

# Pancreaticoduodenectomy in Qld public and private hospitals 2004-2013

for pancreatic, biliary tract or duodenal cancers



## Acknowledgements

This report has been prepared under the auspices of The Queensland Cancer Control Safety and Quality Partnership, a gazetted quality assurance committee under Part 6, Division 1 of the Hospital and Health Boards Act 2011.

The Pancreaticoduodenectomy in Queensland public and private hospitals 2004-2013 report should be interpreted in the context of a previous publication by The Partnership: Pancreaticoduodenectomy in Queensland Infocus – access and flows 2002-2011. This publication provides detailed information on cancer incidence, mortality and survival, surgery rates and patient flows for patients undergoing pancreaticoduodenectomy. The report is available at <https://qccat.health.qld.gov.au>.

This report was prepared by Michael Blake, Danica Cossio, Nathan Dunn, Tania Eden, Tracey Guan, Shoni Philpot and Nancy Tran, of the Queensland Cancer Control Analysis Team.

We wish to thank Professor Mark Smithers, Dr Nicholas O'Rourke and Professor Jonathan Fawcett for reviewing the report and providing valuable comments.

## Disclosure

This report is confidential and legally protected under section 87 of the Hospital and Health Boards Act 2011 (the Act). It cannot be accessed under any administrative or judicial order and is not admissible in any proceeding, other than a proceeding for an offence under Part 6, Division 1 of the Act.

For more information:

Queensland Cancer Control Analysis Team  
Queensland Health  
GPO Box 48 Brisbane, Queensland, 4001 Australia  
Ph: +61 (07) 3840 3200  
Fax: +61 (07) 3176 4458  
Email: [qccat@health.qld.gov.au](mailto:qccat@health.qld.gov.au)  
<https://qccat.health.qld.gov.au>

Pancreaticoduodenectomy in Queensland public and private hospitals for pancreatic, biliary tract and duodenal cancer, 2004-2013

ISBN:

Suggested citation:

Queensland Government. Pancreaticoduodenectomy in Queensland Public and Private Hospitals 2004-2013. Queensland Health, Brisbane, 2015

Copyright protects this publication. However, the Queensland Government has no objection to this material being reproduced with acknowledgement, except for commercial purposes.

Permission to reproduce for commercial purposes should be sought from:

The Manager  
Queensland Cancer Control Analysis Team  
Queensland Health  
GPO Box 48 Brisbane, Queensland, 4001 Australia

## Table of Contents

Background .....	1
Data sources .....	1
Patients .....	1
How the cohorts were defined .....	2
Key Points .....	3
Hospital and Health Service Survival.....	3
Surgical Overview .....	3
Survival .....	3
Part 1 .....	4
Epidemiology of pancreas, biliary tract and duodenal cancer in Queensland .....	4
Projections Queensland 2021 .....	5
Incidence and Mortality .....	8
Variation in Incidence and Mortality .....	12
Prevalence .....	14
Survival .....	15
Part 2 .....	16
Pancreatic, Biliary Tract & Duodenal Cancer Overview by Hospital and Health Service .....	16
Patient Characteristics .....	17
Incidence and Mortality by patient residence .....	18
Survival by patient residence .....	20
Part 3 .....	21
A Surgical Overview 2004 – 2013: Pancreaticoduodenectomy .....	21
Introduction .....	21
Pancreaticoduodenectomy cohort .....	23
Hospital volumes .....	26
Postoperative mortality .....	28
Factors affecting postoperative mortality .....	32
Risk groups.....	32
Inpatient postoperative mortality .....	33
30 day postoperative mortality .....	34
90 day postoperative mortality .....	35
1 year survival.....	36
2 year survival.....	37
5 year survival.....	38
All-Cause Survival.....	39
Cause Specific Survival.....	39
Hospital Volumes 2003-2008 vs 2009-2013.....	40
Very low volume hospital characteristics .....	42
Part 4 .....	44
Pancreaticoduodenectomy Surgery Recommendations .....	44
Pancreaticoduodenectomy Summary.....	45
Hospital Volume and Postoperative Mortality .....	45
Guiding Practice Statements Summary .....	46
Improving Care .....	47
Guiding Practice Statements.....	48
Appendix.....	51
Distal Pancreatectomy cohort .....	52
Data Sources .....	54
Glossary and Common Abbreviations.....	55

## Background

The Pancreaticoduodenectomy in Queensland public and private hospitals for pancreatic, biliary tract and duodenal cancer 2004-2013 report has been developed to contribute to our understanding of variation in complex cancer surgery between Hospital and Health Services (HHS) and hospitals in Queensland. Pancreaticoduodenectomy is a relatively uncommon surgical procedure and the management of patients undergoing the surgery is complex. Patients require care from a multidisciplinary team to ensure they receive the appropriate treatment that will lead to the best outcomes. By providing information on the patterns of surgery and outcomes this report aims to guide best practice.

This report reveals differences between HHS and individual hospitals which may not be obvious in daily clinical practice but become clear with this type of analysis. Preparing this report is an important first step in raising awareness amongst individual hospitals of the link between surgical volume and outcomes in Queensland.

The Partnership encourages you to consider how this information will inform how pancreaticoduodenectomy is managed in your jurisdiction in Queensland. Pancreaticoduodenectomy in Queensland will continue to be monitored with a focus on ensuring the best possible outcomes for our patients.

## Data sources

Key to QCCAT's program of work is our ability to link population based cancer information on an individual patient basis, using a master linkage key specifically developed by our team. This matched and linked data is housed in Queensland Oncology Repository (QOR), a resource managed by QCCAT. This centralised repository, QOR, compiles and collates data from a range of source systems including Queensland Cancer Registry, hospital admissions data, death data, treatment systems, public and private pathology, hospital clinical data systems and QOOL (Queensland Oncology On-Line). QOR contains approximately 32 million records between 1982 – 2014. Our matching and linking process provides the 423,633 matched and linked records of cancer patients between 2004 – 2013, which are the starting point for this analysis.

## Patients

### *Pancreatic, biliary tract and duodenal cancer cohort*

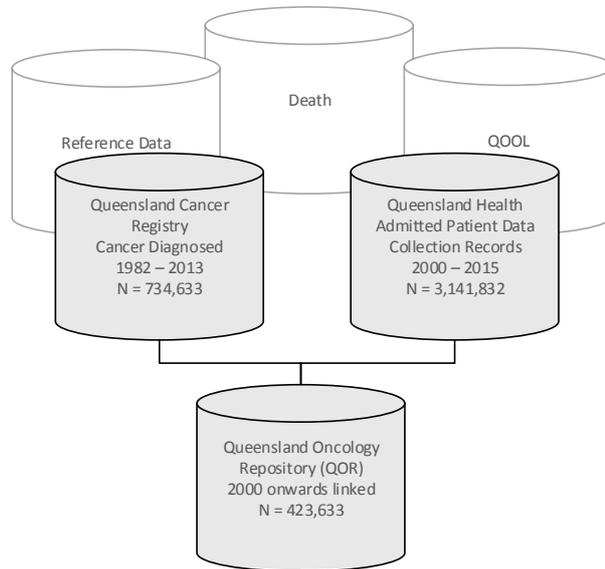
The patients included in the analysis of surgical outcomes had a primary diagnosis of either pancreas (C25), biliary tract (C24) or duodenal (C17) cancer between 2004 and 2013.

### *Pancreaticoduodenectomy cohort*

Patients who underwent pancreaticoduodenectomy surgery with formation of stoma (ICD code 30584-00) for pancreatic, biliary tract or duodenal cancer are included in this report. Those who underwent pancreaticoduodenectomy for causes other than pancreatic, biliary tract or duodenal cancers were excluded.

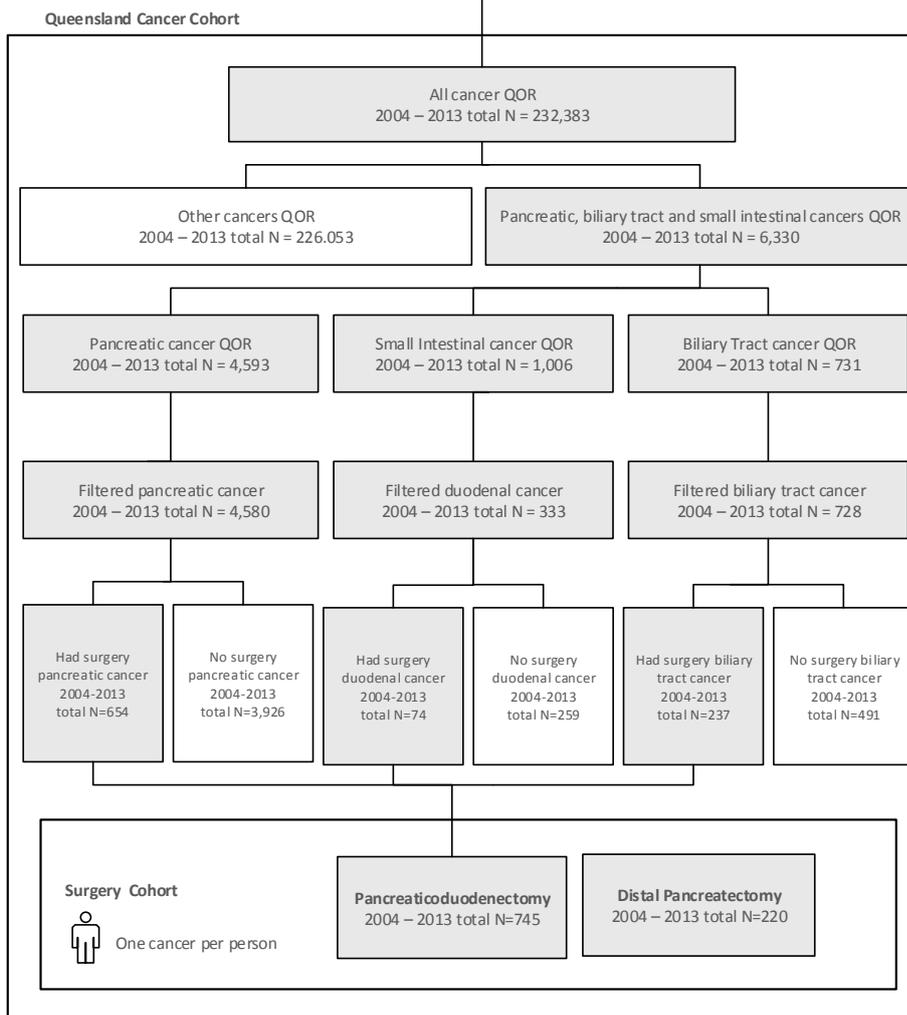
## How the cohorts were defined

### 2004-2013: PUBLIC & PRIVATE HOSPITAL PATIENTS



**Queensland Oncology Repository**  
 QOR consolidates patient information for Queensland and contains data on invasive, benign and uncertain cancers, patient demographics, surgery, chemotherapy, radiotherapy and death. QOR also contains data collected by clinicians at MDT meetings

Sophisticated matching and linking is performed to identify all persons with cancer who had surgery



**Queensland Cancer Cohort**  
 Includes: Queensland Invasive Cancer incidence  
 Discharged patients from public or private hospitals  
 Queensland residents  
 All ages

**Surgery Cohort**  
 Filtered cases  
 Potential duplicate records

**Rules**  
 If the surgery happened > 1 month before the date of diagnosis then the surgery is excluded

**No Surgery Cohort**  
 Includes Qld residents of all ages diagnosed with pancreatic, biliary tract and small intestinal cancer who did not undergo a pancreaticoduodenectomy or pancreatectomy in the surgical cohort time period

## Key Points

This report provides information on the incidence and mortality of Queensland patients who have a diagnosis of pancreatic, biliary tract or duodenal cancer and have undergone pancreaticoduodenectomy. It describes the delivery and outcome of complex and specialised cancer surgery in Queensland.

## Queensland Incidence and Mortality

Nearly 800 people are estimated to be living with pancreatic, biliary tract and duodenal cancers in Queensland in 2013 and 810 new cases – 440 in males and 370 in females – are expected to be diagnosed in 2021. The total incidence is increasing due to population growth and ageing, with the age-standardised incidence rates also increasing from 9.3 per 100,000 in 1982 to 9.8 per 100,000 in 2013 for pancreatic cancer, from 1.4 per 100,000 in 1982 to 1.6 per 100,000 in 2013 for biliary tract cancer and from 0.3 per 100,000 in 1982 to 0.9 per 100,000 in 2012 for duodenal cancer. Mortality rates follow a similar pattern and also show slight increases from 8.4 per 100,000 in 1982 to 9.0 per 100,000 in 2013 for pancreatic cancer, 1.1 in 1982 to 1.3 per 100,000 in 2013 for biliary tract cancer and 0.1 in 1982 to 0.4 per 100,000 in 2013 for duodenal cancer.

## Hospital and Health Service Survival

There is some regional variation in survival of pancreatic, biliary tract and duodenal cancer across the state. Residents in the North West HHS geographical area have the lowest 5 year survival at 7% and West Moreton, Metro South and Torres & Cape have the highest 5 year survival at 15%.

## Surgical Overview

There is significant variation across hospitals in the volume and outcome of pancreaticoduodenectomy. Between 2004 and 2013, 19 hospitals across Queensland performed pancreaticoduodenectomy for pancreatic, biliary tract and duodenal cancer at rates ranging from 0.1 to 13.6 cases per year. Overall postoperative mortality rates are low in Queensland however rates are generally higher among low volume hospitals with this trend persisting when adjusted for case mix.

## Survival

Overall survival for pancreatic cancer in Queensland is poor. For those undergoing pancreaticoduodenectomy the 5 year all-cause survival is 29% for pancreatic, 53% for biliary tract and 57% for duodenal cancers. Differing morphologies also affect survival rates with those diagnosed with pancreatic adenocarcinoma at 22% compared to those with neuroendocrine cancer with 92% 5 year survival.

## Part 1

# Epidemiology of pancreas, biliary tract and duodenal cancer in Queensland



Queensland pancreatic, biliary tract & duodenal cancer data is presented in this report. The International Classification of Diseases for Oncology (ICD-O) has been applied to distinguish between pancreas, biliary tract and duodenal cancer.

Pancreas cancer is defined as those with a primary site of C25; biliary tract cancer C24; and duodenal cancer C17. Patients who reside outside Queensland have been excluded.

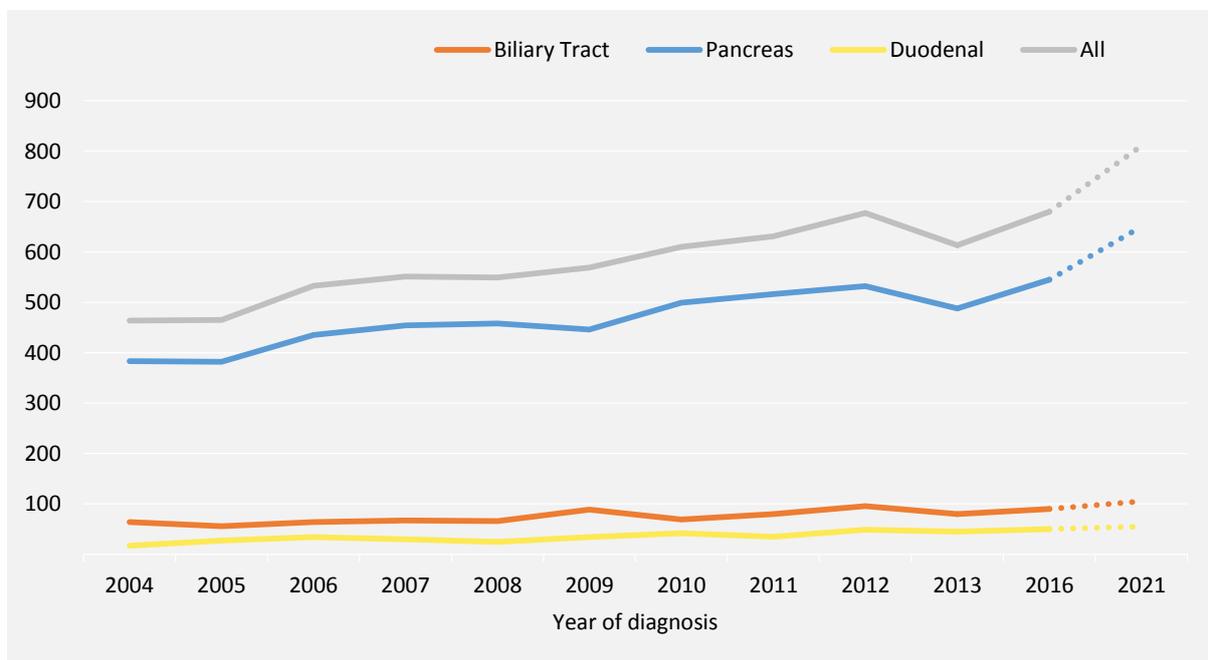
## Projections Queensland 2021

It is estimated in 2021 that 810 new cases of invasive pancreatic, biliary tract & duodenal cancers will be diagnosed among Queensland residents and that 715 Queenslanders will die of the disease.

Pancreatic, biliary tract and duodenal cancer is expected to continue to be slightly more common in males (440 new cases), than in females (370 cases). Projected incidence for 2021 shows a 32% increase from the 2013 incidence of 613 cases.

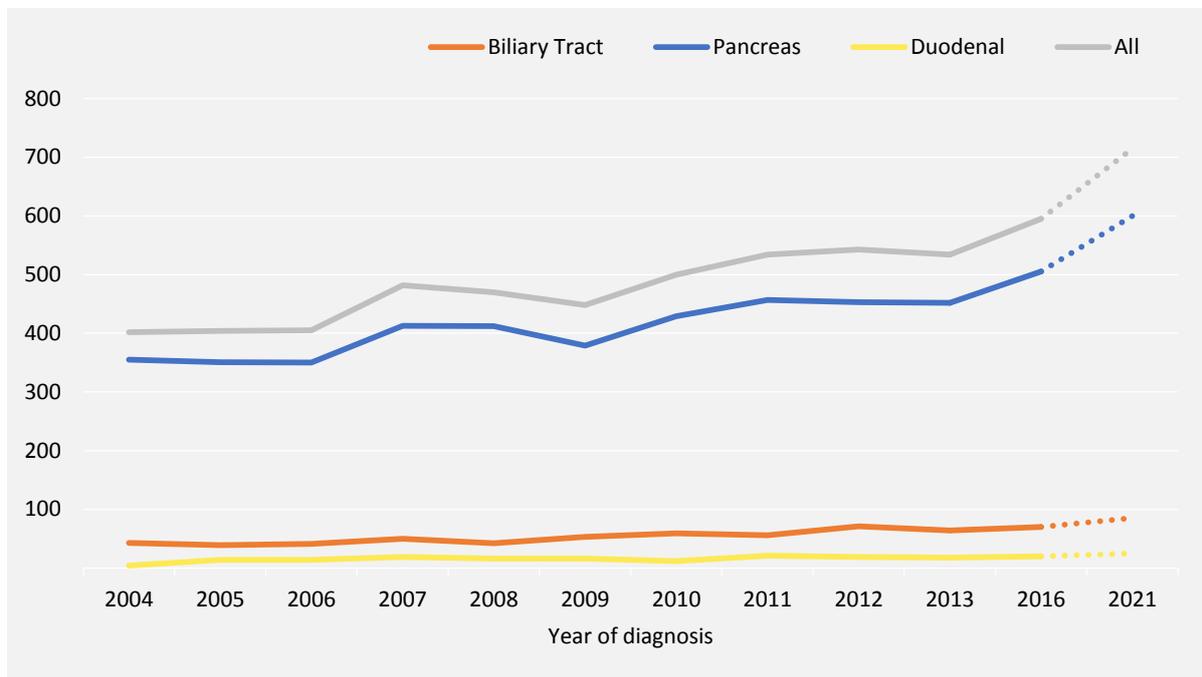
452 pancreatic, 64 biliary tract and 18 duodenal cancer deaths were recorded in 2013 with an expected increase of 33% for pancreatic, 33% for biliary tract and 39% for duodenal cancer by 2021.

*Pancreatic, biliary tract and duodenal actual and projected cancer incidence  
Year of diagnosis 2004-2013*



Source: Oncology Analysis System, Queensland Cancer Control Analysis Team.

*Pancreatic, biliary tract and duodenal actual and projected cancer mortality  
Year of diagnosis 2004-2013*

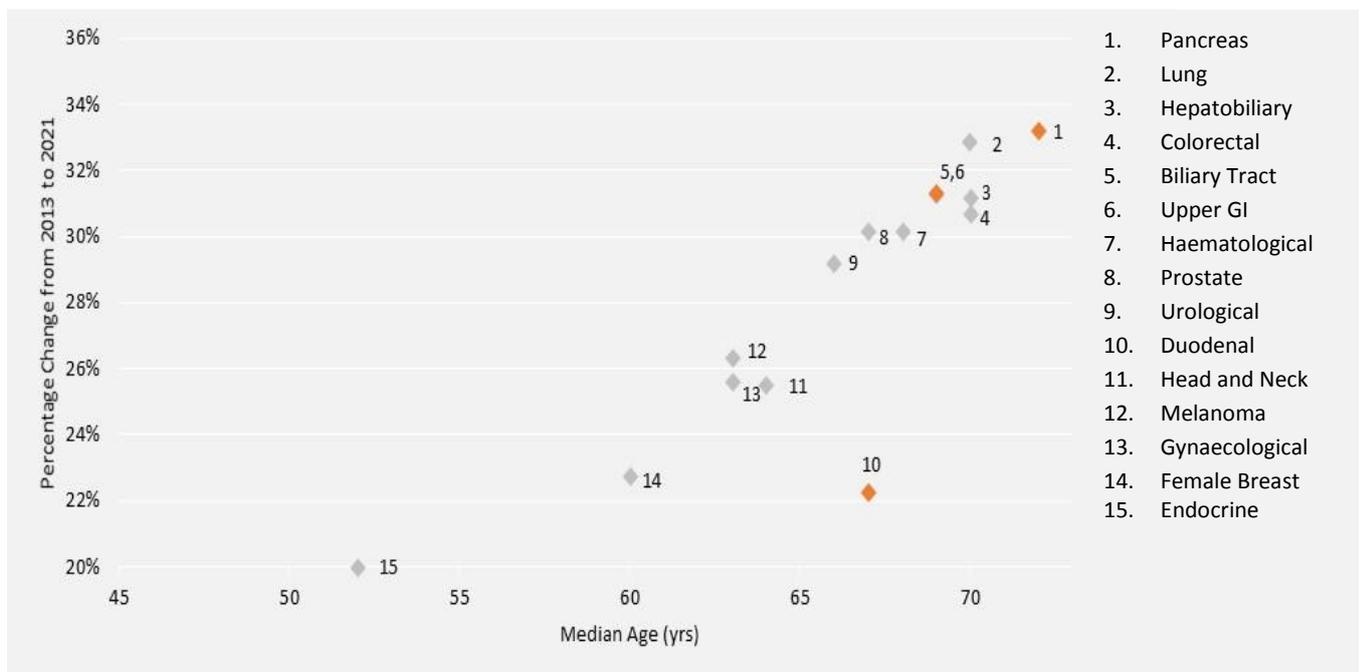


Source: Oncology Analysis System, Queensland Cancer Control Analysis Team.

The percentage change in cancer incidence between 2013 and 2021 is shown below. Assuming no change in incidence rates during this period biliary tract and pancreatic cancer, both common in older people, are projected to show a relatively larger increase (80 new cases in 2013 to 105 in 2021 - 31% increase for biliary tract, 488 new cases in 2013 to 650 in 2021 – 33% increase for pancreatic) than cancers common in younger people. Duodenal cancer demonstrates a lower increase of 22% (45 new cases in 2013 to 55 in 2021).

These trends are a direct consequence of projected changes in the age distribution of Queensland residents, as the number of people aged 65 years and older is expected to grow at a much faster rate than the rest of the population. These projections provide an indication of the likely burden of pancreas, biliary tract and duodenal cancer and the demand for cancer services in 2021.

*Pancreatic, biliary tract and duodenal projected percentage change from 2013 to 2021 for common cancers by median age at diagnosis*



Source: Oncology Analysis System, Queensland Cancer Control Analysis Team.

## Incidence and Mortality

### Pancreatic, biliary tract and duodenal cohort

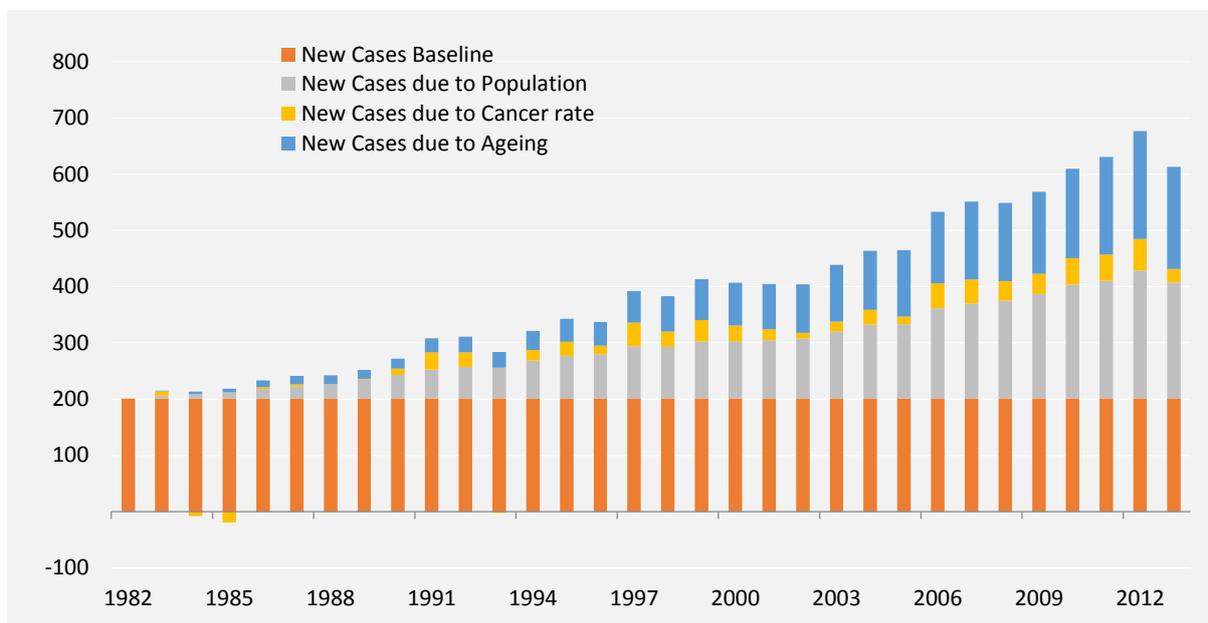
Year of diagnosis 2004-2013

	Annual average - incidence	Annual average - mortality
Biliary Tract	73	52
Pancreas	459	405
Duodenal	34	15
<b>Total</b>	<b>566</b>	<b>472</b>

The number of new cases of pancreatic, biliary tract and duodenal cancer among Queensland residents has increased by 205% between 1982 and 2013. For males, the number of new cases increased from 129 in 1982 to 327 (153%) in 2013; for females, the number of new cases increased from 72 to 286 (297%). These increases were due to population growth and ageing.

Queensland's population increased from 2.4 million in 1982 to 4.7 million in 2013, an increase of 92%, making Queensland the fastest growing state in Australia and one of the fastest among developed countries. The proportion of people 65 years and older also increased, from 9.7% in 1982 to 13.6% in 2013.

### *Growth in pancreatic, biliary tract and duodenal cancer Year of diagnosis 1982-2013*

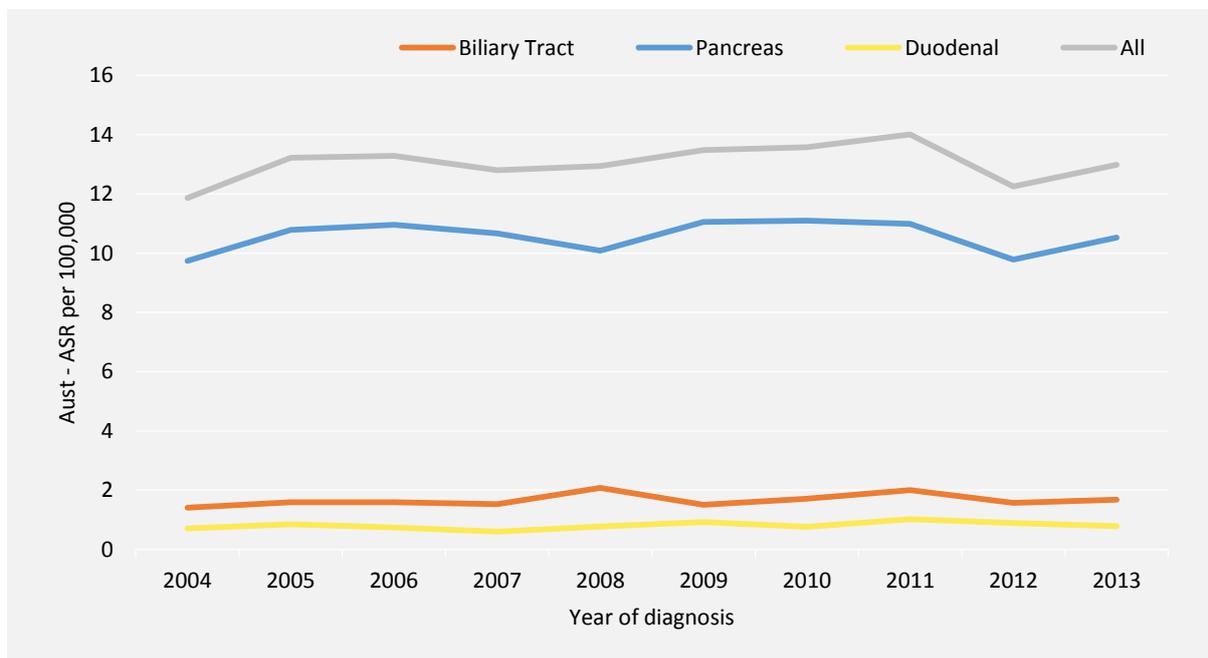


Source: Oncology Analysis System, Queensland Cancer Control Analysis Team.

The age-standardised incidence rate of pancreatic cancer increased slightly from 9.3 per 100,000 in 1982 to 9.8 per 100,000 in 2013, biliary tract cancer increased from 1.4 in 1982 to 1.6 per 100,000 in 2013 and duodenal cancer had the largest increase from 0.3 in 1982 to 0.9 per 100,000 in 2013.

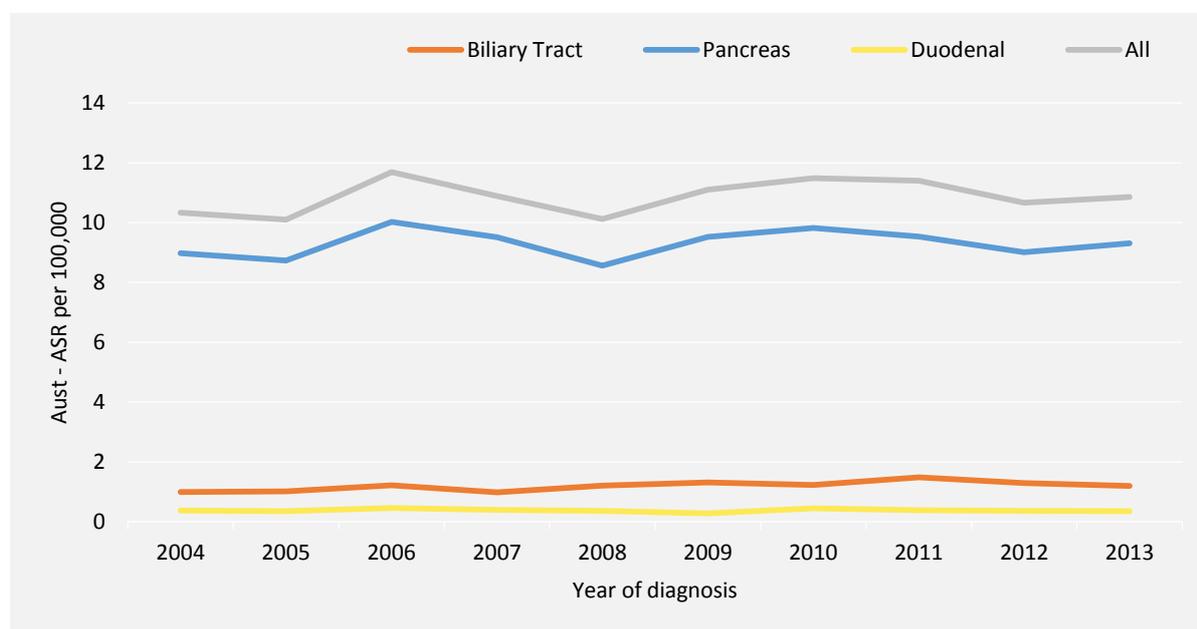
Mortality rates followed a similar pattern and also increased slightly from 8.4 per 100,000 in 1982 to 9.0 per 100,000 in 2013 for pancreatic cancer, 1.1 in 1982 to 1.3 per 100,000 in 2013 for biliary tract cancer and 0.1 in 1982 to 0.4 per 100,000 in 2013.

*Pancreatic, biliary tract and duodenal cancer age-standardised incidence rates per 100,000  
Year of diagnosis 2004-2013*



Source: Oncology Analysis System, Queensland Cancer Control Analysis Team.

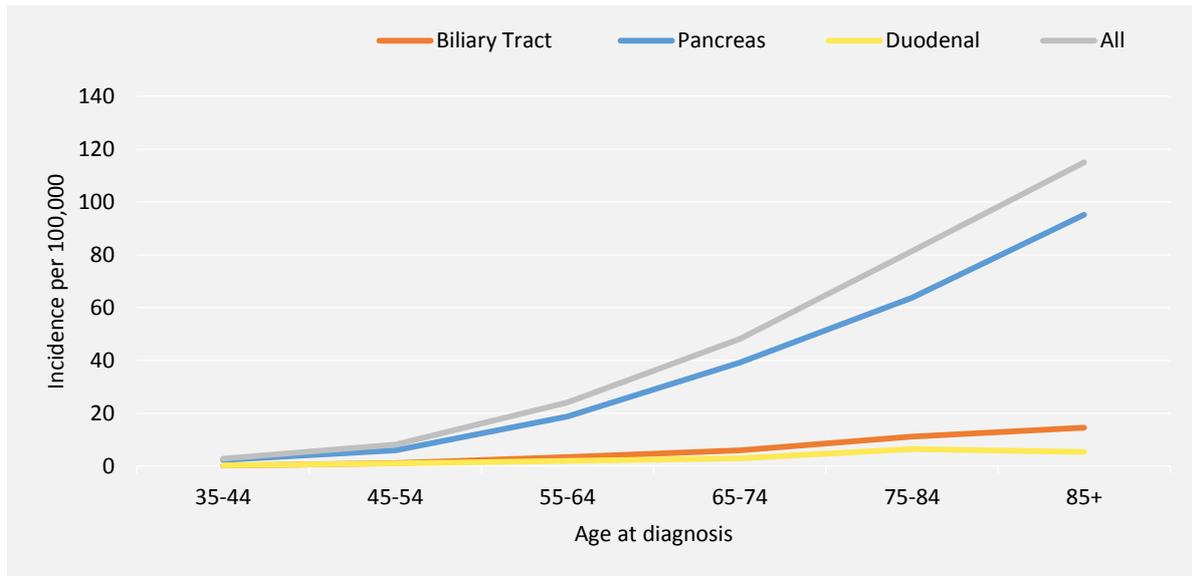
*Pancreatic, biliary tract and duodenal cancer age-standardised mortality rates per 100,000  
Year of diagnosis 2004-2013*



Source: Oncology Analysis System, Queensland Cancer Control Analysis Team.

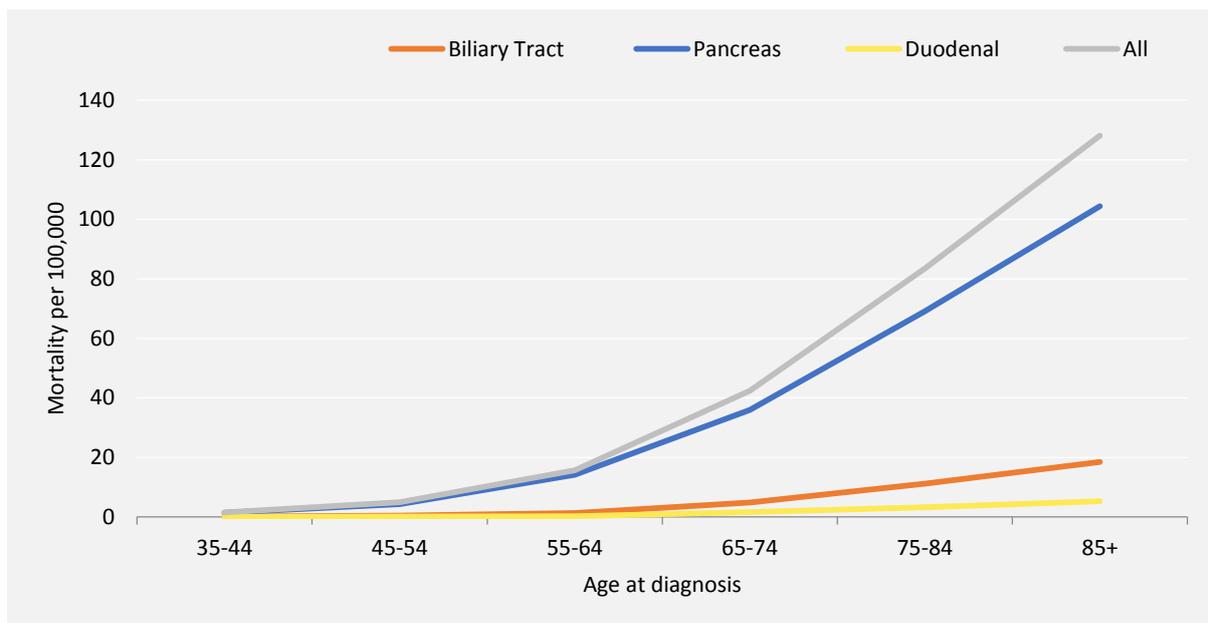
Pancreatic, biliary tract & duodenal cancer incidence increased with age. Mortality rates increased overall with age but individually duodenal cancer mortality rates decreased for the 85+ age-group. For every 100,000 people aged 85 and older 115 were diagnosed with, and 128 died from pancreatic, biliary tract & duodenal cancer. Very few cases of pancreatic, biliary tract & duodenal cancer were recorded for persons under the age of 45 (<5 cases per 100,000).

*Pancreatic, biliary tract and duodenal cancer incidence per 100,000, by age at diagnosis  
Year of diagnosis 2013*



Source: Oncology Analysis System, Queensland Cancer Control Analysis Team.

*Pancreatic, biliary tract and duodenal cancer mortality per 100,000, by age at diagnosis  
Year of diagnosis 2013*



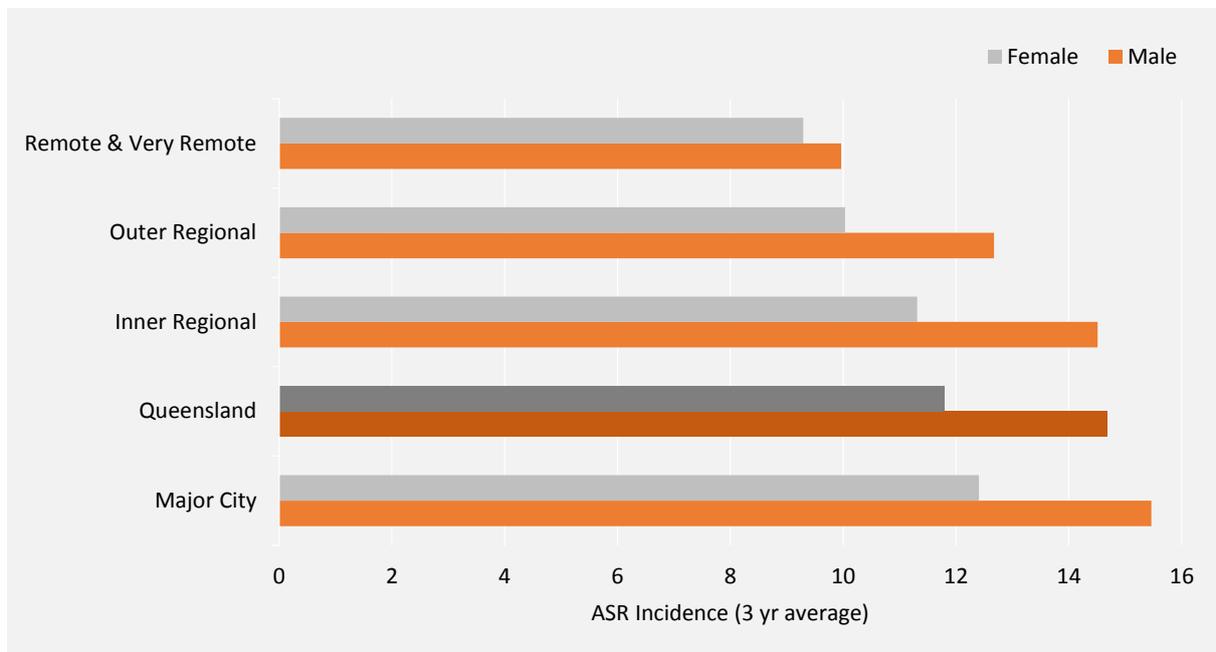
Source: Oncology Analysis System, Queensland Cancer Control Analysis Team.

## Variation in Incidence and Mortality

On average, incidence for pancreatic, biliary tract & duodenal cancer varied by remoteness of residence for both males and females from 2011-2013. The highest average rate was seen in males who lived in the major city areas of Queensland (15.5 per 100,000), for females the rate was 12.4 per 100,000 also in the major city areas of Queensland.

Mortality rates for pancreatic, biliary tract and duodenal cancers varied by remoteness for both males and females from 2011-2013. The lowest rates were seen in the remote & very remote areas of Queensland with 9.7 per 100,000 for males and 6.8 per 100,000 for females. The highest rates were in the Major City areas of Queensland with 13.0 per 100,000 for males and 9.8 per 100,000 for females.

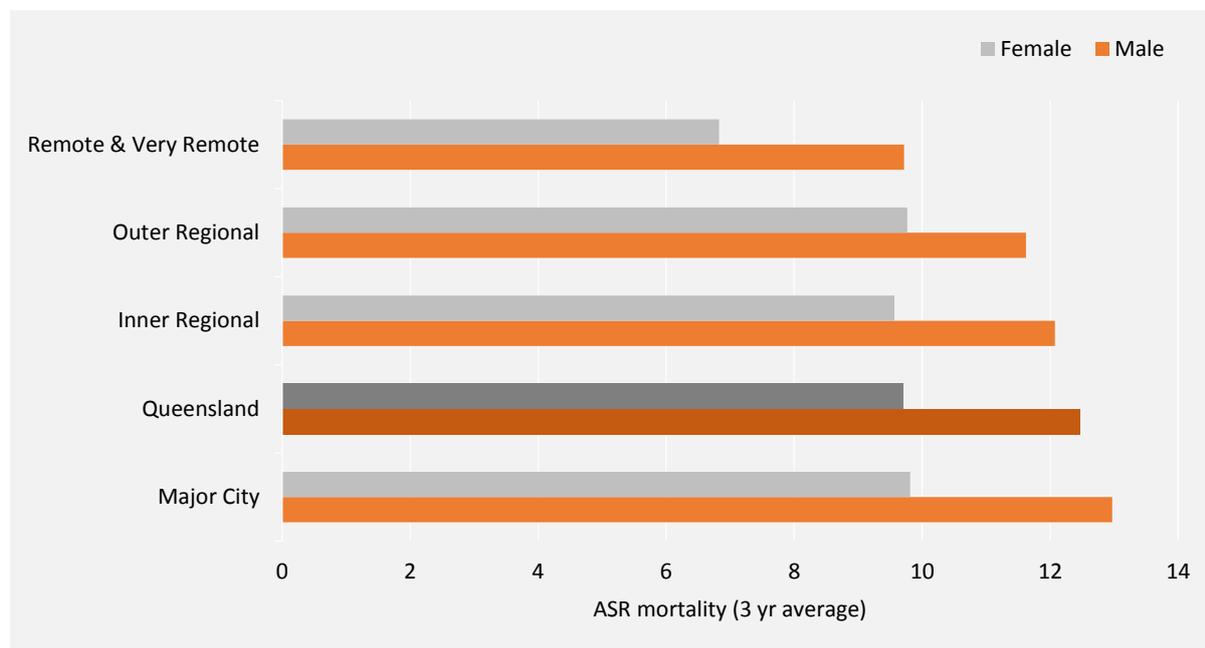
### *Pancreatic, biliary tract and duodenal cancer age-standardised incidence rates by remoteness of residence Year of diagnosis 2011-2013*



Source: Oncology Analysis System, Queensland Cancer Control Analysis Team.

*In the interest of completeness, incidence and mortality rates have been included for all Hospital and Health Services including those with fewer than 16 cases. Incidence and mortality rates based on small numbers of cases should be interpreted with caution due to the poor reliability of rate calculations based on small numbers. For example, the relative standard error (RSE) will be equal or greater than 25% when incidence rates are based on fewer than 16 cases. For more information, refer to the technical notes available at: [http://www.cdc.gov/cancer/npcr/uscs/2007/technical\\_notes/stat\\_methods/suppression.htm](http://www.cdc.gov/cancer/npcr/uscs/2007/technical_notes/stat_methods/suppression.htm)*

*Pancreatic, biliary tract and duodenal cancer age-standardised mortality rates by remoteness of residence  
Year of diagnosis 2011-2013*

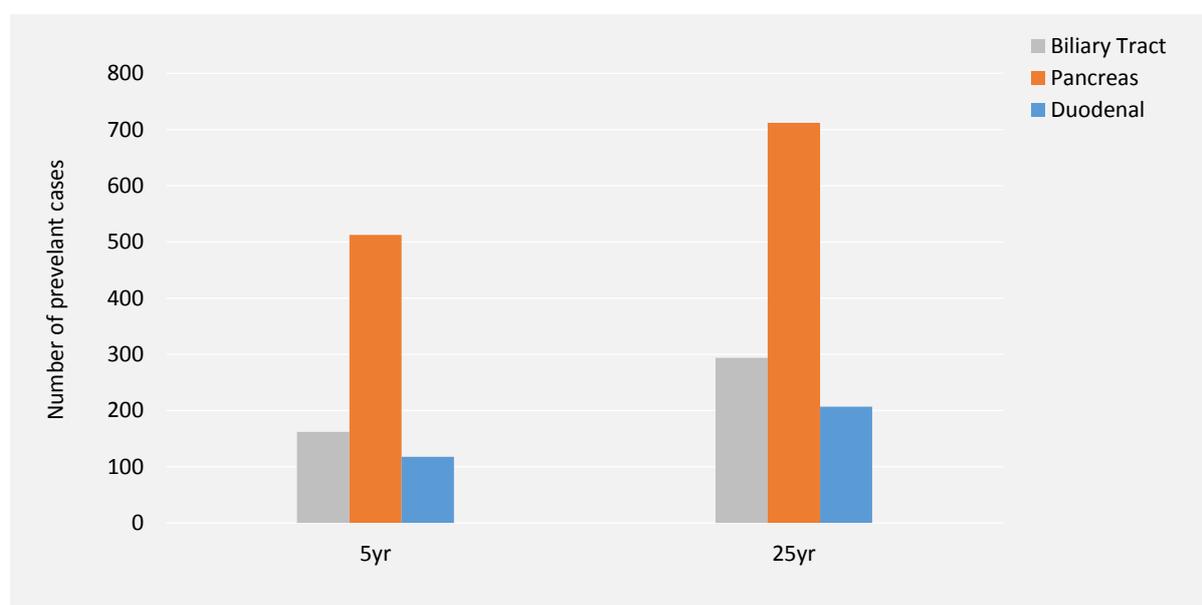


Source: Oncology Analysis System, Queensland Cancer Control Analysis Team  
Note: Mortality rates with fewer than 16 cases should be treated with caution

## Prevalence

Prevalence represents the number of people living with a cancer and is a measure of the burden of the disease for the individual, families and society. Pancreatic, biliary tract and duodenal cancer prevalence is increasing as more people are diagnosed and survival improves. At the end of 2013, nearly 800 people were living with a diagnosis of pancreatic, biliary tract and duodenal cancer in the previous five years.

*Prevalence of pancreatic, biliary tract and duodenal cancer, by time since diagnosis  
Year of diagnosis 2013*



Source: Oncology Analysis System, Queensland Cancer Control Analysis Team

**Prevalence of pancreatic, biliary tract and duodenal cancer, by time since diagnosis  
Year of diagnosis 2013**

	Pancreatic		Biliary tract		Duodenal	
	Male	Female	Male	Female	Male	Female
<b>5 year</b>	271	242	97	65	69	49
<b>25 year</b>	367	345	182	112	116	91

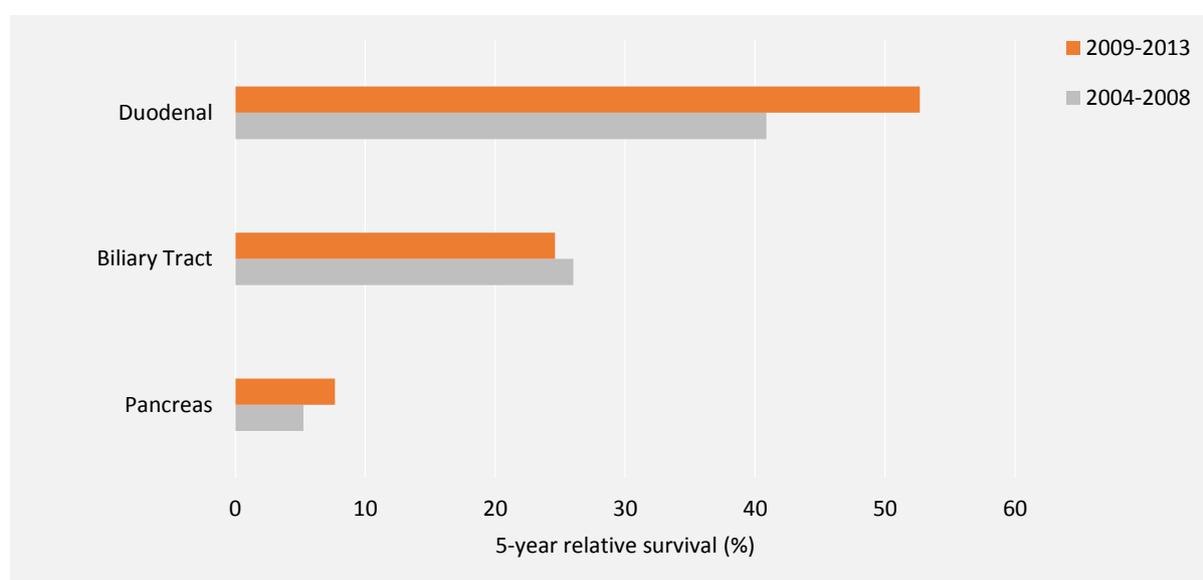
Source: Oncology Analysis System, Queensland Cancer Control Analysis Team

## Survival

Relative survival is a measure of the survival of a group of people with a condition, such as cancer, relative to a comparable group from the general population without the condition. For cancer, five-year relative survival represents the proportion of patients alive five years after diagnosis, taking into account age, gender and year of diagnosis.

The average five-year relative survival for pancreatic cancer between 2009–2013 was 8%, biliary tract cancer was 25% and duodenal cancer was 53%.

### *5 year relative survival for pancreatic, biliary tract and duodenal cancer Year of diagnosis 2009-2013 and 2004-2008*



Source: Oncology Analysis System, Queensland Cancer Control Analysis Team

## Part 2

### Pancreatic, Biliary Tract & Duodenal Cancer

#### Overview by Hospital and Health Service



## Patient Characteristics

In this section an overview of incidence and mortality is presented for the fifteen Hospital and Health Services (HHS) in Queensland for the time period 2011-2013.

The median age for pancreatic, biliary tract & duodenal patients in Queensland was 72 with a range of 55-79 years across HHS. Pancreatic, biliary tract & duodenal cancer was generally more common in males representing between 36-71% of incidence across the state. The majority of pancreatic, biliary tract & duodenal cancer patients resided in Metro South and Metro North who contributed 39% of the total incidence. Socioeconomic status, varied across Queensland.

Pancreatic, biliary tract and duodenal cancer patient characteristics, by Hospital and Health Service  
Year of diagnosis annual average 2011-2013

	<b>Incidence annual average 2011-2013</b>	<b>Median age</b>	<b>% Male</b>	<b>% Disadvantaged</b>	<b>% Indigenous</b>	<b>% With Comorbidity</b>	<b>% Public</b>
Metro South	139	69 yrs	49%	16%	1%	43%	53%
Metro North	113	73 yrs	54%	15%	1%	47%	48%
Gold Coast	88	72 yrs	53%	6%	1%	42%	43%
Sunshine Coast	66	74 yrs	54%	9%	1%	43%	49%
Darling Downs	45	73 yrs	52%	44%	1%	55%	44%
Wide Bay	40	72 yrs	53%	86%	1%	54%	55%
West Moreton	33	71 yrs	48%	60%	5%	43%	55%
Cairns and Hinterland	30	71 yrs	43%	41%	5%	39%	66%
Townsville	29	70 yrs	64%	28%	4%	51%	58%
Central Queensland	25	70 yrs	51%	31%	3%	37%	59%
Mackay	14	72 yrs	56%	30%	2%	44%	63%
South West	4	69 yrs	71%			43%	67%
North West	2	56 yrs	71%	100%		57%	83%
Central West	1	55 yrs	50%	25%		25%	75%
Torres and Cape	1	60 yrs	50%	100%	50%	75%	100%
Qld Unknown	5	79 yrs	36%			55%	79%
<b>Queensland</b>	<b>636</b>	<b>72 yrs</b>	<b>52%</b>	<b>26%</b>	<b>2%</b>	<b>45%</b>	<b>52%</b>

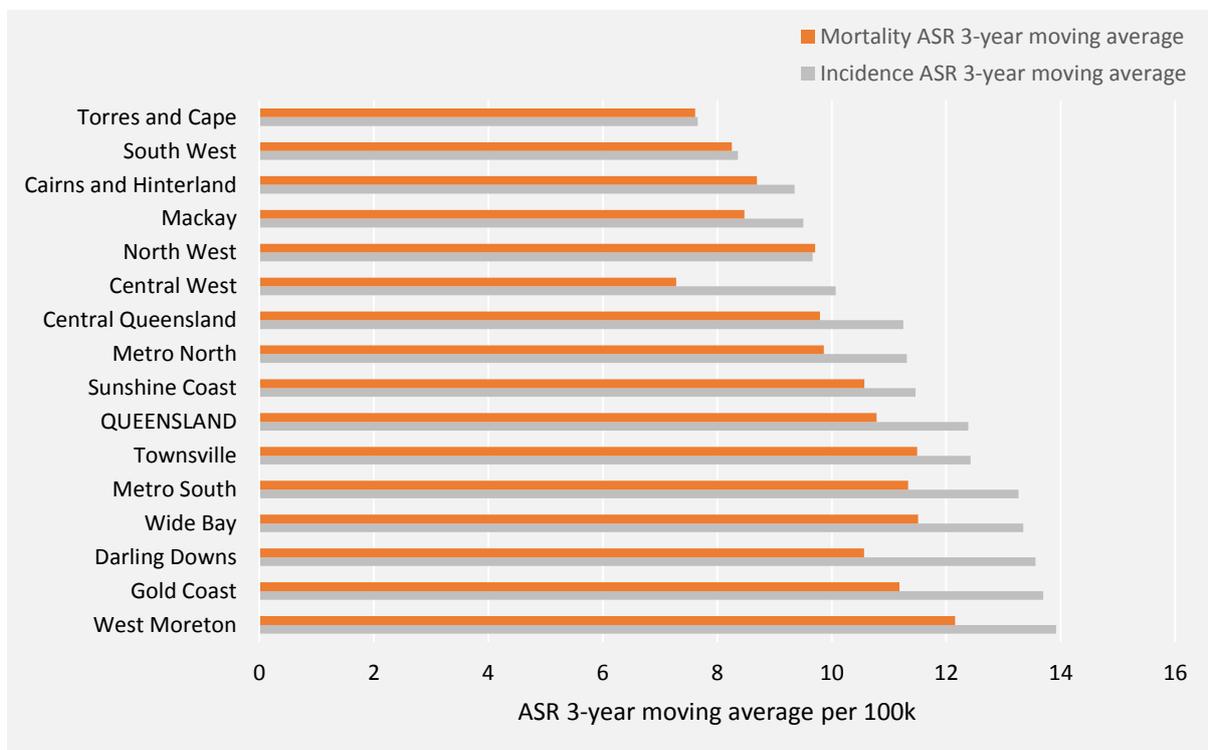
Source: Oncology Analysis System, Queensland Cancer Control Analysis Team

## Incidence and Mortality by patient residence

Age-standardised incidence and mortality rates vary across the state depending on patient residence. Reasons for the variations are diverse and complex and include exposure to environmental factors, socioeconomic status, access to health services and chance. It should be noted that remote Hospital and Health Services have small populations and estimates of mortality rates based on such small numbers may not be as accurate as those for areas with larger populations.

Pancreatic, biliary tract & duodenal cancer age-standardised incidence rates are highest in the West Moreton Hospital and Health Services with 14.9 per 100,000 diagnosed. Mortality rates were also highest in the West Moreton area with 12.4 per 100,000 deaths. The South West Hospital and Health Services experienced the lowest age-standardised incidence while the Central West experienced the lowest mortality rates.

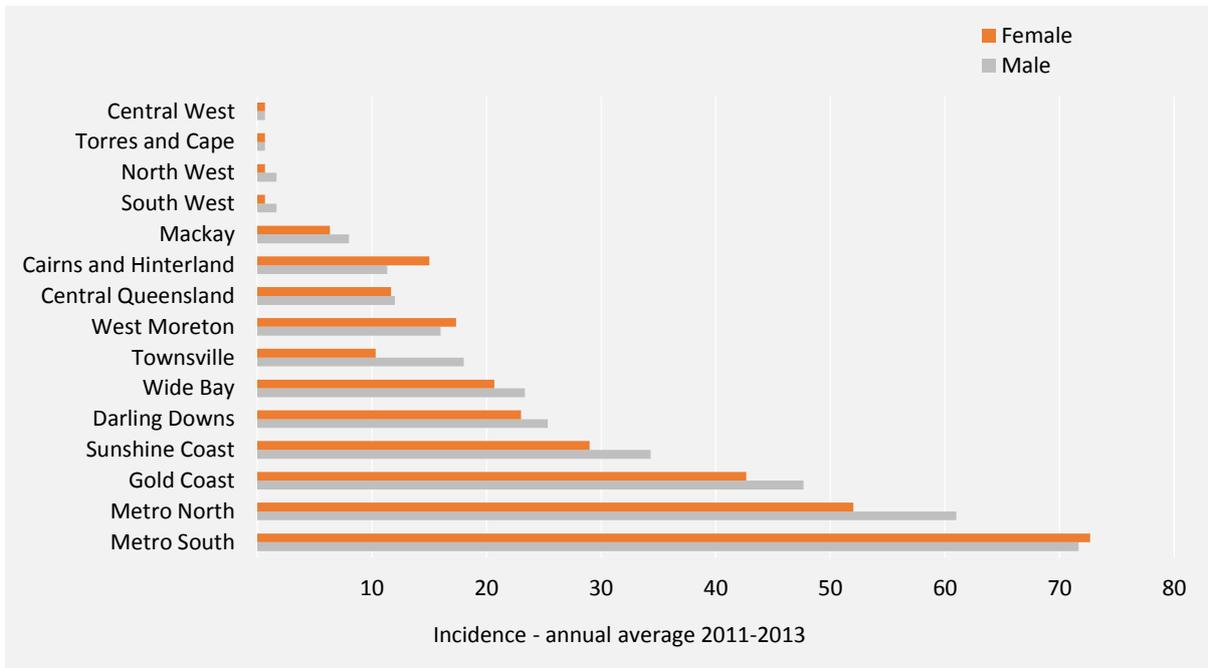
*Pancreatic, biliary tract and duodenal cancer Age Standardised Rate 3-year moving average by HHS  
Year of diagnosis 2011-2013*



Source: Oncology Analysis System, Queensland Cancer Control Analysis Team

Pancreatic, biliary tract and duodenal cancer annual incidence (2011-2013) is highest for residents of the Metro South and Metro North Hospital and Health Services accounting for 23% and 18% for the state’s incidence respectively.

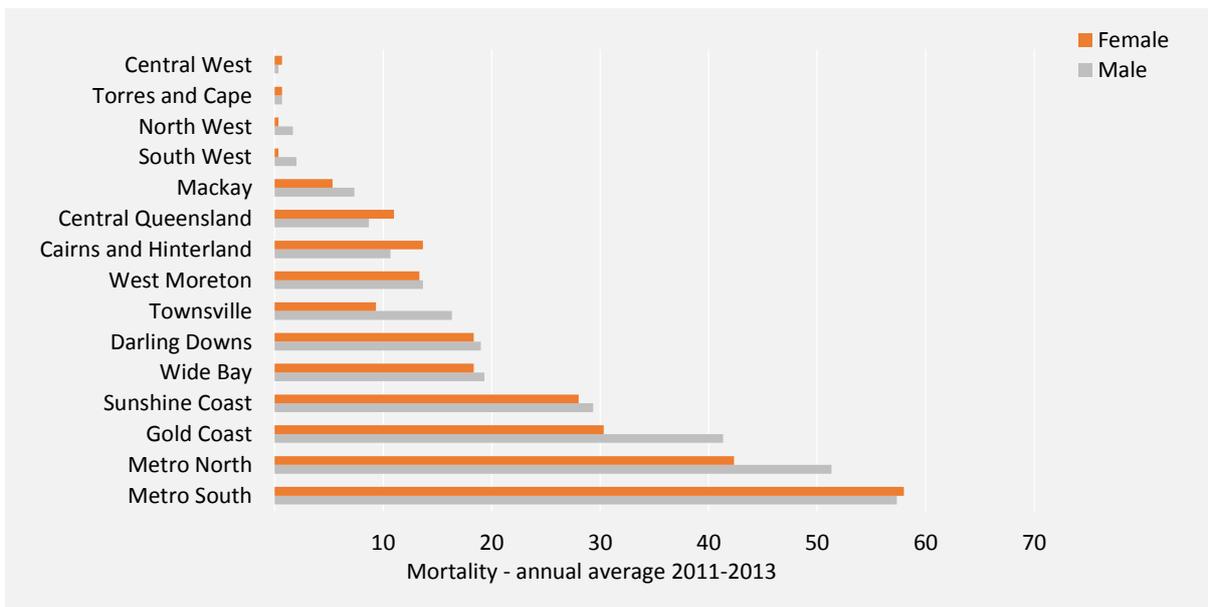
**Pancreatic, biliary tract and duodenal cancer annual average incidence by HHS of Residence**  
 Year of diagnosis 2011-2013



Source: Oncology Analysis System, Queensland Cancer Control Analysis Team

Similar to incidence, the average annual mortality (2011-2013) is highest for residents of the Metro South and Metro North Hospital and Health Services accounting for 22% and 18% of the state’s mortality respectively.

**Pancreatic, biliary tract and duodenal cancer annual average mortality by HHS Residence**  
 Year of diagnosis 2011-2013

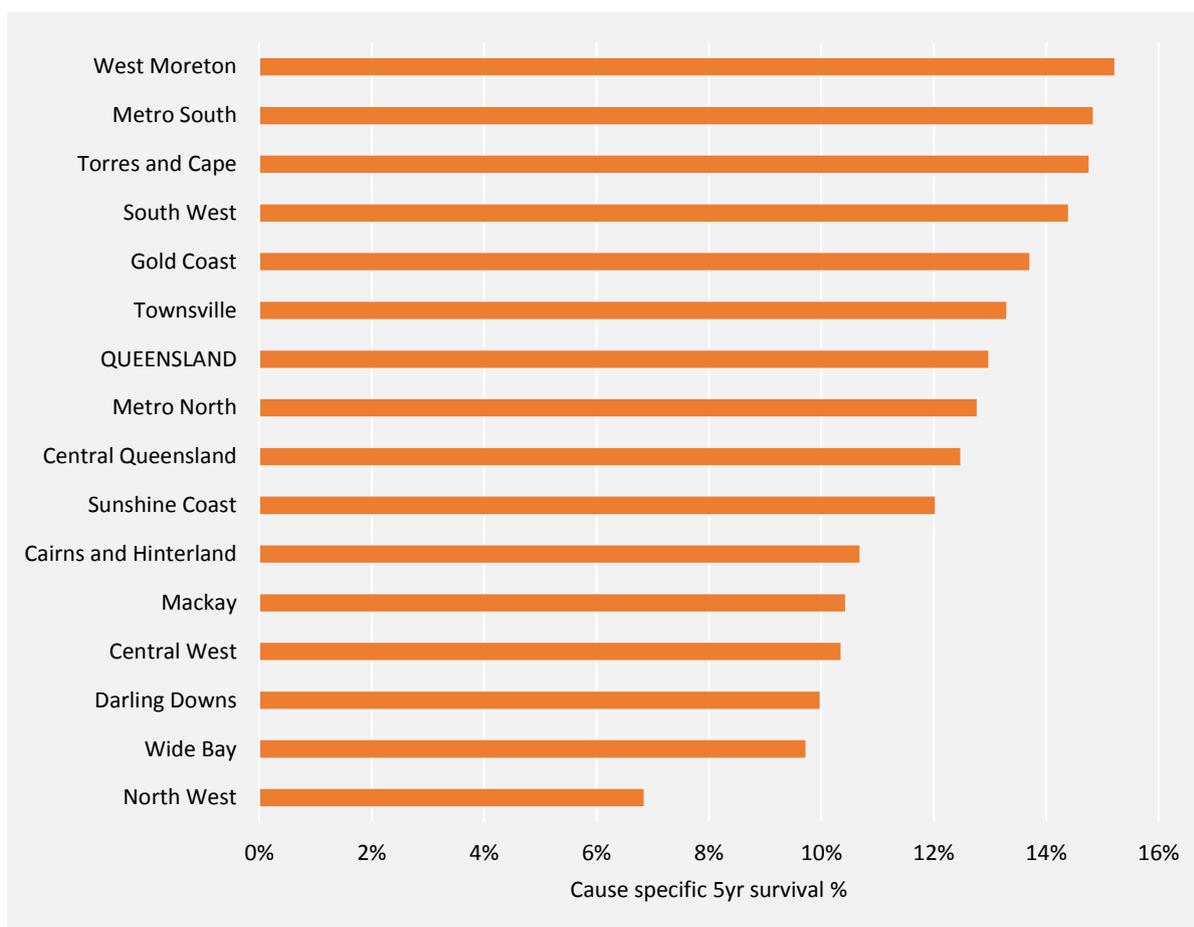


Source: Oncology Analysis System, Queensland Cancer Control Analysis Team

## Survival by patient residence

There is some regional variation in cause specific 5-yr survival of Queensland pancreatic, biliary tract & duodenal cancer across the state depending on patient residence. Those who reside in the North West Hospital and Health Services geographical area represented the lowest 5 year survival percentage of 7% and residents of the Torres and Cape York, Metro South and West Moreton Hospital and Health Services had the highest at 15%.

### *Pancreatic, biliary tract and duodenal cancer cause specific survival by HHS of residence Year of diagnosis 1982-2013*



Source: Oncology Analysis System, Queensland Cancer Control Analysis Team

## Part 3

### A Surgical Overview 2004 – 2013:

### Pancreaticoduodenectomy



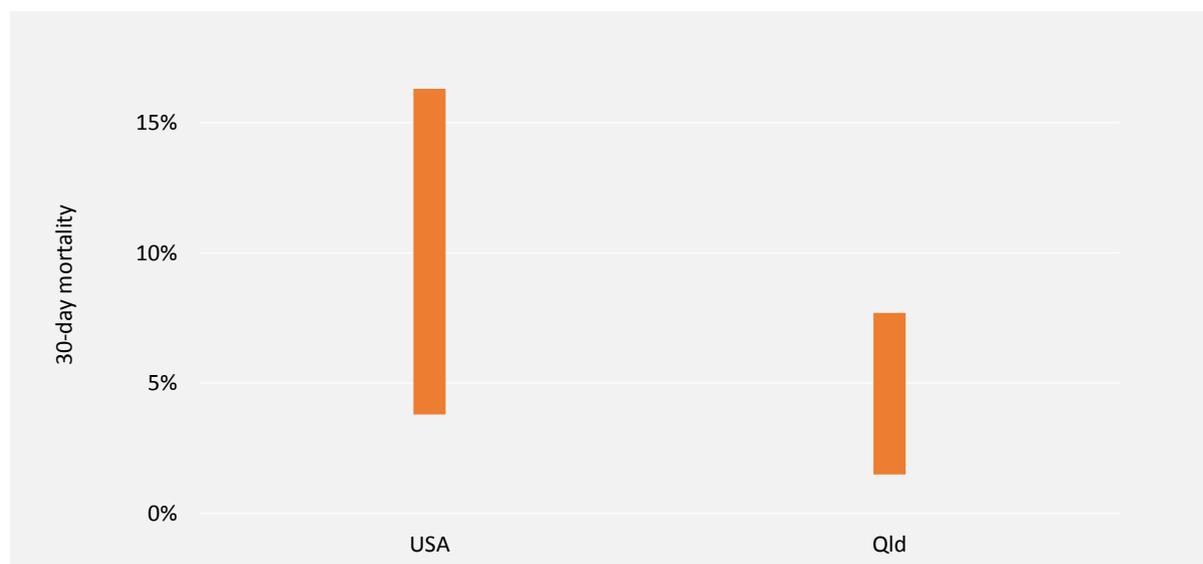
## Introduction

Pancreaticoduodenectomy is a complex operation primarily performed for patients diagnosed with pancreatic, biliary tract and duodenal cancer. Studies have shown that patients undergoing complex surgeries have better outcomes at hospitals that perform such procedures in large volumes.<sup>1</sup> Most of these studies were conducted in the US and UK, where average hospital volumes are larger than in Australia. Results from similar studies in this country have been inconsistent, possibly due to heterogeneity in the range of volumes as well as in the types of surgeries and outcomes examined.

The higher risk of postoperative death in low volume hospitals has led to the centralisation of pancreaticoduodenectomy surgery in the UK, US and the Netherlands.<sup>2,3,4</sup> A study published in April 2002 edition of the New England Journal of Medicine based on pancreaticoduodenectomy surgical mortality in the US found operative mortality rates to be four times higher (16.3 vs 3.8 percent) at low-volume hospitals (averaging less than one pancreaticoduodenectomy per year) compared to high-volume (16 or more per year).<sup>2</sup> The operative mortality rates ratio for Qld of low-volume hospitals compared to medium-volume is consistent with the US.

Compared to other countries, Queensland has a low 30 day postoperative mortality rate for pancreaticoduodenectomy of 2.7%. Despite this, there is variation in the outcomes of pancreaticoduodenectomy in Queensland, indicating that volume-outcome trends exist in Queensland.

### *Pancreaticoduodenectomy 30 day postoperative mortality rate variance for USA and Queensland*



<sup>1</sup> Gruen RL, Pitt V, Green S, Parkhill A, Campbell D, Jolley D. The effect of provider case volume on cancer mortality: Systematic Review and Meta-analysis. *CA Cancer J Clin* 2009; 59: 192-211.

<sup>2</sup> Birkmeyer JD, Siewers AE, Finlayson EV, Stukel TA, Lucas FL, Batista I, et al. Hospital volume and surgical mortality in the United States. *N Engl J Med* 2002 Apr 11;346(15):1128-37

<sup>3</sup> Elberm H, Hooper J, Badran A, Shamali A, Johnson C, Abu-Hilal M. Centralisation of pancreatic surgery services in central south coast, the UK model. *Pancreatology*, Volume 14, Issue 3, Pages S37-S38

<sup>4</sup> Gooiker GA, van der Geest LGM, Wouters MWJM, et al. Quality Improvement of Pancreatic Surgery by Centralization in the Western Part of the Netherlands. *Annals of Surgical Oncology* 2011;18(7):1821-1829. doi:10.1245/s10434-010-1511-4.

## Pancreaticoduodenectomy cohort

Population	Queensland residents
Year of diagnosis	2004-2013
Diagnosis	Invasive pancreatic (C25), biliary tract (C24) or duodenal cancer (C17)
Procedure	Pancreaticoduodenectomy with formation of stoma*
Sector	Public and private
Gender	All

\*Distal pancreatectomy has been excluded in this cohort. Please refer to appendix 1 for further information.

Of the Queensland patients with pancreatic, biliary tract and duodenal cancer diagnosed between 2004 and 2013, 13% underwent pancreaticoduodenectomy. The mean age for surgery is 64 years, compared to 73 years for those who did not undergo surgery. Adenocarcinoma was the most common morphology in pancreatic, biliary tract and duodenal cancers.

Pancreatic, biliary tract and duodenal cohort Year of diagnosis 2004-2013			
	Had pancreaticoduodenectomy	No pancreaticoduodenectomy	All
Incidence	745	4,896	5,641
Median age at diagnosis	64 yrs	73 yrs	71 yrs
% male	59%	53%	54%
% with comorbidity	42%	48%	47%
% indigenous	1%	2%	2%
% disadvantaged	23%	24%	24%
% regional & remote	37%	38%	38%
% histology basis	99%	58%	63%

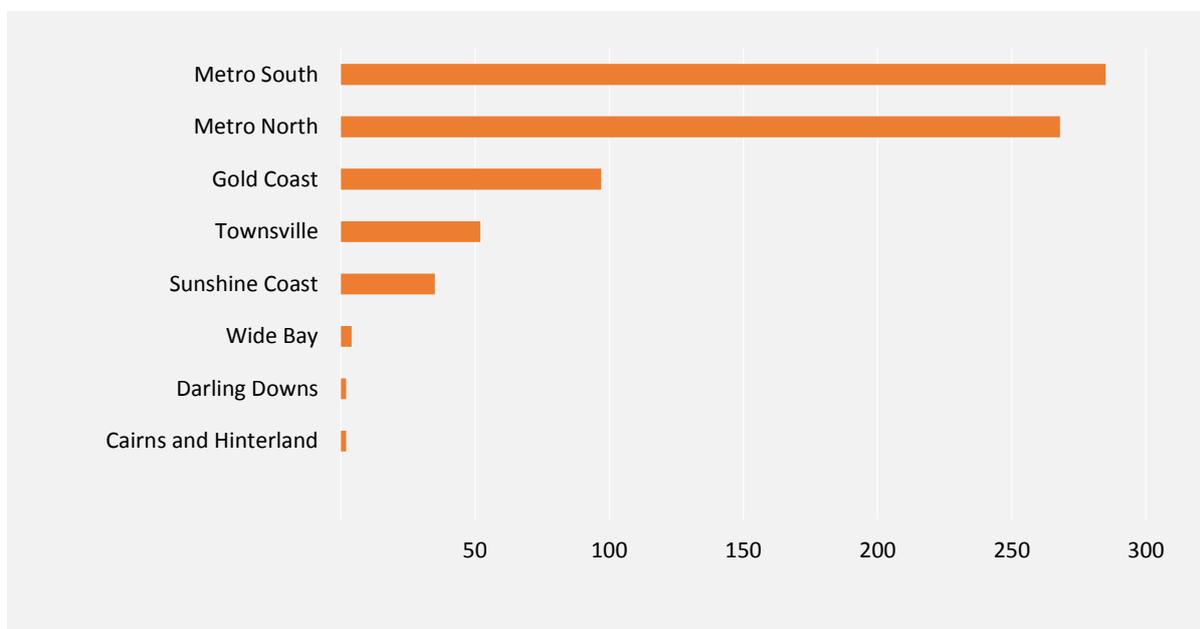
Morphological breakdown – pancreaticoduodenectomy cohort Year of diagnosis 2004-2013		
	Morphologies	All
Pancreas	Adenocarcinomas	388
	Neuroendocrine carcinomas	43
	Other carcinomas	6
Biliary Tract	Adenocarcinomas	228
	Neuroendocrine carcinomas	7
	Other carcinoma	1
Duodenum	Adenocarcinomas	62
	Neuroendocrine carcinomas	10

## Hospital and health service performing pancreaticoduodenectomy

Metro South HHS performed the most pancreaticoduodenectomies for patients diagnosed between 2004-2013, accounting for 38% of the total, followed by Metro North HHS with 36% of the total.

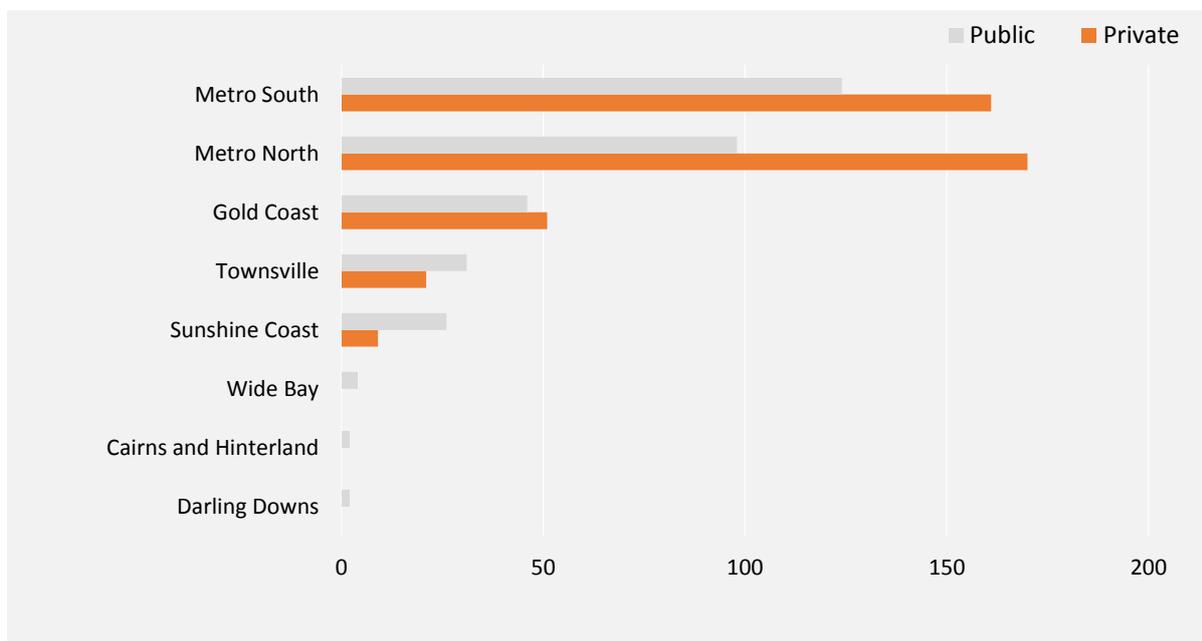
Almost half (45%) of all pancreaticoduodenectomies were performed in the public health sector, but the proportion varies across health services. In the Metro South, Metro North and Gold Coast HHS more surgeries were performed in the private sector, while in many rural and regional health services, more surgeries were performed in the public sector.

*Number of pancreaticoduodenectomies by HHS performing surgery  
Year of diagnosis 2004-2013*



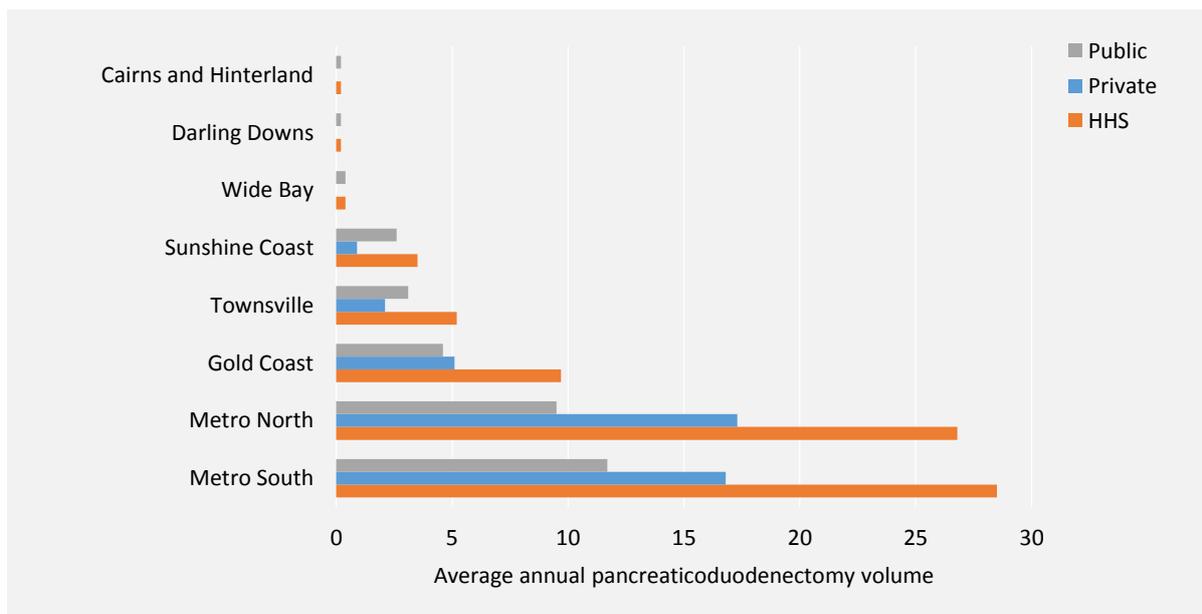
*Source: Oncology Analysis System, Queensland Cancer Control Analysis Team*

Number of pancreaticoduodenectomies by HHS performing surgery and sector (public or private)  
Year of diagnosis 2004-2013



Source: Oncology Analysis System, Queensland Cancer Control Analysis Team

Pancreaticoduodenectomy annual average by HHS performing surgery and sector (public or private)  
Year of diagnosis 2004-2013



Source: Oncology Analysis System, Queensland Cancer Control Analysis Team

## Hospital volumes

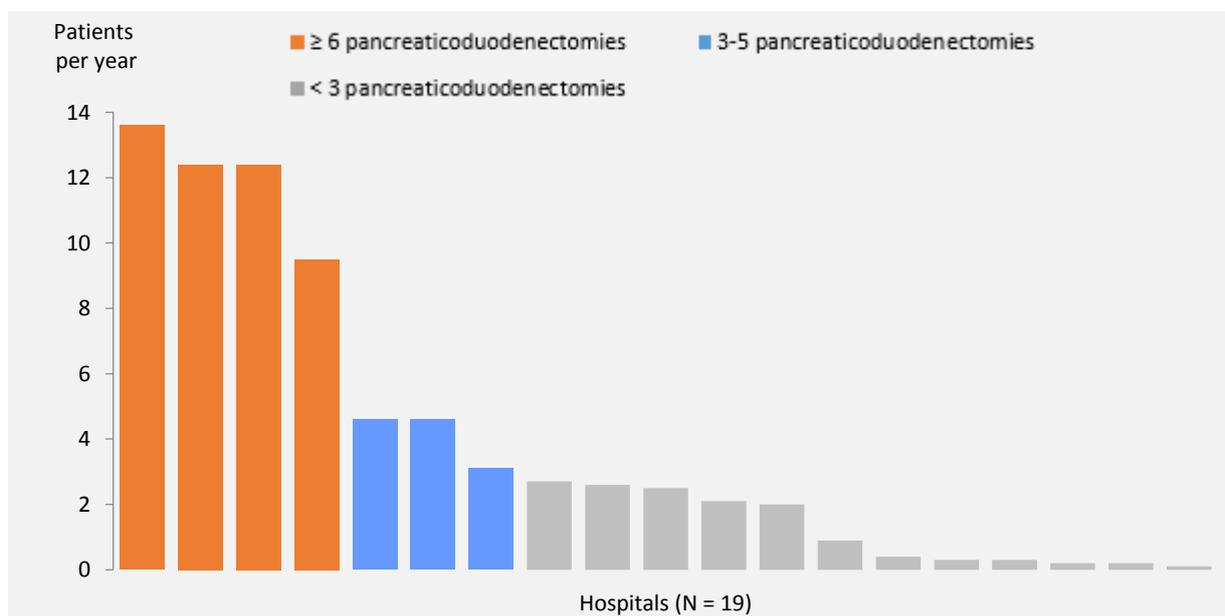
A total of 745 pancreaticoduodenectomies were performed on pancreatic, biliary tract and duodenal cancer patients diagnosed between 2004 and 2013, across 19 Queensland hospitals. On average, individual hospital pancreaticoduodenectomy volumes ranged from 0.1 to 13.6 cases per year. Four hospitals performing more than 6 per year accounted for more than half of all pancreaticoduodenectomies in the state. The majority of the other hospitals performed 2 or fewer pancreaticoduodenectomies on cancer patients per year.

On average 13 hospitals performed pancreaticoduodenectomies each year for patients diagnosed between 2004 and 2013. The lowest number of hospitals performing pancreaticoduodenectomies was in 2007 with 9 hospitals and the highest was in 2004 with 17 hospitals.

Pancreaticoduodenectomy annual volume, patient characteristics and postoperative mortality  
Year of diagnosis 2004-2013

	<b>Very Low</b>	<b>Low</b>	<b>Medium</b>	<b>All</b>
Number of patients	143	123	479	745
Number of hospitals	12	3	4	19
Median length of stay (days)	18	15	15	16
ASA 3 <sup>+</sup> (%)	29	43	51	45
1-yr survival (%)	75	77	84	81
Number of inpatient deaths	10	3	8	21
Number of 30-day deaths	11	2	7	20
Number of 90-day deaths	14	5	11	30
Inpatient mortality	7.0%	2.4%	1.7%	2.8%
30-day mortality	7.7%	1.6%	1.5%	2.7%
90-day mortality	9.8%	4.1%	2.3%	4.0%
Annual volume	< 3	3 - 5	≥ 6	<1 - 13

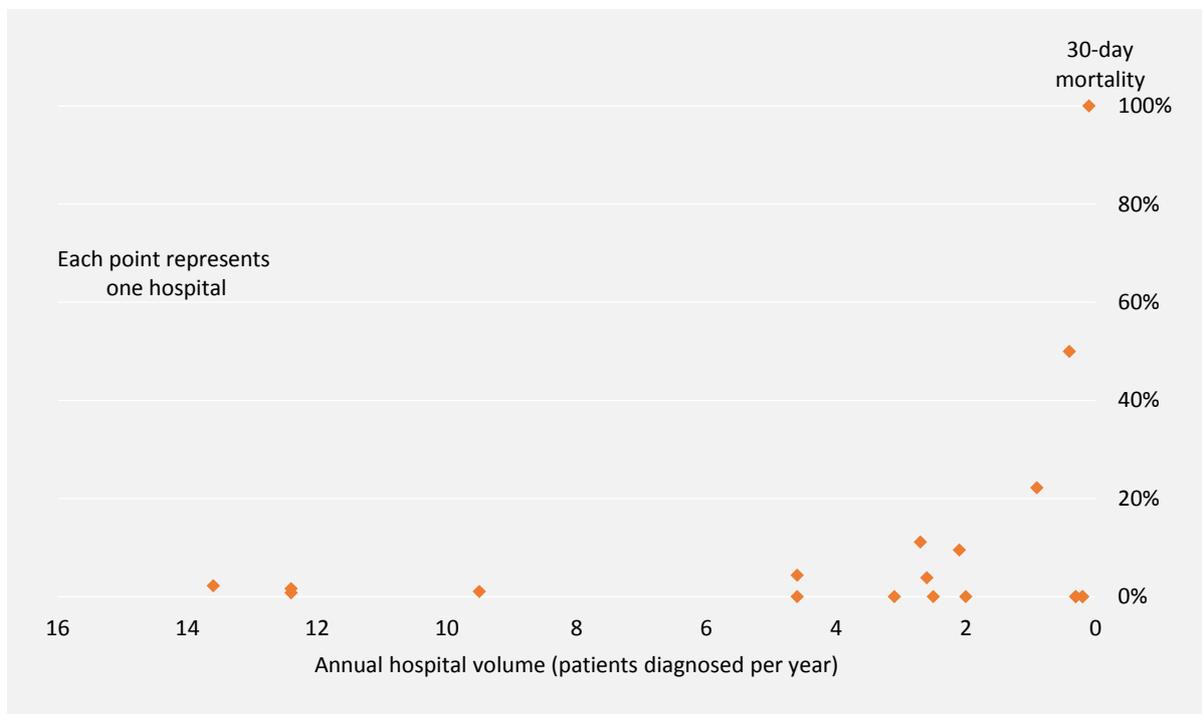
*Pancreaticoduodenectomy annual average volume by hospital  
Year of diagnosis 2004-2013*



Source: Oncology Analysis System, Queensland Cancer Control Analysis Team

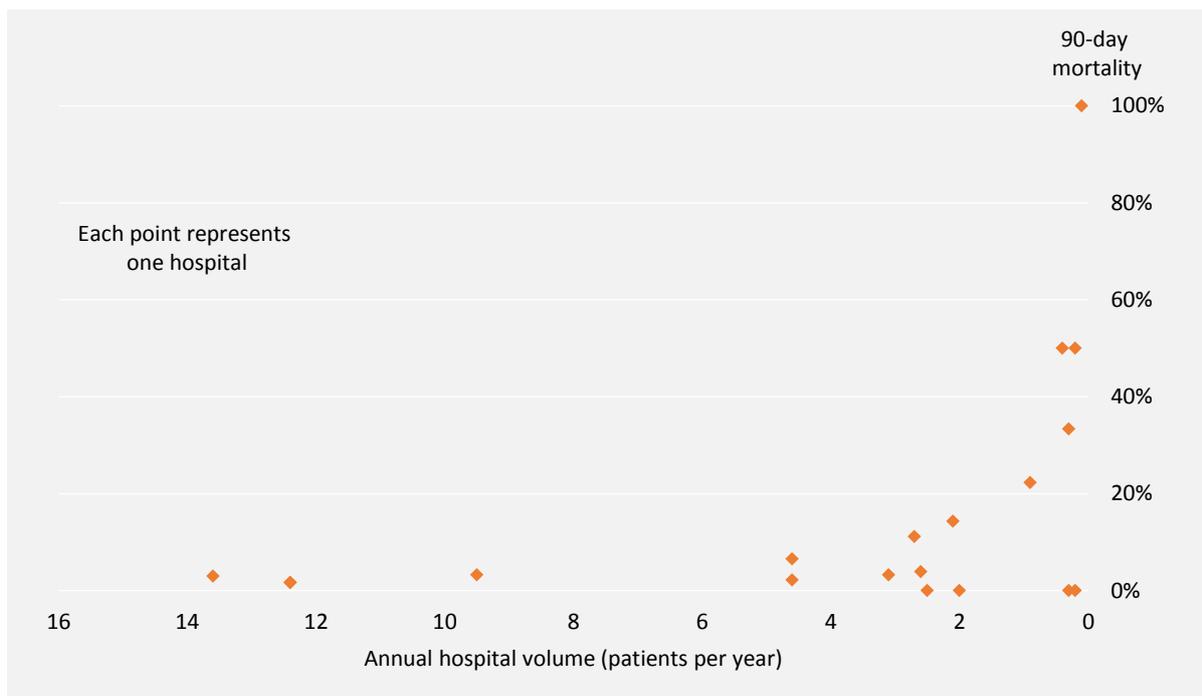


*Pancreaticoduodenectomy annual average volume and 30 day post-operative mortality  
Year of diagnosis 2004-2013*



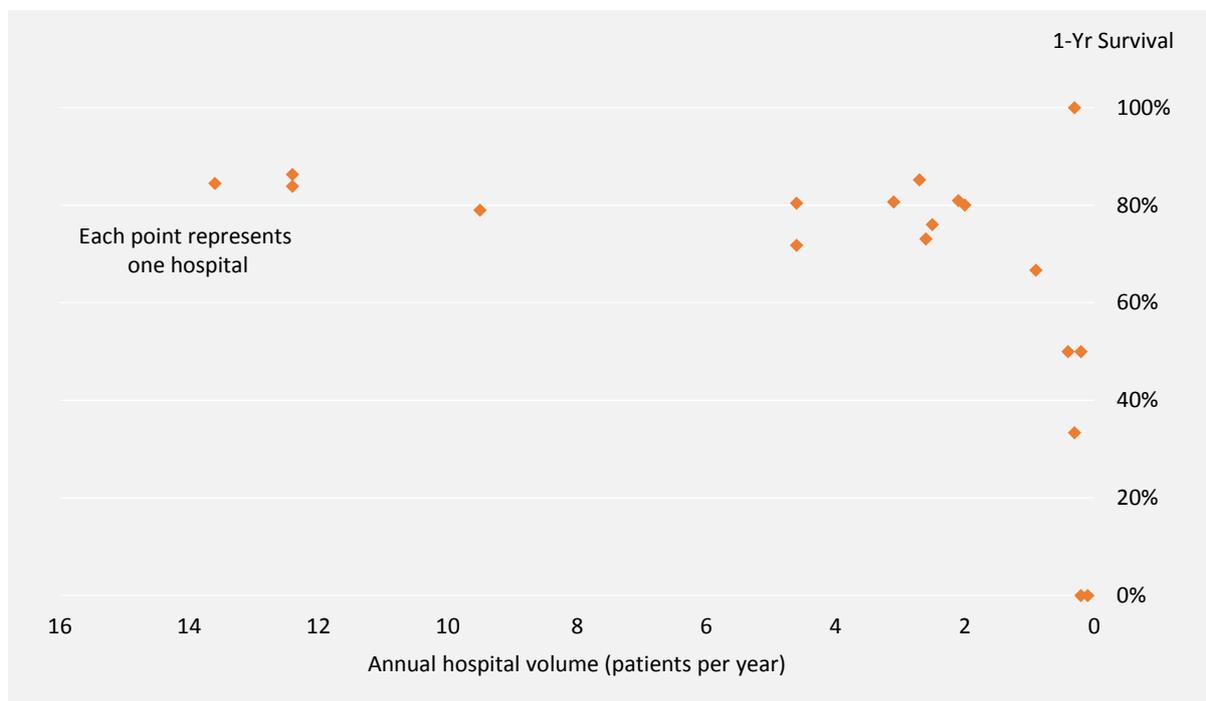
Source: Oncology Analysis System, Queensland Cancer Control Analysis Team

*Pancreaticoduodenectomy annual average volume and 90 day post-operative mortality  
Year of diagnosis 2004-2013*



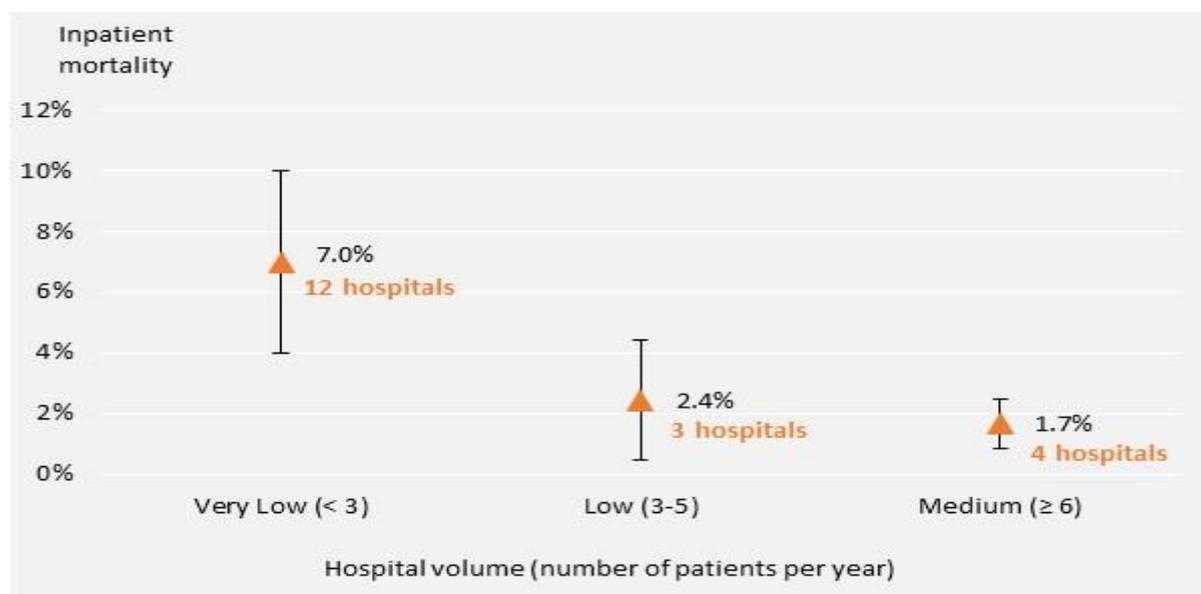
Source: Oncology Analysis System, Queensland Cancer Control Analysis Team

*Pancreaticoduodenectomy annual average volume and 1-year survival*  
*Year of diagnosis 2004-2013*



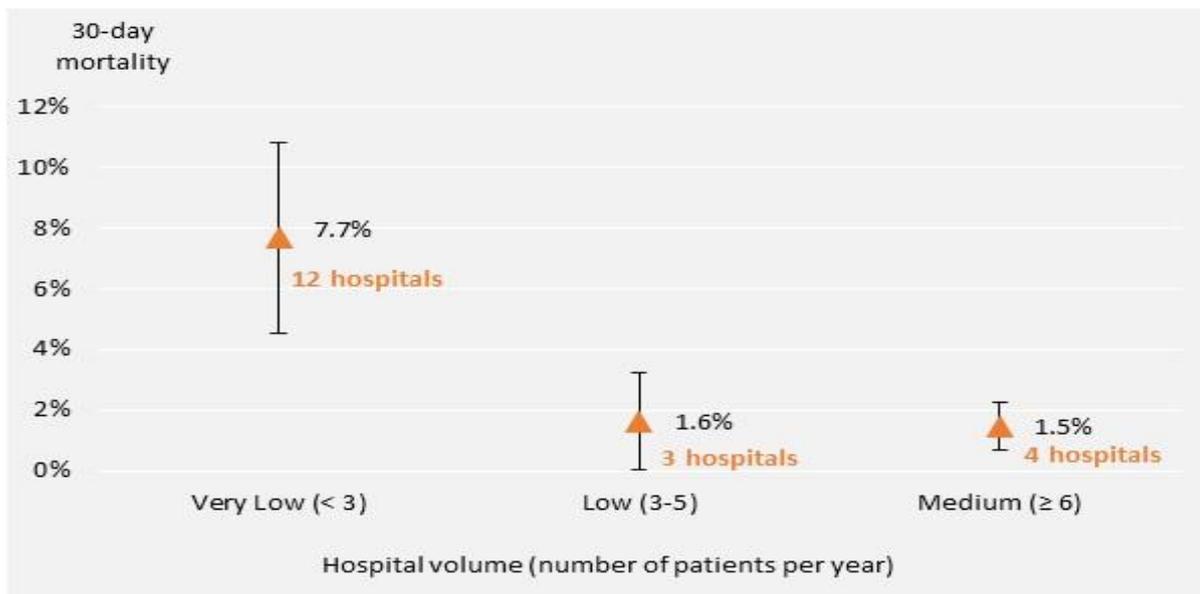
Source: Oncology Analysis System, Queensland Cancer Control Analysis Team

*Inpatient post-operative mortality by hospital volume*  
*Year of diagnosis 2004-2013*



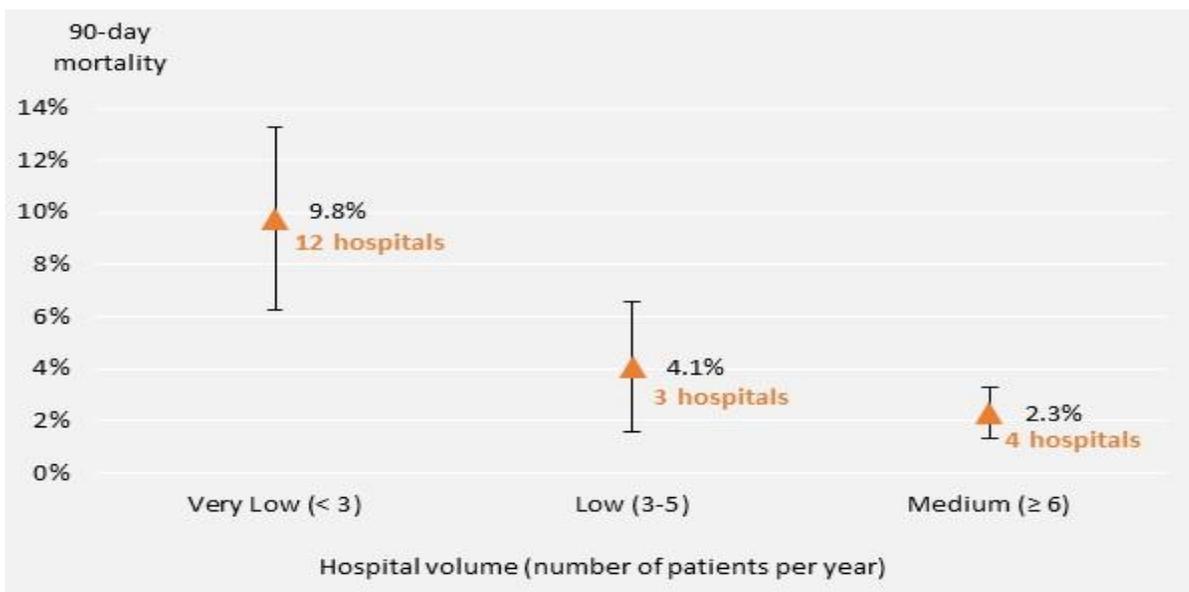
Source: Oncology Analysis System, Queensland Cancer Control Analysis Team

**30 day post-operative mortality by hospital volume**  
Year of diagnosis 2004-2013



Source: Oncology Analysis System, Queensland Cancer Control Analysis Team

**90 day post-operative mortality by hospital volume**  
Year of diagnosis 2004-2013



Source: Oncology Analysis System, Queensland Cancer Control Analysis Team

## Factors affecting postoperative mortality

In multivariate analysis, the risk of 30-day postoperative death increased with age and was greater in male patients and patients with comorbidity. Socioeconomic status and rurality were not significant determinants of 30-day surgical mortality. Emergency admission patients had better outcomes than non-emergency patients as did public patients compared to private. When adjusted for emergency admission rates, comorbidity and case-mix the risk of postoperative mortality was 5.13 times higher in very low volume hospitals.

Similar conclusions can be made with 90-day postoperative death which demonstrated increases with age, gender and comorbidity. 90-day postoperative death also increased slightly for public hospital patients and ASA 3+. Socioeconomic and rurality were not significant determinants of 90-day surgical mortality. Emergency admission patients had better outcomes than non-emergency patients. When adjusted for emergency admission rates, comorbidity and case-mix the risk of postoperative mortality was 4.90 times higher in very low volume hospitals.

The risk of in-hospital mortality after pancreaticoduodenectomy surgery increased with age, comorbidity, gender and public hospital patients. Socioeconomic status, ASA and rurality were not significant determinants of in-hospital mortality. Emergency admission patients had a better outcomes than non-emergency patients. When adjusted for emergency admission rates, comorbidity and case-mix the risk of in-hospital postoperative mortality was 4.33 times higher in very low volume hospitals.

## Risk groups

The risk of 30 day postoperative mortality was 4.3 times higher in very low volume hospitals than in medium volume hospitals. The risk of 90 day postoperative mortality was 4.1 times higher in very low volume hospital than in medium volume hospitals. The risk of in-hospital postoperative mortality was 4 times higher in very low volume hospitals.

The risk was highest in patients of very low volume hospitals, who were older than 70 and had metastatic cancer at the time of surgery. 30-day postoperative deaths among these patients accounted for 33% of all surgical mortality.

## Inpatient postoperative mortality

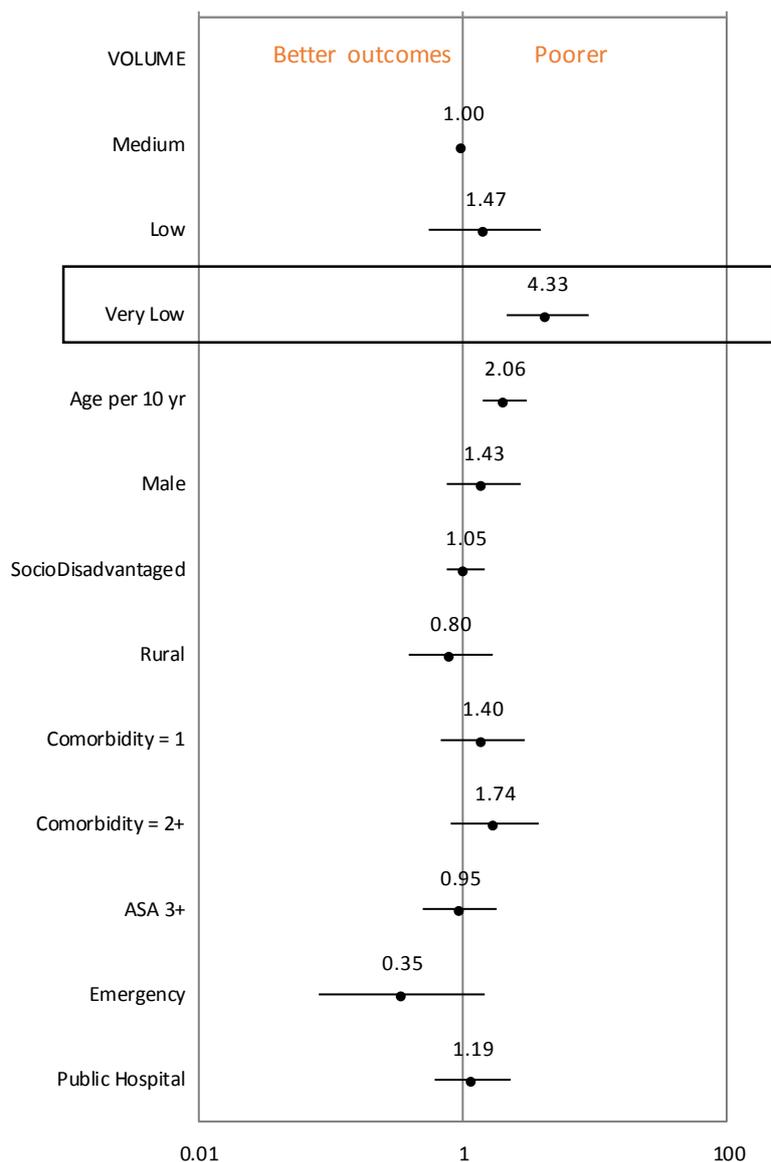
Relative risk of **inpatient** mortality post pancreaticoduodenectomy

Very low volume <3 pancreaticoduodenectomies

Low volume 3-5 pancreaticoduodenectomies

Median volume >5 pancreaticoduodenectomies

Year of diagnosis 2004-2013



Source: Queensland Cancer Control Analysis Team

\*Values are hazard ratios (HR) from multivariate Cox proportional hazards model; bars represent 95% confidence intervals.

### 30 day postoperative mortality

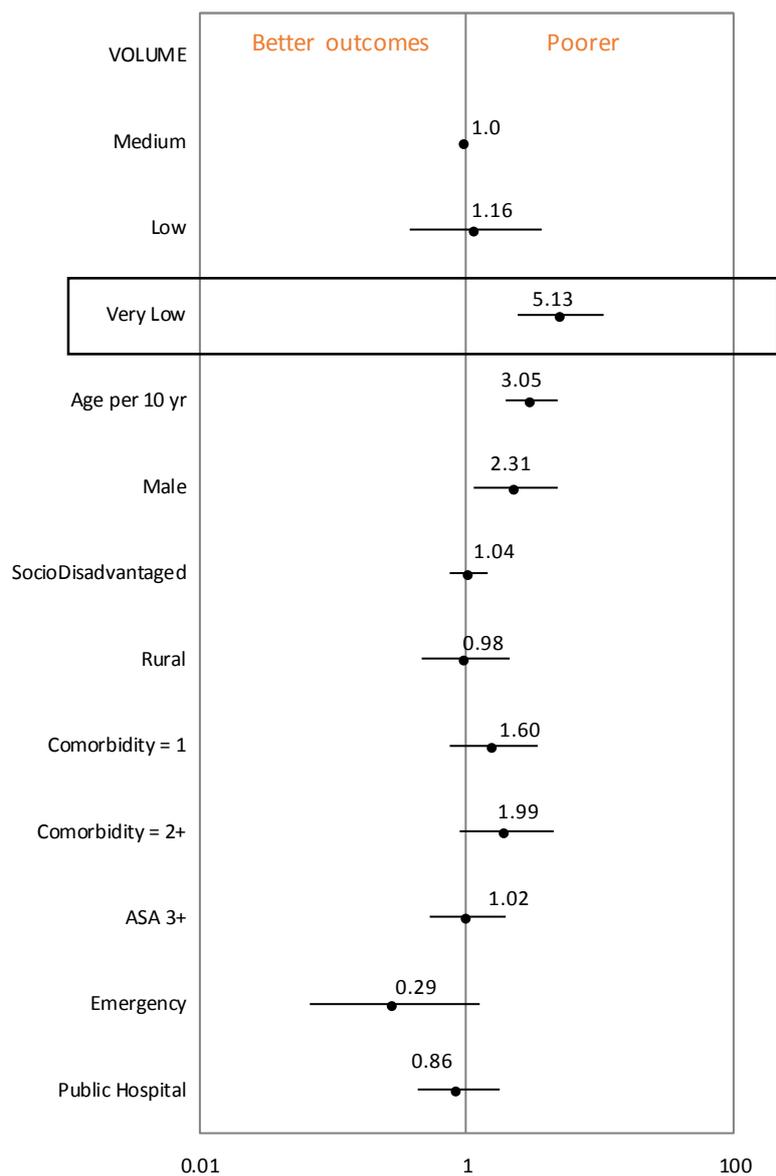
Relative risk of **30 day** mortality post pancreaticoduodenectomy

Very low volume <3 pancreaticoduodenectomies

Low volume 3-5 pancreaticoduodenectomies

Median volume >5 pancreaticoduodenectomies

Year of diagnosis 2004-2013



Source: Queensland Cancer Control Analysis Team

\*Values are hazard ratios (HR) from multivariate Cox proportional hazards model; bars represent 95% confidence intervals.

## 90 day postoperative mortality

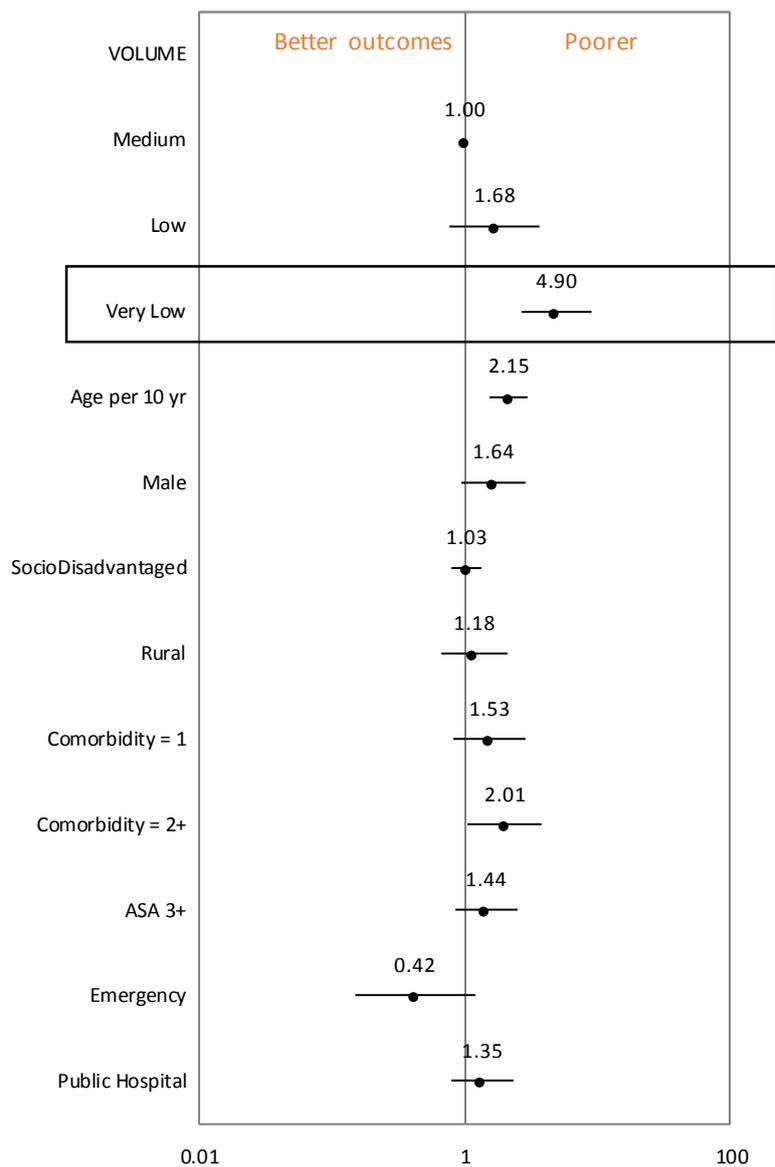
Relative risk of **90 day** mortality post pancreaticoduodenectomy

Very low volume <3 pancreaticoduodenectomies

Low volume 3-5 pancreaticoduodenectomies

Median volume >5 pancreaticoduodenectomies

Year of diagnosis 2004-2013



Source: Queensland Cancer Control Analysis Team

\*Values are hazard ratios (HR) from multivariate Cox proportional hazards model; bars represent 95% confidence intervals.

## 1 year survival

The 1-year overall survival rate in very low volume hospitals was 1.67 times lower compared to medium volume, when adjusted for case-mix. The 1-year survival rate in low volume hospitals was 1.33 times lower compared to medium volume. Among patients who had pancreaticoduodenectomy surgery private hospital patients had slightly better survival than public hospital patients as did non-emergency patients compared to emergency.

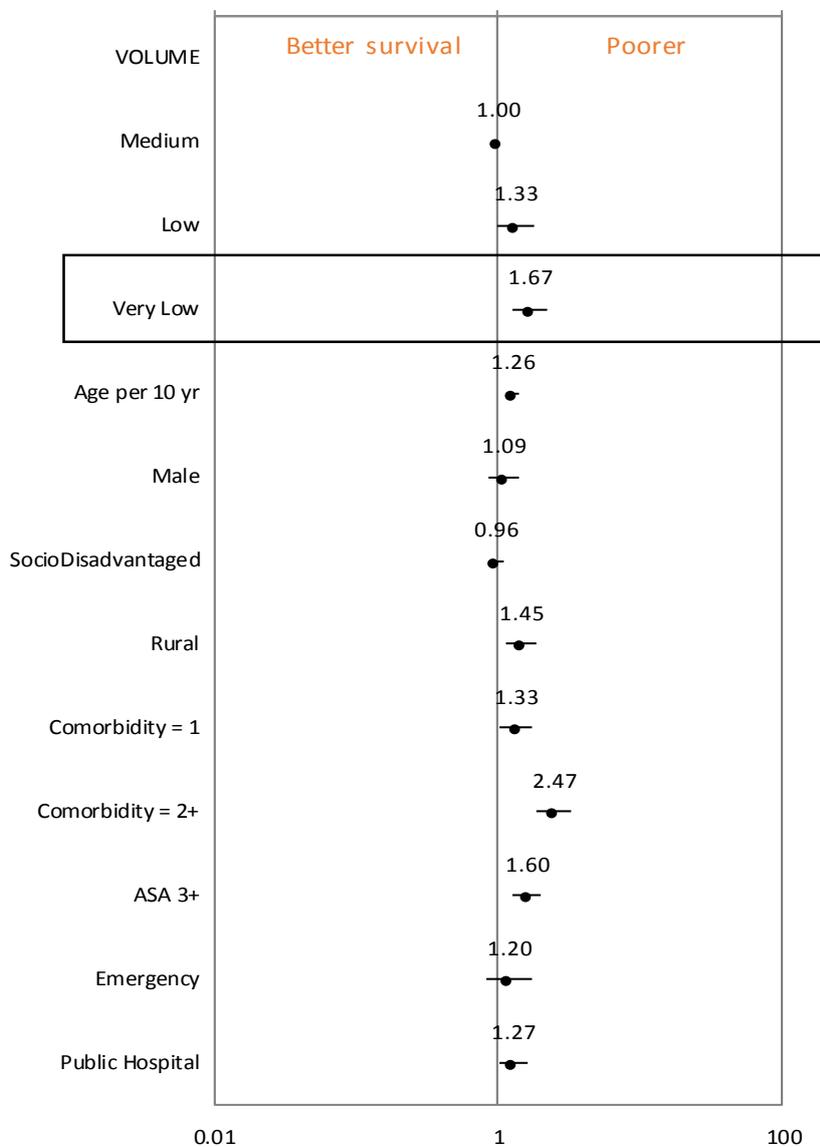
### Relative risk of 1 year survival post pancreaticoduodenectomy

Very low volume <3 pancreaticoduodenectomies

Low volume 3-5 pancreaticoduodenectomies

Median volume >5 pancreaticoduodenectomies

Year of diagnosis 2004-2013



Source: Queensland Cancer Control Analysis Team

\*Values are hazard ratios (HR) from multivariate Cox proportional hazards model; bars represent 95% confidence intervals.

## 2 year survival

The 2-year overall survival rate in very low volume hospitals was 1.34 times lower compared to medium volume, when adjusted for case-mix. The 2-year survival rate in low volume hospitals was 1.09 times lower compared to medium volume. Among patients who had pancreaticoduodenectomy surgery private hospital patients had slightly better survival than public hospital patients as did non-emergency patients compared to emergency.

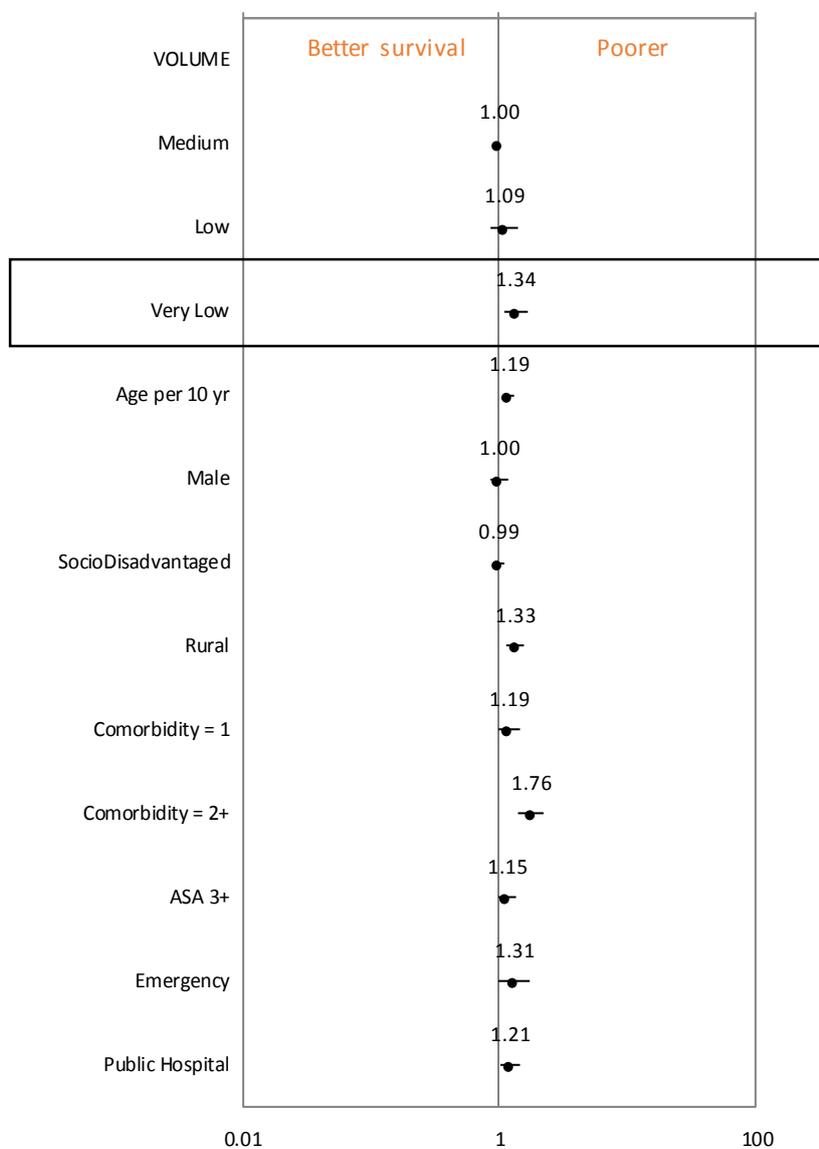
### Relative risk of 2 year survival post pancreaticoduodenectomy

Very low volume <3 pancreaticoduodenectomies

Low volume 3-5 pancreaticoduodenectomies

Median volume >5 pancreaticoduodenectomies

Year of diagnosis 2004-2013



Source: Queensland Cancer Control Analysis Team

\*Values are hazard ratios (HR) from multivariate Cox proportional hazards model; bars represent 95% confidence intervals.

## 5 year survival

The 5-year overall survival rate in very low volume hospitals was 1.11 times lower compared to medium volume, when adjusted for case-mix. Among patients who had pancreaticoduodenectomy surgery private hospital patients had slightly better survival than public hospital patients as did non-emergency patients compared to emergency.

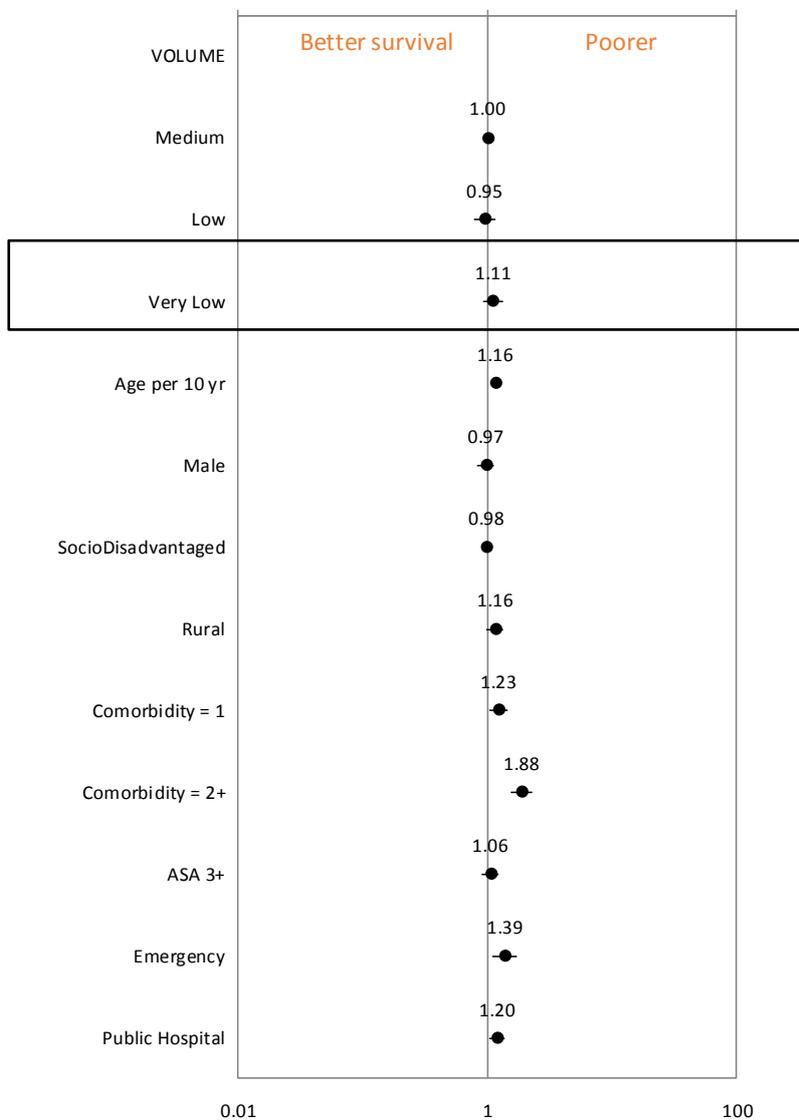
### Relative risk of 5 year survival post pancreaticoduodenectomy

Very low volume <3 pancreaticoduodenectomies

Low volume 3-5 pancreaticoduodenectomies

Median volume >5 pancreaticoduodenectomies

Year of diagnosis 2004-2013



Source: Queensland Cancer Control Analysis Team

\*Values are hazard ratios (HR) from multivariate Cox proportional hazards model; bars represent 95% confidence intervals.

## All-Cause Survival

The duodenal cancer cohorts had the highest all-cause survival rates with 88%, 74% and 57% for 1-year, 2 year and 5-year survival respectively. The pancreatic cancer cohort had the lowest all-cause survival rates with 77%, 54% and 29% for 1-year, 2-year and 5-year survival respectively. Cause specific survival rates followed the same pattern with the highest rates in duodenal cancer cohort and lowest in pancreatic cancer cohort.

Pancreatic, biliary tract and duodenal cohort surgeries and all-cause survival rates  
Year of diagnosis 2004-2013

	Number of Surgeries	1-Year Survival	2-Year Survival	5-Year Survival
<b>Pancreas</b>	437	77%	54%	29%
Adenocarcinoma	388	74%	49%	22%
Neuroendocrine	43	100%	98%	92%
Other	6	83%	83%	83%
<b>Biliary Tract</b>	236	87%	71%	53%
Adenocarcinoma	228	86%	71%	52%
Neuroendocrine	7	100%	86%	86%
Other	1	100%	100%	-
<b>Duodenum</b>	72	88%	74%	57%
Adenocarcinoma	62	85%	70%	55%
Neuroendocrine	10	100%	100%	67%
<b>Total</b>	745	81%	62%	40%

*\*To allow the calculation of 5-year survival, some patients within the cohort must have been diagnosed over five years prior to the end of the follow-up period.*

## Cause Specific Survival

Pancreatic, biliary tract and duodenal cohort surgeries and cause specific survival rates  
Year of diagnosis 2004-2013

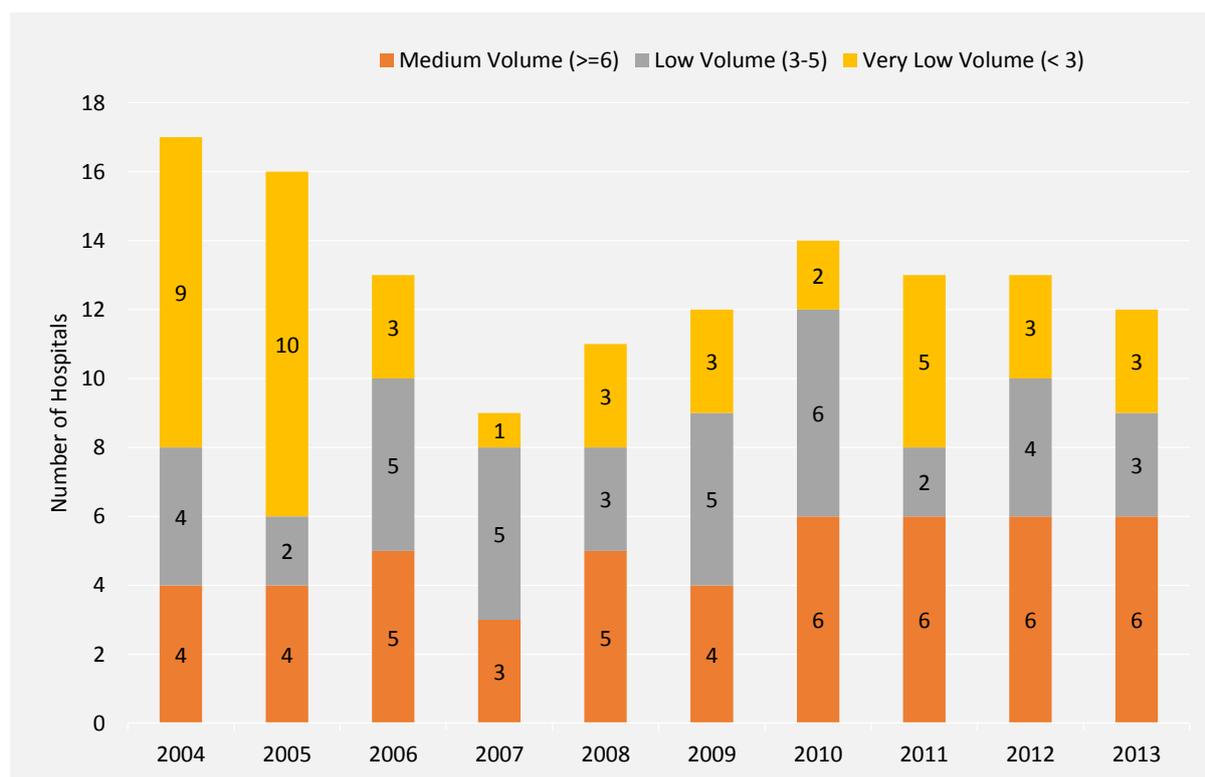
	Number of Surgeries	1-Year Survival	2-Year Survival	5-Year Survival
<b>Pancreas</b>	437	79%	59%	35%
Adenocarcinoma	388	76%	54%	27%
Neuroendocrine	43	100%	100%	100%
Other	6	83%	83%	83%
<b>Biliary Tract</b>	236	88%	75%	58%
Adenocarcinoma	228	88%	74%	57%
Neuroendocrine	7	100%	86%	86%
Other	1	100%	100%	-
<b>Duodenum</b>	72	89%	77%	64%
Adenocarcinoma	62	87%	73%	59%
Neuroendocrine	10	100%	100%	100%
<b>Total</b>	745	83%	66%	46%

## Hospital Volumes 2003-2008 vs 2009-2013

In years 2009-2013, 430 pancreaticoduodenectomies were performed for pancreatic, biliary tract and duodenal cancer in Queensland compared to 315 pancreaticoduodenectomies in years 2004-2008. The average annual hospital volume ranged from 0.2 to 18 cases per year between 2009-2013 whereas the average annual hospital volume ranged from 0.2 to 8.5 cases per year between 2004-2008.

Although there was a relationship between volume and operative mortality, this analysis does not allow an assessment of a threshold for a change in the outcome. However, when assessing lower volumes between 2004-2008, 13 hospitals performed less than three pancreaticoduodenectomies annually. In 2009-2013 six hospitals continued to perform less than three pancreaticoduodenectomies per year. Hence overall there are less hospitals each year in the current five years performing less than 3 pancreaticoduodenectomies than there were in 2004-2008 (particularly compared to the first 2 years 2004-2005).

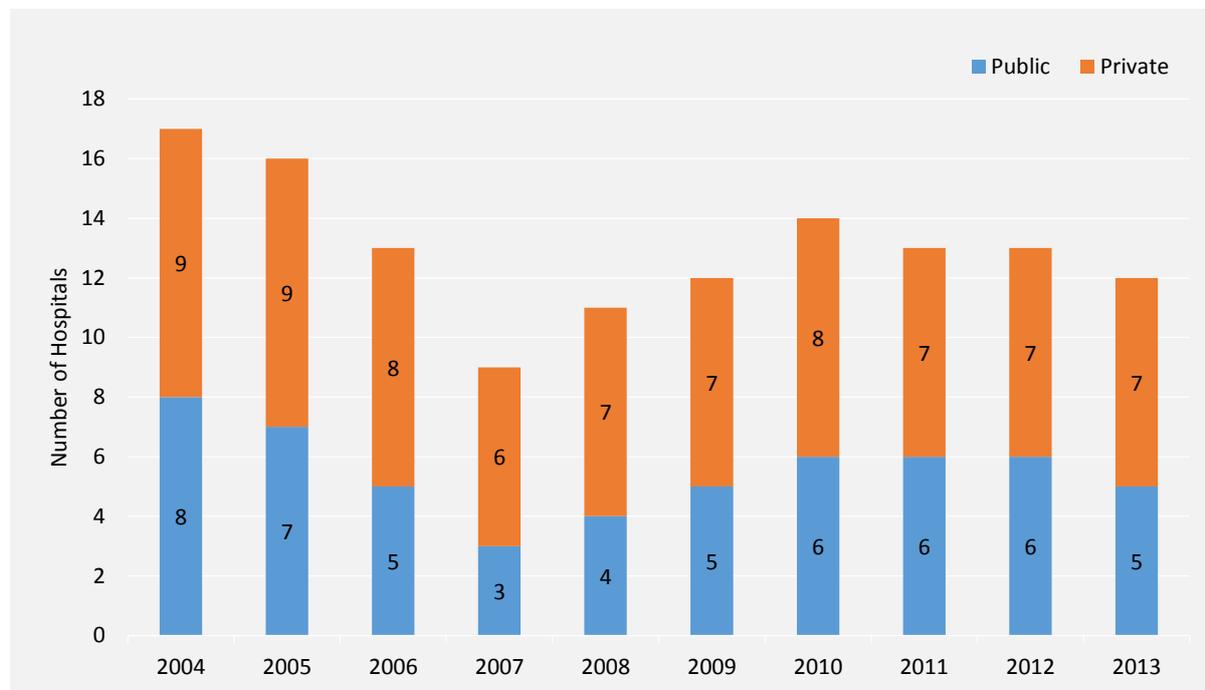
*Number of hospitals performing pancreaticoduodenectomies each year by hospital volume  
Year of diagnosis 2004-2013*



Source: Oncology Analysis System, Queensland Cancer Control Analysis Team

From 2004-2013 there were 9 private hospitals performing a total of 412 pancreaticoduodenectomies and 10 public hospitals performing a total of 333 pancreaticoduodenectomies.

*Number of hospitals performing pancreaticoduodenectomies each year by hospital type  
Year of diagnosis 2004-2013*



*Source: Oncology Analysis System, Queensland Cancer Control Analysis Team*

The 30-day mortality rate for hospitals performing < 3 pancreaticoduodenectomies per year between 2004 - 2008 was 8.2% compared to 2.0% in 2009 – 2013. There was only one death for hospitals performing < 3 pancreaticoduodenectomies per year in the period 2009 - 2013.

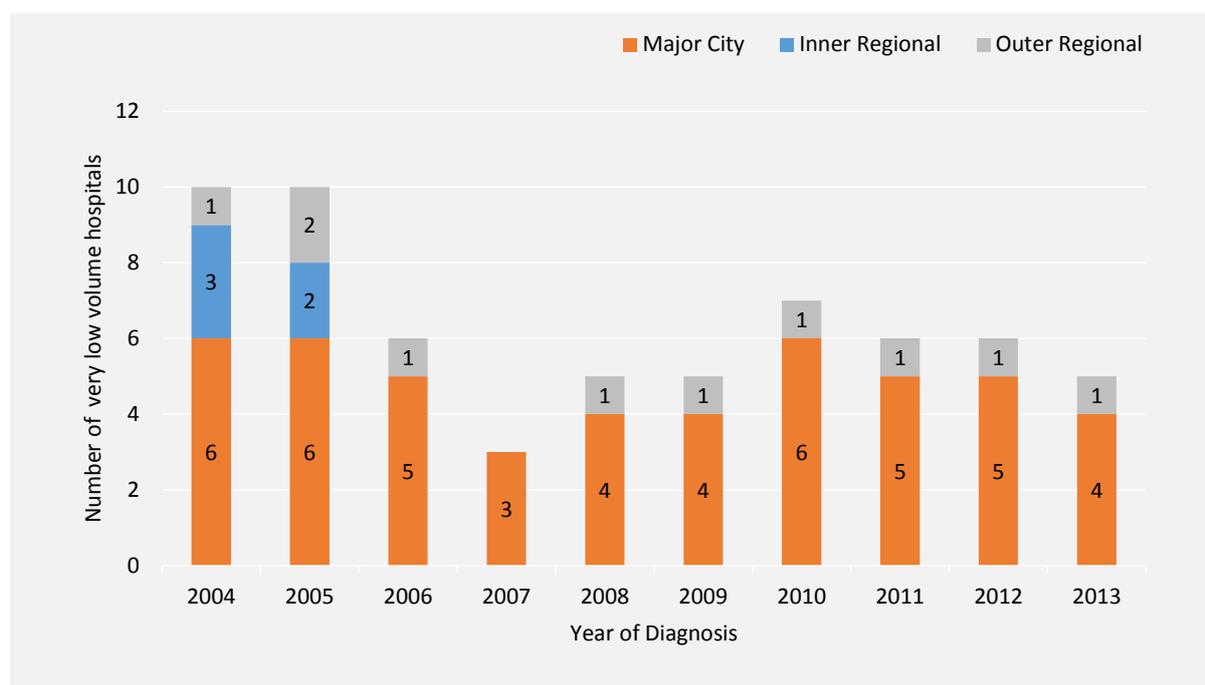
As pancreaticoduodenectomy surgery is the single most important modality in the treatment of pancreatic, biliary tract and duodenal cancer, it is important that those patients who are fit and eligible should receive a resection in an environment where the risks of a poor outcome have been minimised. When deciding whether to perform pancreaticoduodenectomy there are important considerations aside from surgical expertise, such as the service capability of the hospital and the appropriate expertise in offering care and support for the patient. Surgeons involved with this surgery should have specialist training and continue to submit surgical cases and outcomes related to this surgery for regular audit.

## Very low volume hospital characteristics

On average from 2004 – 2013, 42% of the very low volume hospitals were situated in inner or outer regional areas of Queensland. The number of hospitals in the very low volume group ranges from 3-10 from 2004 to 2013. Between 2004 – 2013 7 very low volume hospitals performed pancreaticoduodenectomy each year.

Five of the 12 very low volume hospitals performing less than 3 pancreaticoduodenectomies annually between 2004 and 2013 have not performed pancreaticoduodenectomy surgery since 2006.

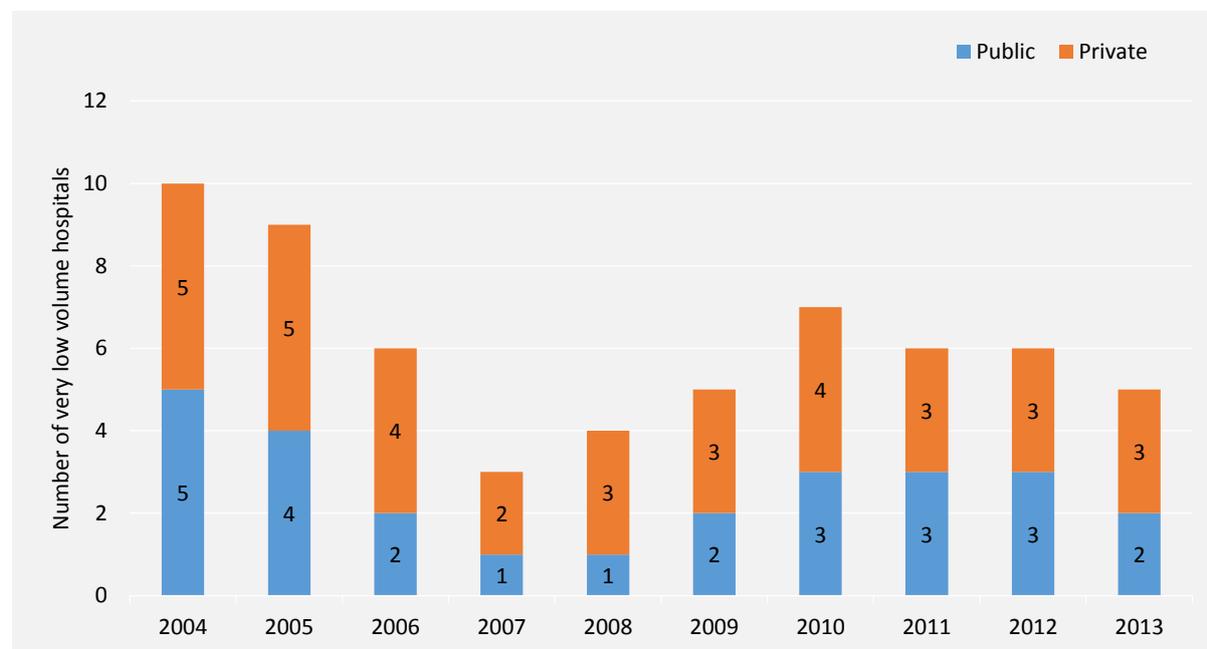
### *Very low volume < 3 pancreaticoduodenectomies Year of diagnosis 2004-2013*



Source: Oncology Analysis System, Queensland Cancer Control Analysis Team

From 2004-2013 there were 5 private hospitals performing less than 3 pancreaticoduodenectomies and 7 public hospitals performing less than 3 pancreaticoduodenectomies per year.

*Very low volume < 3 pancreaticoduodenectomies by hospital type  
Year of diagnosis 2004-2013*



Source: Oncology Analysis System, Queensland Cancer Control Analysis Team

## Part 4

### Pancreaticoduodenectomy Surgery

#### Recommendations





# Pancreaticoduodenectomy Summary

## Hospital Volume and Postoperative Mortality

### 2004-2013 Cancer Incidence

3,029 Male  
2,612 Females  
Median age at diagnosis 71 yrs.

### Pancreatic, Biliary Tract & Duodenal Cancer

Of the 5,641 cases between 2004 – 2013:  
4,896 No pancreaticoduodenectomy  
745 Had pancreaticoduodenectomy

### Medium and Low volume hospitals

Of the 745 pancreaticoduodenectomies:  
143 in very low volume (<3 per yr)  
123 in low volume (3-5 per yr)  
479 in medium volume (≥6 per yr)

### Postoperative 90-Day Mortality

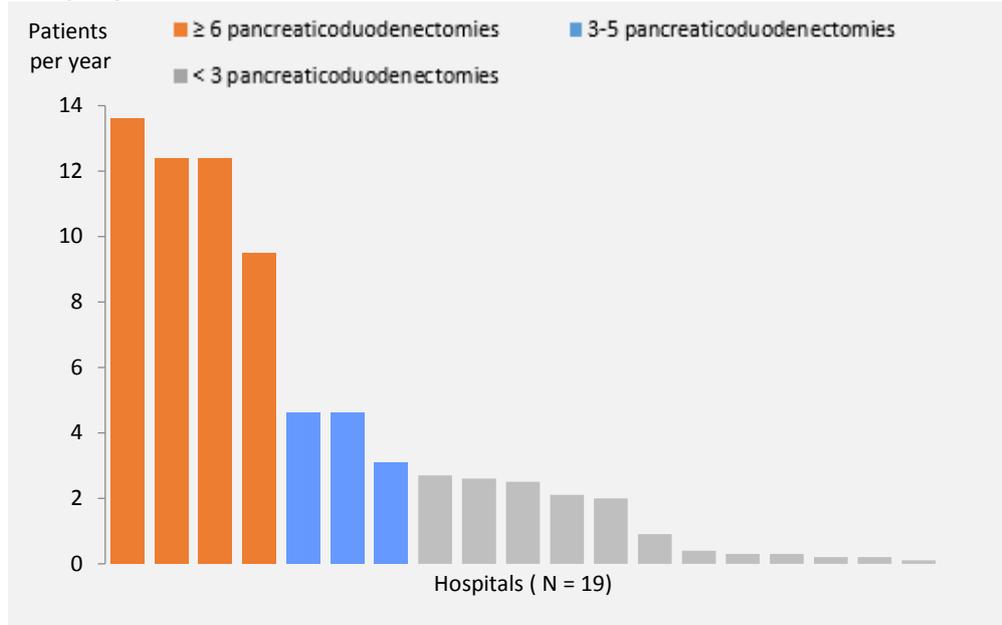
4 medium volume hospitals (≥6)  
3 low volume hospitals (3-5)  
12 very low volume hospitals (<3)

Surgical mortality risk is 5 times higher in very low volume hospitals

47% of all postoperative deaths occur in very low volume hospitals

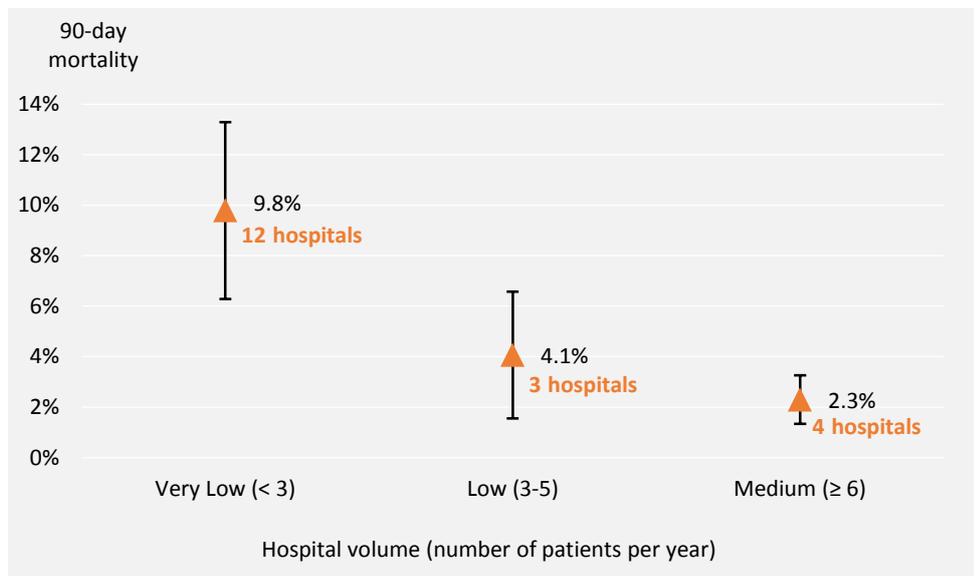
## Hospital Volume

Pancreaticoduodenectomies on Qld pancreatic, biliary tract & duodenal cancer  
Year of diagnoses 2004-2013



## Postoperative Mortality

90 day mortality post pancreaticoduodenectomy for biliary tract & duodenal cancer  
Year of diagnosis 2004-2013



## Guiding Practice Statements Summary

### ***Cancer Centres of Choice***

Consideration should be given to surgical treatment of pancreatic, biliary tract and duodenal cancer patients in a 'cancer centre of choice'.

### ***Multidisciplinary Team (MDT) Meetings***

Following a diagnosis of pancreatic, biliary tract and duodenal cancer, all patients should be referred to a multidisciplinary team meeting for management recommendations.

### ***Staging***

Patients with pancreatic, biliary tract and duodenal cancer should undergo careful preoperative staging to enable targeting of treatment to those likely to benefit.

### ***Surgery***

Pancreaticoduodenectomy and the management of pancreatic, biliary tract and duodenal cancer require post fellowship training and continued exposure to managing the disease. The operative mortality is higher in the centres performing less than six pancreaticoduodenectomies per year.

### ***Neoadjuvant and adjuvant therapy***

Both adjuvant and Neoadjuvant chemotherapy have an increasing role in the management of pancreatic cancer for patients undergoing pancreaticoduodenectomy.

### ***Audit***

Centrally coordinated, standardised audit be undertaken to evaluate the process of care and the outcomes of treatment for all pancreatic, biliary tract and duodenal cancer patients, to examine the extent to which practices produce variation in patient outcomes.

## Improving Care

The Partnership has identified some areas for improvement in the quality of care for pancreatic, biliary tract and duodenal cancer patients in Queensland. These include:

- High proportion of pancreatic, biliary tract and duodenal cancer patients underwent pancreaticoduodenectomy with surgeons who performed relatively few operations for pancreatic, biliary tract and duodenal cancer each year
- High proportion of surgery for pancreatic, biliary tract and duodenal cancer occurring in centres where multidisciplinary team review and management and audit are not common practice

As a consequence, The Partnership proposes that the following *guiding practice* statements be considered to reduce unwanted variation in practice.

The statements are a guide to the optimal care and management of patients with pancreatic, biliary tract and duodenal cancer. They are intended to improve patient outcomes by facilitating consistent care based on evidence and best practice across the state. They set out the key requirements for the provision of optimal care which need to be considered at points of the care pathway.

The population distribution and geographic barriers in Queensland require innovative approaches to the management of pancreatic, biliary tract and duodenal cancer to ensure rural and remote patients are offered equitable access to cancer services. The outcomes described in this report reflect the surgery only and not the overall management of this disease.

These statements are not rules and do not carry a sense of prescription. They represent the 'what', rather than seeking to prescribe the 'how'. Recognising that services should be responsive to the needs of different patients at different phases, the guiding practice statements draw on Queensland evidence, best practice and encourage local solutions. For example, while multidisciplinary care is an essential part of treatment planning, how it is organised depends on the local situation.

## Guiding Practice Statements

### Cancer Centres of Choice (or integrated cancer care)

Consideration should be given to surgical treatment of pancreatic, biliary tract and duodenal cancer patients in a 'cancer centre of choice' (or integrated cancer care setting).

There is a compelling body of evidence showing that survival following complex cancer surgery is worse in hospitals that carry out these procedures with low frequency.<sup>1,5</sup> In the UK, the high mortality rate of pancreatic cancer patients in low-volume hospitals has led to the establishment of oesophago-gastric and pancreatic cancer centres with target catchment populations of 1 to 4 million.<sup>6,7</sup> Similar volume-outcome associations in the US have prompted recommendations for the selective referral of oesophageal and pancreatic cancer patients to high-volume hospitals.<sup>8</sup>

Patients with pancreatic, biliary tract and duodenal cancer should receive cancer care in a 'centre of choice' where:

- Specialist surgical teams are established
- Surgical treatment of pancreatic, biliary tract and duodenal patients is performed by surgeons with expertise in pancreaticoduodenectomy
- Patients are reviewed and managed by multi-disciplinary teams (MDTs)
- Specialist surgical teams routinely participate in audit and feedback
- Patients have access to computed tomography (CT) scanning, endoscopic ultrasound (EUS) and laparoscopy for rapid staging

Palliative care is an integral part of patient management and patients have access to specialist palliative interventions when required.

<sup>1</sup> Gruen RL, Pitt V, Green S, Parkhill A, Campbell D, Jolley D. The effect of provider case volume on cancer mortality: Systematic Review and Meta-analysis. *CA Cancer J Clin* 2009; 59: 192-211.

<sup>5</sup> Chowdhury MM, Dagash H, Pierro A. A systematic review of the impact of volume of surgery and specialization on patient outcome. *Br J Surg* 2007; 94: 145-161

<sup>6</sup> Parry J, Jolly K, Rouse A, Wilson R. Re-organizing services for the management of upper gastrointestinal cancers: patterns of care and problems with change. *Public Health* 2004; 118: 360-369

<sup>7</sup> Siriwardena AK. Centralisation of upper gastrointestinal cancer surgery. *Ann R Coll Surg Engl* 2007; 89:335-336

<sup>8</sup> Hewitt M, Petitti D. *Interpreting the volume-outcome relationship in the context of cancer care*. Washington (DC): National Academy Press; 2001

### Multidisciplinary Team (MDT) Meeting

Following a diagnosis of pancreatic, biliary tract and duodenal cancer, all patients should be referred to a multidisciplinary team meeting for management recommendations.

Multidisciplinary care is recognised as the gold standard for patients with cancer and was identified as a key strategy in the Cancer care statewide health service strategy<sup>9</sup>. Queensland Health has committed to the provision of multidisciplinary care for all patients with cancer with the development of the Queensland Oncology Online system (QOOL) to support multidisciplinary meetings, administration and prospective collection of an agreed minimum dataset for all cancers and the development of an Oncology Analysis System (OASys). These resources are available to *all* hospitals, both public and private, and to *all* clinicians across Queensland. The *Treating cancer in Queensland public hospitals* report (Queensland Health, 2006) found that patients with documented evidence of a MDT review were more likely to receive a wider range of treatment options including radiotherapy and chemotherapy. MDT review also increased the likelihood of patients receiving a documented cancer stage.

The opportunity exists to establish prospective data collection through the multidisciplinary team using an agreed dataset, for all newly diagnosed cases of upper pancreatic, biliary tract and duodenal cancer in Queensland.

<sup>9</sup> Queensland Health. *Queensland Cancer Control Strategic Directions 2005-2010*. Queensland Health, Brisbane, 2006

### Staging

Patients with pancreatic, biliary tract and duodenal cancer should undergo careful preoperative staging to enable targeting of potentially curable treatment to those likely to benefit.

The stage of cancer determines the treatment plan for most patients. The *Treating cancer patients in Queensland public hospitals: Service improvement starts here...* report found that MDT review increased the likelihood of patients receiving a documented cancer stage.<sup>10</sup> The majority of patients (71%) reviewed by a MDT had a documented stage, compared to only 48% of patients who were not reviewed by a MDT.

Aside from endoscopic diagnosis with histopathologic confirmation of the disease, patients will require staging, which may include CT scanning, endoscopic ultrasound, FDG-PET scanning and laparoscopy as deemed suitable by the managing specialists. A formal pre-treatment stage is required before deciding upon the appropriate management of the individual patient.

<sup>10</sup> Queensland Health. *Treating cancer patients in Queensland public hospitals: Service improvement starts here...* Queensland Health, Brisbane, 2006

### Surgery

Pancreaticoduodenectomy should be performed by surgeons with specialised training in a 'cancer centre of choice'.

Pancreaticoduodenectomy and the management of pancreatic, biliary tract and duodenal cancer require post fellowship training and continued exposure to managing the disease. The operative mortality is higher in the centres performing less than six pancreaticoduodenectomies per year.

### Audit

Centrally coordinated, standardised audit be undertaken to evaluate the process of care and the outcomes of treatment for all pancreatic, biliary tract and duodenal cancer patients, to examine the extent to which practices produce variation in patient outcomes.

The audit will collect information on the diagnosis, stage and planned treatment of all patients. The collection of additional information will depend on the nature of the treatment subsequently received by the patient.

Audit may be centrally coordinated and standardised with the use of the QOOL application suite developed by The Partnership, specifically for this purpose.

# Appendix



## Distal Pancreatectomy cohort

Population	Queensland residents
Year of diagnosis	2004-2013
Diagnosis	Invasive pancreatic (C25), biliary tract (C24) or duodenal cancer (C17)
Procedures	Total pancreatectomy (30593-00), distal pancreatectomy (30583-00) and pancreatectomy with splenectomy (30593-01)
Sector	Public and private
Gender	All

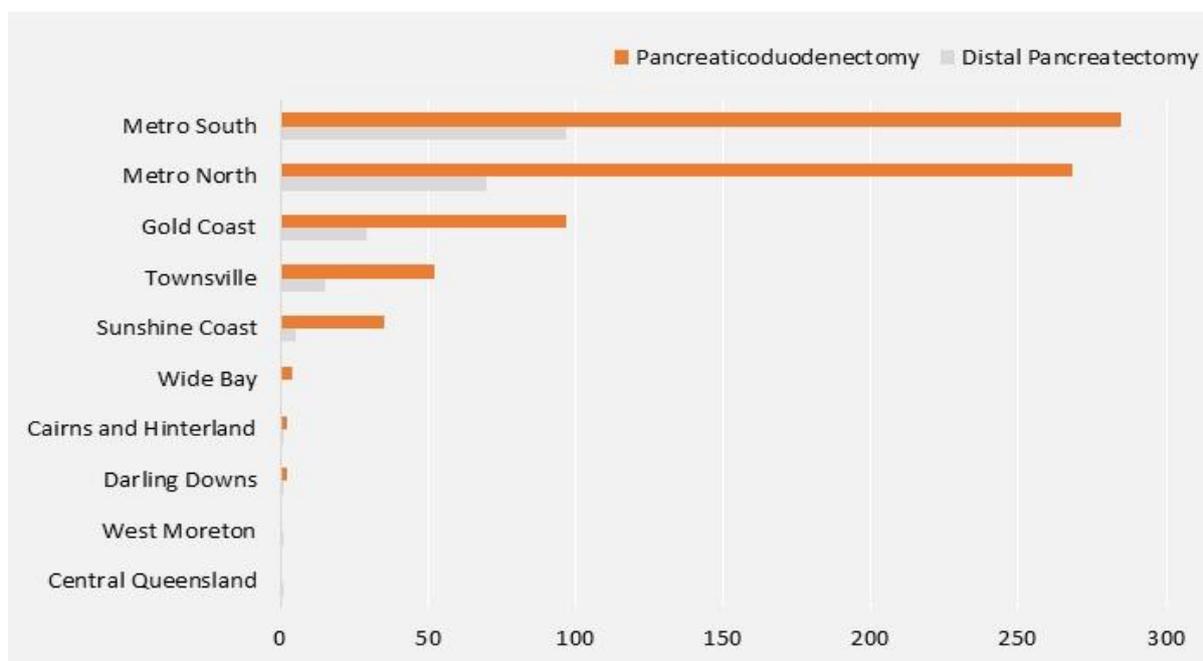
Of the Queensland patients with pancreatic, biliary tract and duodenal cancer diagnosed between 2004 and 2013, 3.9% underwent distal pancreatectomy and the mean age for distal pancreatectomy is 63 years.

Metro South HHS performed the most distal pancreatectomies for patients diagnosed between 2004-2013, accounting for 44% of the total, followed by Metro North HHS with 32% of the total.

### Pancreatic, biliary tract and duodenal cohort Year of diagnosis 2004-2013

	Distal Pancreatectomy	Pancreaticoduodenectomy	No Surgery	All
Incidence	220	745	4,676	5,641
Median age at diagnosis	63 yrs	59%	74 yrs	71 yrs
% male	50%	64 yrs	53%	54%
% with comorbidity	47%	42%	48%	47%
% indigenous	2%	1%	2%	2%
% disadvantaged	23%	23%	24%	24%
% regional & remote	42%	37%	38%	38%
% histology basis	99.5%	99%	56%	63%

Number of surgeries by HHS performing surgery  
Year of diagnosis 2004-2013



## Data Sources

### *Oncology Analysis System*

Oncology Analysis System (OASys) is a state-wide clinical cancer database with diagnostic, treatment, and outcome data on registry-notifiable invasive cancers diagnosed among Queensland residents of all ages (including children) from 1982 to 2013. The database includes inpatient data for public and private admissions and information systems for radiation oncology, pharmacy and pathology. Benign (non-invasive) cancers are excluded. New cancer cases are counted following the rules for counting multiple primary cancers as defined by the International Association for Research on Cancer (IARC).

The data collection, linking and reporting of OASys data is performed under the auspices of Queensland Cancer Control Safety and Quality Partnership, a Quality Assurance Committee gazetted under Section 31, The Health Services Act 1991.

### *Queensland Oncology Repository*

The Queensland Oncology Repository (QOR) is a cancer patient database developed and maintained by the Queensland Cancer Control Analysis Team (QCCAT; Queensland Health) to support Queensland's cancer control, safety, and quality assurance initiatives. QOR consolidates cancer patient information for the state and contains data on cancer diagnoses and deaths, surgery, chemotherapy, and radiotherapy. QOR also includes data collected by clinicians at multidisciplinary team (MDT) meetings across the state. For more information, visit <https://qccat.health.qld.gov.au/QOR>

## Glossary and Common Abbreviations

### Age-standardised incidence/mortality rate (ASR)

The number of new cases or deaths per 100,000 that would have occurred in a given population if the age distribution of that population was the same as that of the Australian population in 2001 and if the age-specific rates observed in the population of interest had prevailed. In international comparisons, the World Standard Population was used as the reference population.

Age-standardised rates are independent of the age-structure of the population of interest and are therefore useful in making comparisons between different populations and time periods.

Except where noted, incidence and mortality rates are standardised to the Australian age-specific population in 2001.

### All-cause survival

All-cause survival: the percentage of cancer cases still alive after a specific period of time from diagnosis.

### Annual average

Annual average refers to the sum of numbers divided by the number of years being reported. In this report annual average numbers have been rounded up to the nearest whole number for those with less than 1.

### Cause specific survival

Cause specific survival: the percentage of cancer cases attributed to a specific cancer still alive after a specified period of time from diagnosis.

### Comorbidity

A clinical condition that has the potential to significantly affect a cancer patient's prognosis after diagnosis with cancer.

Comorbidity is derived from hospital admissions data following the Quan algorithm<sup>1</sup> for classifying ICD-10 coded conditions, modified to exclude metastasis, which is represented by a separate and distinct metastasis dimension.

Comorbidity is limited to conditions coded in any admission episode between 12 months before and 12 months after the date of cancer diagnosis.

For any given cancer diagnosis, comorbidity is restricted to conditions other than the primary cancer. For example: a breast cancer can be a comorbidity to a lung cancer diagnosis and vice versa, if they are diagnosed within 12 months of each other.

Benign tumours are not considered comorbidities.

#### Co-morbidity list

AIDS	Acute myocardial	Cancer
Cerebrovascular disease	Congestive heart failure	Chronic obstructive pulmonary disease
Dementia	Diabetes	Diabetes + complications
Hemiplegia or Paraplegia	Mild liver disease	Moderate/severe liver disease

Peptic ulcer

Peripheral vascular disease

Renal disease

Rheumatoid disease

### **Diagnosis Basis**

Confirmation of cancer through clinical or histological tests.

### **Distal Pancreatectomy**

Distal pancreatectomy – ICD10AM codes 30593-00 (total pancreatectomy), 30583-00 (distal pancreatectomy) and 30593-01 (pancreatectomy with splenectomy).

### **Hospital and Health Services (HHS)**

For residence considerations, a Hospital and Health Service is a geographic area defined by a collection of Statistical Local Areas (SLA). For public hospitals and health service hospitals, the term Hospital and Health Service is synonymous with a group of Queensland Health hospitals and staff responsible for providing and delivering health resources and services to an area which may consist of one or more residential districts.

### **Hospital Volume**

Between 2004 and 2013, 19 hospitals performed pancreaticoduodenectomy. For each surgery, hospitals were ranked according to the average annual number of cases performed over the 10-year period, then divided into very low, low and medium volume groups.

#### **Medium volume hospital**

A hospital that performed  $\geq 6$  surgeries per year on patients diagnosed between 2004 and 2013.

#### **Low volume hospital**

A hospital that performed between 3 and 5 surgeries per year on patients diagnosed between 2004 and 2013.

#### **Very low volume hospital**

A hospital that performed  $< 3$  surgeries per year on patients diagnosed between 2004 and 2013.

### **Incidence (new cases)**

The number of new cases of cancer diagnosed in a defined population during a specified time period. For example, 2013 incidence is the number of cancers which were first diagnosed between 1 January 2013 and 31 December 2013.

### **Indigenous Status**

A measure of whether a person identifies as being of Aboriginal or Torres Strait Islander origin.

### **Median age**

The age that divides a population into halves: one older than the median, the other younger than the median.

**Mortality (deaths)**

The number of deaths attributed to cancer in a defined population during a specified time period regardless of when the diagnosis of cancer was made.

**Prevalence**

The number of Queenslanders with a diagnosis of cancer who were alive on 31 December 2013.

**Private hospital**

All other hospitals that are not Queensland Health hospitals.

**Public hospital**

Queensland Health hospitals.

**Remoteness**

The relative remoteness of residence at time of diagnosis, based on the Australian Standard Geographical Classification (ASGC). In this report, remoteness is classified into four groups: Major City, Inner Regional, Outer Regional, and Remote & Very Remote.

**Pancreaticoduodenectomy**

Pancreaticoduodenectomy surgery (pancreaticoduodenectomy with formation of stoma) – ICD10AM code 30584-00

**30-Day Postoperative Mortality**

30-day postoperative mortality has been defined as any patient who dies within 30 days of undergoing pancreaticoduodenectomy surgery. If two or more hospitals perform a surgery on the same patient the death is assigned to the hospital that performed the most recent surgery.

**90-Day Postoperative Mortality**

90-day postoperative mortality has been defined as any patient who dies within 90 days of undergoing pancreaticoduodenectomy surgery. If two or more hospitals perform a surgery on the same patient the death is assigned to the hospital that performed the most recent surgery.

**In-Hospital Postoperative Mortality**

In-hospital postoperative mortality has been defined as any patient who dies in hospital after undergoing pancreaticoduodenectomy surgery.

**1-year Survival**

All-cause crude survival: the percentage of patients still alive after 1 year from their last cancer surgery. As with postoperative mortality, death within 1 year of surgery is assigned to the hospital that performed the most recent surgery.

**2-year Survival**

All-cause crude survival: the percentage of patients still alive after 2 years from their last cancer surgery.

**5-year Survival**

All-cause crude survival: the percentage of patients still alive after 5 years from their last cancer surgery.

**Sex**

Refers to the biological and physiological characteristics that define men and women.

**Socioeconomic status**

Socioeconomic classification is based on the Socio-Economic Indexes for Areas (SEIFA), a census-based measure of social and economic well-being developed by the Australian Bureau of Statistics (ABS) and aggregated at the level of Statistical Local Areas (SLA).

The ABS uses SEIFA scores to rank regions into ten groups or deciles numbered 1 to 10, with 1 being the most disadvantaged group and 10 being the most affluent group. This ranking is useful at the national level, but the number of people in each decile often becomes too small for meaningful comparisons when applied to a subset of the population. For this reason, this document further aggregates SEIFA deciles into 3 socioeconomic groups:

SEIFA Group	Decile	Percentage of population (approximate)
Affluent	1-2	20%
Middle	3-8	60%
Disadvantaged	9-10	20%

The proportion of cases in each group will vary depending on the subset of the population being examined. For example, the proportion in the Disadvantaged group may be higher than 20% when the data is limited to cancers that are more common in poor compared to rich people

**Statistical Analysis**

The effect of hospital volume on postoperative mortality and 1-year survival for postoperative survivors was estimated through multivariate Cox proportional hazards regression, controlling for case-mix and within-hospital clustering to account for the correlation of outcomes in patients treated by the same hospital.

**Surgeon Volume**

This report is focused on hospital volume rather than individual surgeon volume. It is acknowledged that surgeons may perform pancreaticoduodenectomy across multiple hospitals, both in the public and private sectors.

**For more information:**

Queensland Cancer Control Analysis Team  
Queensland Health  
GPO Box 48 Brisbane, Queensland, 4001 Australia  
Ph: +61 (07) 3239 0886  
Fax: +61 (07) 3239 0930  
Email: [qccat@health.qld.gov.au](mailto:qccat@health.qld.gov.au)  
<https://qccat.health.qld.gov.au>

Although care has been taken to ensure the accuracy, completeness and reliability of the information provided these data are released for purposes of quality assurance and are to be used with appropriate caution. Be aware that data can be altered subsequent to original distribution and that the information is therefore subject to change without notice. Data can also quickly become out-of-date. It is recommended that careful attention be paid to the contents of any data and if required QCCAT can be contacted with any questions regarding its use. If you find any errors or omissions, please report them to [qccat@health.qld.gov.au](mailto:qccat@health.qld.gov.au)