pancreatic Cancer Database. Clin Epidemiol. 2016;8:645-8. https://doi.org/10.2147/CLEP.S99471
4. Fristrup CW, Mortensen MB. Har vi den rette prioritering i forhold til patienter med pancreascancer? Ugeskr Læger. 2023;185:V205152
5. Kilander C, Mattsson F, Ljung R et al. Systematic underreporting of the population-based incidence of pancreatic and biliary tract cancers. Acta Oncol. 2014;53(6):822-9. https://doi.org/10.3109/0284186X.2013.857429
6. Storm HH, Michelsen EV, Clemmensen IH, Pihl J. The Danish Cancer Registry -history, content, quality and use. Dan Med Bull. 1997;44(5):535-9
7. RKKP. Dansk Palliativ Database (DPD). Årsrapport 2023. RKKP, 2024. www.sundhed.dk/content/cms/89/38089_dansk-palliativ-database-dpd-aarsrapport-2023-offentliggjort-version-20240627.pdf (Jan 2025)
8. Kaasa S, Loge JH, Aapro M et al. Integration of oncology and palliative care: a Lancet Oncology Commission. Lancet Oncol. 2018;19(11):e588-e653. https://doi.org/10.1016/S1470-2045(18)30415-7
9. Sørensen ST, Kristensen FP, Troelsen FS et al. Health registries as research tools: a review of methodological key issues. Dan Med J. 2023;70(4):A12220796
10. Baron JA, Weiderpass E. An introduction to epidemiological research with medical databases. Ann Epidemiol. 2000;10(4):200-4. https://doi.org/10.1016/s1047-2797(00)00039-9
11. Hwang YJ, Park SM, Ahn S et al. Accuracy of an administrative database for pancreatic cancer by international classification of disease 10th codes: a retrospective large-cohort study. World J Gastroenterol. 2019;25(37):5619-29. https://doi.org/10.3748/wjg.v25.i37.5619