


ORIGINAL ARTICLE

Variation in ovarian cancer care in Australia: An analysis of patterns of care in diagnosis and initial treatment in New South Wales

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Funding information

This research was supported by an Australian Government Research Training Program Scholarship. The funders had no direct role in this study, other than providing funding for the primary author for their Doctor of Public Health degree.

Abstract

Objective: Ovarian cancer has the highest mortality of all gynaecological cancers. This study aimed to identify the extent to which women across New South Wales experienced variation in their care in diagnosis and initial treatment for ovarian cancer against the national optimal care pathway for ovarian cancer.

Method: Clinical audit methodology was utilised to explore variations for women with primary ovarian cancer; 171 eligible cases were identified through by the NSW Cancer Registry for the period of 1 March 2017 to 28 February 2018.

Results: Limited variation was detected with 86% of women being reviewed by a specialist gynaecological oncology multidisciplinary team; 54% of women received their first treatment within 28 days of their first specialist appointment, 66% of women having their first surgery completed by a gynaecological oncologist and 45% of women received their first treatment in a specialist gynaecological oncology hospital.

Conclusion: Deviation from effective ovarian cancer care is apparent particularly in the location and timeliness of first treatment, with implications for the quality of care received and care outcomes. Understanding factors that contribute to variation is critical to ensure optimal and appropriate ovarian cancer care and to tackle systemic barriers to the provision of effective care.

KEYWORDS

clinical guidelines, clinical variation, ovarian cancer

1 | INTRODUCTION

Ovarian cancer is the leading cause of death in gynaecological cancers internationally (Australian Institute of Health and Welfare, 2017; Du Bois et al., 2009; PEBC's ovarian oncology guidelines group, 2017). It is estimated there were 313,959 new diagnoses of ovarian cancer in

2020 worldwide, with 207,252 deaths in 2020 (International Agency for Research on Cancer, World Health Organisation, 2020). Given the high mortality for ovarian cancer, it is critical to ensure the best available evidence guides clinical practice. Research has shown that adherence to clinical guidelines is a key mechanism to improve outcomes for women with ovarian cancer (White et al., 2019). The identification

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and investigation of deviations from clinical guideline care are important for identifying unwarranted variations and health system effectiveness (White et al., 2019). Through understanding the extent of variation from clinical guidelines, and the factors that impact guideline adherence, care quality and outcomes for women with ovarian cancer may be optimised (White et al., 2019).

Optimal cytoreductive surgery has been identified as a powerful determinant of survival for women with advanced ovarian cancer, highlighting the importance of provision of guideline adherent surgery (Bristow et al., 2002). Improved outcomes for women with an ovarian cancer diagnosis have also been demonstrated from hospitals and specialists with high gynaecological oncology surgery case volume (Bristow et al., 2009; Bristow et al., 2010; Bristow et al., 2014). Evidence suggests that centralising ovarian cancer care into specialist hospitals improves access to gynaecological oncologists, multidisciplinary cancer care teams and higher surgical volume hospitals, and surgeons may have improved survival rates (Woo et al., 2012). Clinical guidelines identify a range of components of effective ovarian cancer care including optimal cytoreductive surgery; surgery completed by a gynaecological oncologist; treatment of ovarian cancer in hospitals and by specialists who see high volumes of women with ovarian cancer; and in those jurisdictions where centralised care is in place ensuring referral of women into the appropriate centralised specialist gynaecological oncology hospital when ovarian cancer is suspected. These practices are integrated as part of clinical guidelines for the diagnosis and treatment of ovarian cancer internationally (Ledermann et al., 2013; National Comprehensive Cancer Network, 2020; National Institute for health and clinical excellence, 2011).

To ensure optimal clinical practice and outcomes, there is a need to understand the extent to which effective care is being practised and the extent of variation from guidelines (Institute of Medicine, 2001; Wennberg, 2011). Through identifying where there is variation in guideline adherent care, and investigating the specific elements of the clinical guideline that are not being adhered to, programmes of work can be developed that focus on reducing variation and optimising guidelines and care pathways to improve adherence (White et al., 2019). This may lead to improved outcomes for women with ovarian cancer.

While no clinical guidelines are available for the treatment of ovarian cancer in Australia, international guidelines such as the *National Comprehensive Cancer Network guideline* (NCCN) for ovarian cancer from the United States and the *European Society for Medical Oncology (ESMO) Guideline for ovarian cancer* are utilised (Ledermann et al., 2013; National Comprehensive Cancer Network, 2017). In 2015, the Department of Health Australia endorsed an optimal care pathway for ovarian cancer, reflecting fundamental components of the international guidelines available (Cancer Council Victoria, Victorian Department of Health and human services, Cancer Australia, 2015). The aim of the optimal care pathway was to promote best-practice cancer care, reduce variation in effective care pathways and enhance the quality of care for women with ovarian cancer nationally. The pathway outlines seven steps in providing the optimal pathway of care: prevention and early detection; presentation, initial

investigations and referral; diagnosis, staging and treatment planning; treatment; care after initial treatment and recovery; managing recurrent, residual and metastatic disease; and end-of-life care (Cancer Council Victoria, Victorian Department of Health and human services, Cancer Australia, 2015). The present study aimed to identify the extent and nature of variation in ovarian cancer care across New South Wales (NSW) Australia against four events of the optimal cancer care pathway for ovarian cancer, as well as identifying the factors that may contribute to these deviations in each Local Health District (LHD) area.

2 | METHODS

2.1 | Ethics and governance approval

This study was granted ethics approval by the NSW Population and Health Services Research Ethics Committee (HREC/17/CIPHS/13). A waiver of consent was granted, which led to limitations on demographic information able to be collected (age and metropolitan, rural or remote residence).

2.2 | Methods

This research project was designed using a retrospective clinical audit method of a consecutive cohort to determine the extent of variation in care for women with ovarian cancer in NSW against four events of the national optimal cancer-care pathway for ovarian cancer. A retrospective medical record audit was undertaken of women identified by the NSW Cancer Registry with a diagnosis of primary ovarian, primary fallopian tube and primary peritoneal cancer from 1 March 2017 to 28 February 2018. The NSW Cancer Registry fast-tracked identification of ovarian cancer cases to provide a timelier cohort than if cases had been fully coded. At the time of the study, fully coded cases were only available to December 2012.

2.3 | Setting

This study covered care received by women with ovarian cancer in both the public and private healthcare systems of NSW. Of the 15 LHDs in NSW, data were collected from residents across 14 LHDs (one LHD had no residents treated in NSW during the time period of the study), which included eight public hospitals and eight private hospitals (both specialist and non-specialist gynaecological oncology centres). Residents from a number of states and territories across Australia were included in the study. These locations have been reported as two distinct geographical locations due to NSW providing treatment for complex cancers for one interstate jurisdiction, and the other combining a number of interstate locations into one geographical location for reporting. At the time of this study, there were eight specialist gynaecological oncology centres in NSW. These hospitals

met the criteria set by the Cancer Institute NSW and the Agency for Clinical Innovation that certified gynaecological oncologists are employed at the hospital, and there is a gynaecological oncology multidisciplinary cancer care team at the hospital. The specialist gynaecological oncology hospitals in NSW at the time of this study were made up by six public hospitals and two private hospitals. All specialist hospitals were included in this study.

2.4 | Data sources

Medical records accessed included inpatient and outpatient paper medical records; the NSW public health electronic medical record (Cerner PowerChart); oncology medical information systems (MOSAIQ[®], ARIA, MEDITECH); bespoke electronic medical record systems in private hospitals; gynaecological oncology clinic and multidisciplinary team databases; and paper notes in gynaecological oncologist's specialist rooms. In accordance with the journal's guidelines, we will provide our data for the reproducibility of this study in other centres if such is requested.

2.5 | Sample

Cases were eligible for the study if they met the following inclusion criteria: identified diagnosis of primary ovarian, fallopian tube or peritoneal cancer (ICD-10 codes C56, C57, C48.2) during the time period of the study, had been diagnosed or received treatment for these cancers in NSW and were over the age of 18. Cases were excluded if they were diagnosed by death certificate or autopsy or had a pre-existing or other primary cancer/s (excluding melanoma).

2.6 | Procedure

A manual review of pathology and electronic notifications was undertaken by the NSW Cancer Registry. Staff at the NSW Cancer Registry consist of specialist medical coders and pathologists who code all cancer notifications made to the registry. Potentially eligible cases were identified using agreed keywords, as the cases had not yet been formally coded into the NSW Cancer Registry. This process allowed for more recent cases to be identified. Identified cases were screened by staff from the Data Access and Research Liaison Service at the Cancer Institute NSW, independent of the researcher, and variables identified from the pathological and electronic notification. KW completed all data extraction from the clinical medical records using a medical record audit tool (available in the Supporting Information).

2.7 | Analysis

To identify variation in the optimal pathway of care for women with ovarian cancer, four events focussed on the diagnostic, and initial

treatment phases of the optimal cancer care pathway were analysed: if the case was discussed at a gynaecological oncology multidisciplinary team meeting; if first treatment was received within 28 days from first specialist appointment; if initial surgery for ovarian cancer was performed by a gynaecological oncologist; and if the first surgery was performed at a gynaecological oncology specialist hospital. Previous studies have demonstrated that the timely initiation of treatment of cancer can improve outcomes (Alexander et al., 2017; Hiom, 2015; Seagle et al., 2017). The use of multidisciplinary cancer care teams is now considered best practice in cancer care, ensuring multispecialty discussion, as well as consensus team agreement of diagnosis and the treatment plan (Cancer Australia, 2014; Cancer Care Ontario, 2012; National Cancer Action Team, National Health Service, 2010). As discussed earlier, the link between care received in specialist gynaecological oncology hospitals and receipt of surgery from gynaecological oncologists have been shown to improve outcomes for women with ovarian cancer (Bristow et al., 2014; Phippen et al., 2013). These four events of the pathway were also chosen as focus areas, as they are areas of care that align with the quality features of effective, efficient and timely care (Institute of Medicine, 2001).

Healthcare in NSW is provided across 15 LHDs, with 8 metropolitan LHDs and 7 rural and regional LHDs. LHDs were set up in NSW to manage public hospitals and health institutions, as well as providing health services within allocated geographical areas of the state. Unadjusted proportions were computed for each LHD and examined on a funnel plot with limits computed at two and three standard deviations from the target rate of 90% adherence to a given pathway point. Associations between adherence to pathways and cancer, person and geographic factors were explored with Bayesian logistic regression. Predictor variables in the model were FIGO stage, Eastern Cooperative Oncology Group Performance Status (ECOG) score, Charlson Comorbidity Index, age and LHD type (metropolitan, regional or interstate). The continuous Age variable was re-scaled to have a mean = 0 and standard deviation = 1. Missing data were re-coded as 'No evidence of adherence to pathway' and were analysed as 'Non-adherence to pathway'. The prior distribution for the model was a Cauchy distribution (scale = 1.5). Bayesian logistic regression is similar to standard logistic regression; however, it produces more reliable estimates of association in situations with smaller datasets (Gelman et al., 2008). Statistical analysis was performed using SPSS, version 25.0 (IBM Corp, New York, 2017) and R version 3.5.2.

3 | RESULTS

There was a total of 336 cases of primary ovarian, fallopian tube or peritoneal cancer identified by the NSW Cancer Registry. Of these, 113 cases did not meet the study inclusion criteria when reviewed by the Cancer Institute NSW Data Access and Research Liaison Service team. These cases were primarily ineligible due to having a previous history of cancer (91 cases), not being treated in NSW (1 case) or having the incorrect cancer type (18 cases).

This left 223 eligible cases in the cohort. Of these cases, a further 52 were excluded from the study as their medical records were unable to be identified, or their pathology was the only case from a single hospital for the study period. The decision was made to not seek governance approval for data collection for small numbers of cases, as the data collected to this point were able to answer the proposed research questions. These cases were across 3 regional LHDs and 3 private hospitals. The final study cohort included 171 women who were resident across 14 LHDs and interstate residents. The incidence of ovarian cancer in NSW in 2016 was 492 cases, with the study cohort accounting for approximately 35% of the NSW incidence (Cancer Institute NSW, 2020). Figure 1 outlines the study cohort.

3.1 | Demographic findings

The mean age of women in the study was 62 years of age, with a range from 23 to 91 years of age and a standard deviation of 14.7 years. The majority of women had a performance status as measured by an ECOG score of 0 (77%), equating to being fully active and able to carry on all pre-disease performance without restriction (Oken et al., 1982). Comorbidity was measured using the Charlson Comorbidity Index, with 70% ($n = 119$) of women having no comorbidities identified (Charlson et al., 1987). Ovarian, peritoneal and fallopian tube cancers were not included in the calculation of the Charlson Comorbidity Index, since these are the diseases of interest, not a comorbidity. Of the patients, 33% ($n = 57$) were diagnosed with FIGO stage IIIC, 10% ($n = 17$) with IVA and 5% ($n = 9$) with IVB. There were 36% ($n = 61$) women presenting with a diagnosis of FIGO stage I–II and 60% ($n = 102$) presenting with FIGO stage III–IV. Sixty-seven percent had a histopathology of serous ovarian cancer (67%, $n = 114$), with the next highest proportion being endometrioid (13%, $n = 23$). Table 1 outlines the characteristics of the study cohort.

Table 2 outlines the proportion of cases by LHD of residence that adhered to each of the four optimal pathway events investigated. Logistic regression analysis was completed for all four optimal care pathway events identified as meeting adherence with the optimal care pathway. Women with FIGO stage IV disease were less likely to be discussed at a gynaecological oncology multidisciplinary team meeting (FIGO IV vs. FIGO I; 95% CI 0.06–0.98; $P = 0.047$; OR 0.3) (Table 3). Women who had poorer performance status (ECOG 2–4) were less likely than those with better performance status to receive their first treatment within 28 days of their first specialist appointment (ECOG 2–4 vs. ECOG 0; 95% CI 0.12–1.26; $P = 0.116$; OR 0.4) (Table 4). This variation in the pathway point may be appropriate and would require further investigation to identify if the variation is unwarranted. Women with FIGO stage IV disease were more likely have their first surgery by a gynaecological oncologist (FIGO I vs. FIGO IV; 95% CI 0.04–0.38; $P < 0.001$; OR 0.1) (Table 5). The results from the regression analysis for first surgery in a specialist hospital can be found in Table 6.

The four points of adherence to the optimal cancer care pathway were examined and showed: 86% (147/171) of women were reviewed by a specialist gynaecological oncology multidisciplinary team; 54% (92/171) of women received their first treatment within 28 days of their first specialist appointment; 86% (113/171) of women had their first surgery completed by a gynaecological oncologist; and 45% (77/171) of women received their first treatment in a specialist gynaecological oncology hospital. While this study found a mean of 27 days and median of 14 days from first specialist seen to the initiation of the first treatment, the range was large, at 0–317 days, with a high SD of 48 days, highlighting delay in time to treatment for some patients in the cohort. There were 60% (103/171) of women who had evidence of seeing both a gynaecological oncologist and were presented at a gynaecological oncology multidisciplinary team.

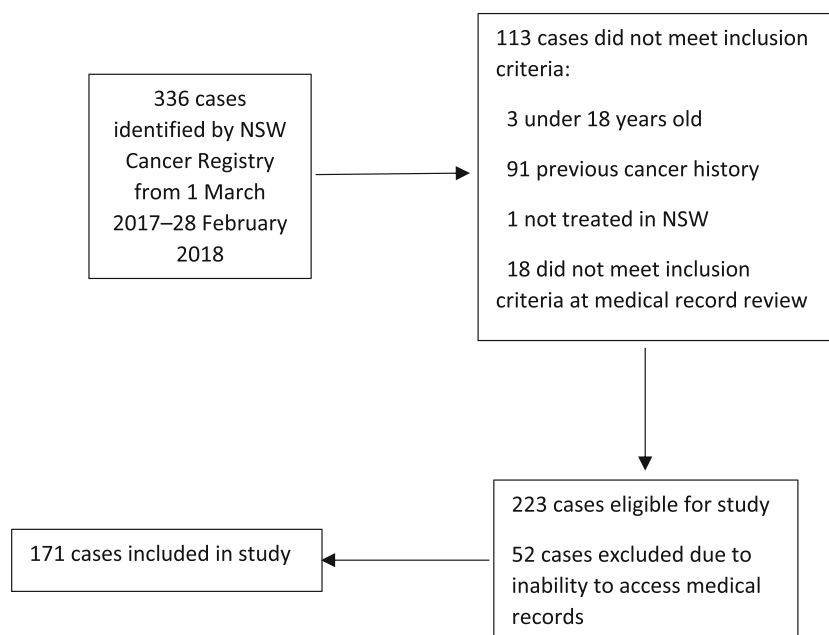


FIGURE 1 Study flow diagram

TABLE 1 Characteristics of the study cohort

Age range (years)	N (%)
18–39	11 (6.4)
40–59	61 (35.7)
60–79	80 (46.8)
>80	19 (11.1)
Place of residence	
Metropolitan	107 (62.6)
Regional/rural	52 (30.4)
Interstate	12 (0.1)
ECOG	
0	131 (76.6)
1	24 (14)
2	12 (7)
3	1 (0.6)
4	1 (0.6)
Unknown	2 (1.2)
Charlson comorbidity index	
0	119 (69.6)
1	36 (21.1)
2	11 (6.4)
3	5 (2.9)
FIGO stage	
I	37 (21.6)
II	24 (14)
III	76 (44.4)
IV	26 (15.2)
Unknown	8 (4.7)
Total	171 (100)

Funnel plots demonstrate adherence to a benchmark of 90% at the resident LHD level, as well as between LHD variation. There is notable variation for three of the four optimal care pathway points chosen, which could not be explained by variation in patient characteristics. Discussion at a gynaecological oncology MDT had the least amount of variation across the optimal care pathway points investigated, with nine of 16 LHDs of residence achieving above the 90% adherence benchmark set as shown in Figure 2. For receipt of treatment within 28 days of the first specialist appointment, four LHDs of residence sit at or below 40% adherence, as shown in Figure 3.

Three LHDs of residence reached the benchmark of 90% as the proportion of their residents who had their first surgery performed by a gynaecological oncologist (Figure 4). Most LHDs of residence sat around the observed mean of 66% of the proportion of their residents who had their first surgery performed by a gynaecological oncologist (Figure 4).

Figure 5 demonstrates two LHDs of residence reached the benchmark target of 90% for the study cohort having surgery performed at a specialist gynaecological oncology hospital. Most other

LHDs of residence had adherence below 60%, with the observed mean sitting at 45%.

4 | DISCUSSION

The study findings indicate substantial state-wide variation in adherence to key components of the optimal care pathway for ovarian cancer, specifically, the location and timeliness of women receiving their first treatment. Given the strong evidence that care in specialist centres is associated with improved survival, the finding that 55% of the study sample did not receive their first treatment in a specialist gynaecological oncology hospital has implications for care quality and outcomes and warrants further examination (Woo et al., 2012). Delays in treatment are also linked to poorer outcomes for people with a cancer diagnosis (Alexander et al., 2017; Hiom, 2015; Seagle et al., 2017). The findings of this study reflect wider research suggesting that diagnostic delay, and treatment delay is a complex issue, caused both by patients not identifying the seriousness of their symptoms leading to delays in seeking medical review, as well as doctors not referring patients to gynaecological oncologists for assessment (Barrett & Hamilton, 2008; Evans et al., 2007; Redman et al., 2011). This study does not speak to the help-seeking behaviours and attitudes of patients.

The cohort of women investigated in this study can be compared with the characteristics of a published study by White et al. on the patterns of surgical care for women with ovarian cancer in NSW (White et al., 2020). The previous study by White et al. reported a mean age of 62 years of age, the same as the current study, and 75% of women resided in metropolitan areas, with 25% residing in regional areas, compared with 63% and 31% in the current study (White et al., 2020). There were higher levels of no comorbidity in the previous study by White et al., with 89%, compared to the current study with 70% (White et al., 2020). While there were less women with ovarian cancer included in the current study's cohort, there are similarities to the earlier cohort previously investigated by White et al (White et al., 2020). There is also a decrease found in the number of hospitals completing surgery for women with ovarian cancer, decreasing from 57 in the White et al study to 22 hospitals completing surgery in the current study (White et al., 2020). This aligns with the work completed since 2015 to centralise ovarian cancer care to specialist gynaecological oncology hospitals across NSW (White et al., 2020).

The study found a high level of adherence to the pathway event of review by a specialist gynaecological oncology multidisciplinary team (85%; 147/171). Gynaecological oncology tumour boards have been in place for many years, providing multidisciplinary discussion of gynaecological oncology cases. Tumour boards have over time developed into multidisciplinary team meetings as cancer services in Australia began to implement this new structure of multidisciplinary cancer care (Luxford & Rainbird, 2001). The current NSW Cancer Plan highlights multidisciplinary cancer care team care as a prioritised action that all people diagnosed with cancer have their care overseen

TABLE 2 Adherence to optimal care pathway, by region of residence, March 2018–February 2019

Region of residence (region)	Discussion at a gynaecological oncology multidisciplinary team meeting (see Table 3)	First treatment received within 28 days of first specialist appointment (see Table 4)	First surgery performed by a gynaecological oncologist (see Table 5)	First surgery performed at a specialist gynaecological oncology hospital (see Table 6)
	% (Y:N:unknown)			
Region 1 (n = 10)	80% (8:0:2)	50% (5:0:5)	60% (6:1:3)	30% (3:4:3)
Region 2 (n = 10)	100% (10:0:0)	50% (5:2:3)	90% (9:0:1)	40% (4:5:1)
Region 3 (n = 20)	85% (17:3:0)	45% (9:5:6)	50% (10:2:8)	30% (6:6:8)
Region 4 (n = 19)	68% (13:1:5)	84% (16:3:0)	74% (14:2:3)	58% (11:5:3)
Region 5 (n = 5)	80% (4:0:1)	80% (4:0:1)	60% (3:0:2)	20% (2:2:0)
Region 6 (n = 4)	100% (4:0:0)	50% (2:1:1)	100% (4:0:0)	50% (2:2:0)
Region 7 (n = 6)	83% (5:0:1)	17% (1:3:2)	17% (1:1:4)	17% (1:1:4)
Region 8 (n = 1)	100% (1:0:0)	0% (0:0:1)	100% (1:0:0)	100% (1:0:0)
Region 9 (n = 22)	91% (20:2:0)	68% (15:3:4)	73% (16:1:5)	18% (4:13:5)
Region 10 (n = 1)	100% (1:0:0)	100% (1:0:0)	0% (0:0:1)	0% (0:0:1)
Region 11 (n = 1)	100% (1:0:0)	100% (1:0:0)	100% (1:0:0)	100% (1:0:0)
Region 12 (n = 28)	79% (22:1:5)	54% (15:4:9)	61% (17:6:5)	57% (16:7:5)
Region 13 (n = 8)	100% (8:0:0)	25% (2:4:2)	88% (7:0:1)	88% (7:0:1)
Region 14 (n = 18)	94% (17:0:1)	61% (11:4:3)	61% (11:2:5)	50% (9:4:5)
Region 15 (n = 5)	100% (5:0:0)	40% (2:0:3)	80% (4:1:0)	80% (4:1:0)
Region 16 (n = 13)	85% (11:1:1)	23% (3:5:5)	69% (9:3:1)	54% (7:5:1)
Total (n = 171)	86% (147:8:16)	54% (92:34:45)	66% (113:19:39)	45% (77:55:39)

TABLE 3 Factors associated with discussion at gynaecological oncology MDT

Term	Proportion discussed at gynaecological MDT	Adjusted odds ratio	95% confidence interval	P value
Age	-	0.9	0.59–1.52	0.817
Place of residence				
Metropolitan resident (ref)	84%	1	-	-
Regional resident	91%	1.5	0.52–4.38	0.449
Interstate resident	83%	0.9	0.21–3.82	0.888
Pathological stage of disease at diagnosis				
FIGO I (ref)	97%	1		
FIGO II	79%	0.3	0.08–1.31	0.114
FIGO III	85%	0.4	0.13–1.45	0.175
FIGO IV	77%	0.3	0.06–0.98	0.047
FIGO unknown	87%	0.6	0.08–4.46	0.623
Functional status				
ECOG 0 (ref)	86%	1	-	-
ECOG 1	88%	1.3	0.37–4.67	0.678
ECOG 2–4	86%	1.2	0.28–4.92	0.831
Comorbidity status				
Charlson comorbidity 0 (ref)	87%	1	-	-
Charlson comorbidity 1–3	85%	0.9	0.35–2.29	0.809

TABLE 4 Factors associated with treatment initiation within 28 days of first specialist appointment

Term	Proportion initiated treatment within 28 days	Adjusted odds ratio	95% confidence interval	P value
Age	-	0.9	0.64–1.25	0.513
Place of residence				
Metropolitan resident (ref)	57%	1	-	-
Regional resident	44%	0.6	0.31–1.25	0.180
Interstate resident	58%	1	0.32–3.05	0.974
Pathological stage of disease at diagnosis				
FIGO I (ref)	51%	1	-	-
FIGO II	63%	1.5	0.56–4.13	0.417
FIGO III	50%	1	0.49–2.22	0.914
FIGO IV	58%	1.3	0.49–3.37	0.618
FIGO unknown	63%	1.3	0.33–5.23	0.706
Functional status				
ECOG 0 (ref)	57%	1	-	-
ECOG 1	50%	0.9	0.35–2.19	0.784
ECOG 2–4	29%	0.4	0.12–1.26	0.116
Comorbidity status				
Charlson comorbidity 0 (ref)	56%	1	-	-
Charlson comorbidity 1–3	48%	0.9	0.42–1.73	0.665

TABLE 5 Factors associated with gynaecological oncologist completing the first surgery

Term	Proportion Gynaecological oncologist first surgery	Adjusted odds ratio	95% confidence interval	P value
Age	-	0.9	0.63–1.33	0.633
Place of residence				
Metropolitan resident (ref)	66%	1	-	-
Regional resident	67%	1.1	0.49–2.34	0.871
Interstate resident	58%	0.7	0.2–2.31	0.538
Pathological stage of disease at diagnosis				
FIGO I (ref)	81%	1	-	-
FIGO II	96%	3.9	0.74–20.42	0.108
FIGO III	63%	0.5	0.2–1.14	0.095
FIGO IV	27%	0.1	0.04–0.38	<0.001
FIGO unknown	63%	0.5	0.12–2.28	0.389
Functional status				
ECOG 0 (ref)	71%	1	-	-
ECOG 1	46%	0.5	0.18–1.34	0.168
ECOG 2–4	57%	0.6	0.18–1.96	0.393
Comorbidity status				
Charlson comorbidity 0 (ref)	63%	1	-	-
Charlson comorbidity 1–3	73%	1.6	0.70–3.50	0.277

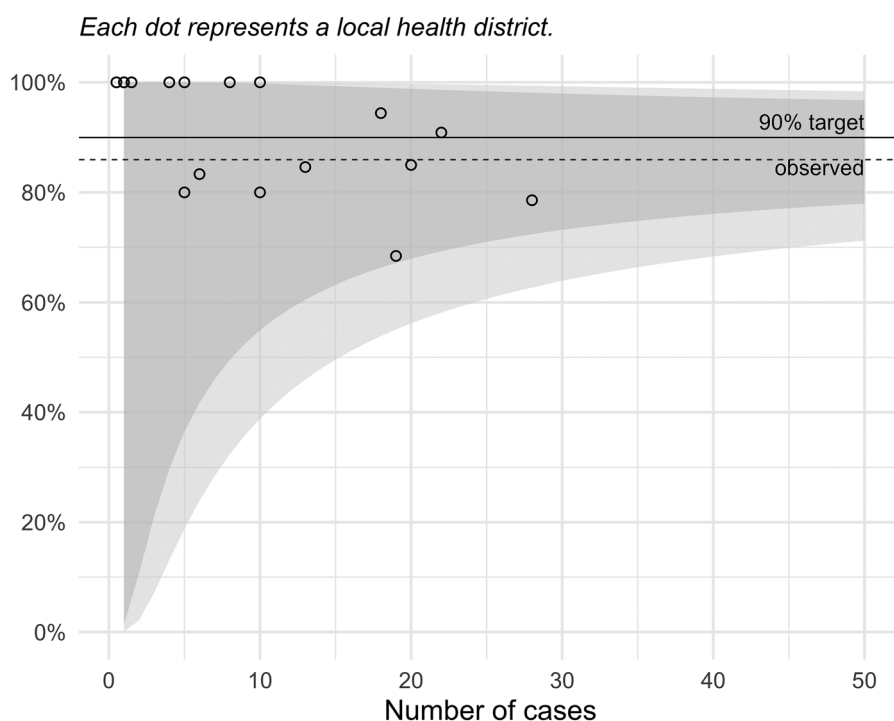
by a multidisciplinary team, highlighting that in NSW, multidisciplinary cancer care teams are an ongoing area for improvement (Cancer Institute NSW, 2016). This is in line with international policy that multidisciplinary teams in cancer care are best practice care (Cancer Care

Ontario, 2012; Ministry of Health, 2012; National Cancer Action Team, National Health Service, 2010; Querleu et al., 2016).

The mean proportion (66%) of women who had their first surgery completed by a gynaecological oncologist demonstrates an

TABLE 6 Factors associated with first surgery performed at a specialist gynaecological oncology hospital

Term	Proportion initiated treatment within 28 days	Adjusted odds ratio	95% confidence interval	P value
Age	-	0.5	0.35–0.74	<0.001
Place of residence				
Metropolitan resident (ref)	45%	1	-	-
Regional resident	48%	1.2	0.60–2.56	0.557
Interstate resident	33%	0.8	0.24–2.64	0.707
Pathological stage of disease at diagnosis				
FIGO I (ref)	57%	1	-	-
FIGO II	58%	1.4	0.51–3.83	0.518
FIGO III	41%	0.7	0.32–1.50	0.348
FIGO IV	31%	0.5	0.17–1.31	0.149
FIGO unknown	38%	0.5	0.12–2.15	0.352
Functional status				
ECOG 0 (ref)	45%	1	-	-
ECOG 1	46%	2.1	0.78–5.38	0.144
ECOG 2–4	43%	1.4	0.46–4.52	0.523
Comorbidity status				
Charlson comorbidity 0 (ref)	44%	1	-	-
Charlson comorbidity 1–3	48%	1.5	0.74–3.20	0.244

**FIGURE 2** Funnel plot of discussion at a gynaecological oncology multidisciplinary team meeting, adherence benchmark set to 90%, 1 March 2017 to February 2018, women with primary ovarian, primary fallopian tube and primary peritoneal cancer. Each dot represents a local health district/geographical region.*Data should be interpreted with caution due to low numbers in some geographical regions.

improvement in access to specialist surgeons over time in Australia, but still more needs to be done to improve access. The study by Grossi et al. found 47.2% of women in Victoria, Australia from 1993 to 1995 had their primary surgery with a gynaecological oncologist (Grossi et al., 2002). During this period, gynaecological oncology was

an emerging sub-speciality of gynaecology and obstetrics in Australia, where gynaecological oncology is now an accepted and established sub-speciality in Australia.

Variation is not universally problematic; some variation in care is normal and can be indicative of systems and services that are

FIGURE 3 Funnel plot of treatment received within 28 days of first specialist appointment, adherence benchmark set to 90%, 1 March 2017 to February 2018, women with primary ovarian, primary fallopian tube and primary peritoneal cancer. Each dot represents a local health district/geographical region. *Data should be interpreted with caution due to low numbers in some geographical regions.

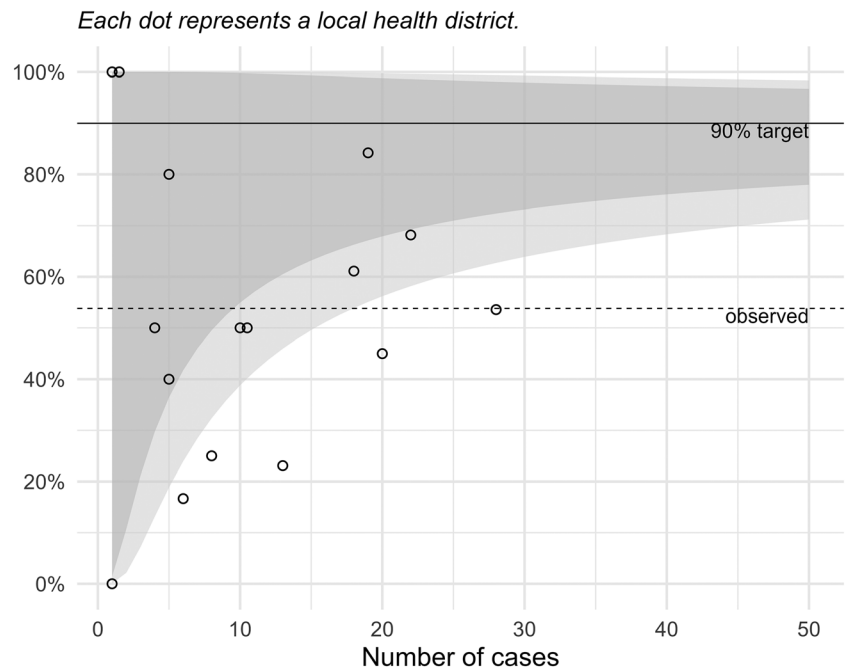
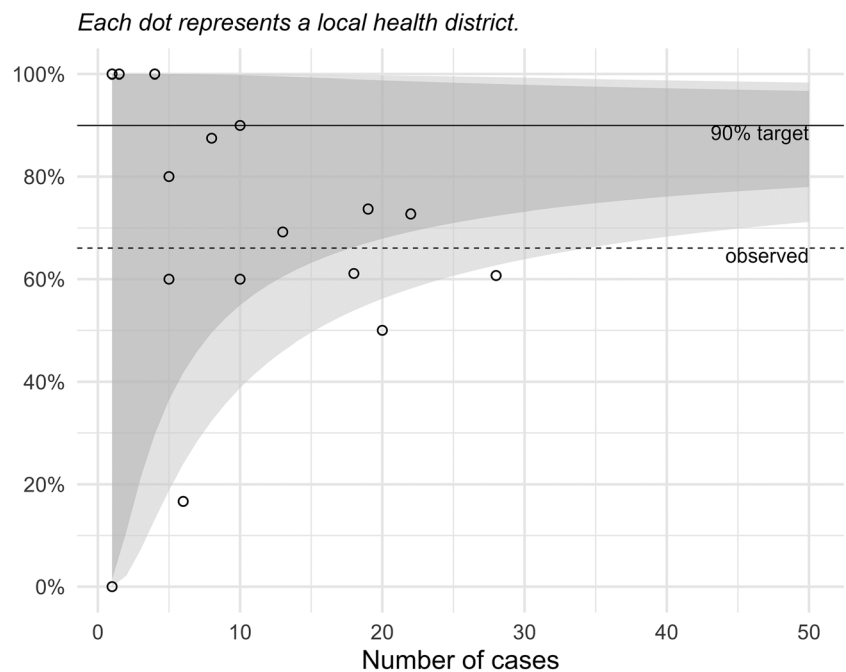


FIGURE 4 Funnel plot of gynaecological oncologist completing the first surgery, adherence benchmark set to 90%, 1 March 2017 to February 2018, women with primary ovarian, primary fallopian tube and primary peritoneal cancer. Each dot represents a local health district/geographical region. *Data should be interpreted with caution due to low numbers in some geographical regions.



responsive to individual patient needs (Querleu et al., 2016). Yet, understanding the factors contributing to variation from known effective pathways is important to ensure that the observed variation is appropriate and not problematic (Harrison et al., 2018). A number of factors were associated with whether women were less likely to experience variation from the pathway events investigated. For timeliness of treatment initiation by LHD of residence, poorer performance status was the primary factor found. Having surgery performed at a specialist gynaecological oncology hospital was less likely with older age. A U.S. study using SEER data found >60% of women over the age of 75 years were not seen by a gynaecological oncologist, with only 38%

of women over the age of 75 years receiving stage appropriate surgery (Warren et al., 2017).

Delay is a common feature of less common cancers, where symptoms may be gradual or not readily recognised by the patient or their primary care providers (Barrett & Hamilton, 2008; Redman et al., 2011). Due to the relatively rare nature of ovarian cancer, a general practitioner may only see one case every 5 years, leading to challenges in diagnosis, as it is not a common disease seen by general practitioners (Evans et al., 2007; Redman et al., 2011). However, an older Australian study investigated the pathways to diagnosis for women with epithelial ovarian cancer from 2002 to 2005, finding that

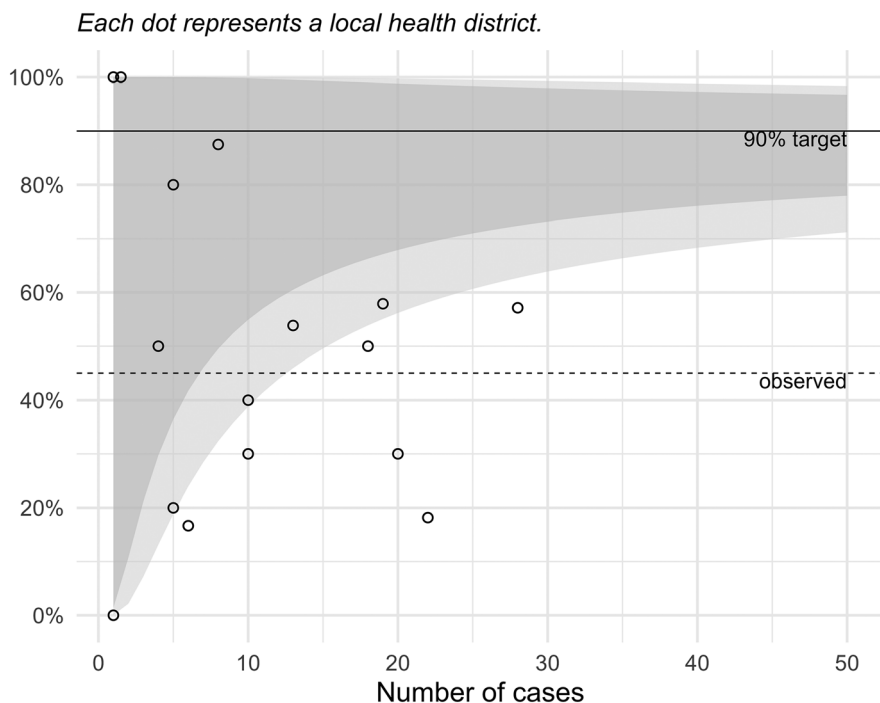


FIGURE 5 Funnel plot of first surgery performed at a specialist gynaecological oncology hospital, adherence benchmark set to 90%, 1 March 2017 to February 2018, women with primary ovarian, primary fallopian tube and primary peritoneal cancer. Each dot represents a local health district/geographical region. *Data should be interpreted with caution due to low numbers in some geographical regions.

most women with ovarian cancer in Australia at that time period were investigated and diagnosed without significant delays, with only 10% of women reporting that diagnosis took up to 6 months (Jordan et al., 2010).

The current study found one of the factors linked to a decreased likelihood of receipt of timely treatment was living in a regional LHD. A recent systematic literature review found people who lived in rural areas were 5% less likely to survive cancer when compared with people living in metropolitan areas (Carriere et al., 2018). Tracey et al. found that women with ovarian cancer in NSW were more likely to have their cancer care at a specialist gynaecological oncology hospital the closer they lived to one, also they were more likely to have extensive surgery if they had their cancer care at a specialist gynaecological oncology hospital (Tracey et al., 2014).

Each of the four optimal care pathway events investigated was found to have different factors influencing if women were less likely to receive care adherent to a specific pathway point. If a patient had more advanced disease at diagnosis, they were less likely to be discussed at a gynaecological oncology multidisciplinary team meeting and have their first surgery performed by a gynaecological oncologist. Having surgery performed at a specialist gynaecological oncology centre was less likely with older age, demonstrating a change in patterns when compared to the 2020 study by White et al., where they found little evidence that age was associated with specialist care in NSW (White et al., 2020). None of these factors is easy to address with one intervention. Focussing on ensuring there are strong referral pathways from regional areas into specialist gynaecological oncology centres and ensuring general practitioners are aware of the early signs and symptoms of ovarian cancer, as well as the appropriate referral pathway, may improve timeliness of treatment for women. A study by Bankhead et al. investigated symptoms of ovarian cancer, identifying

symptoms had been present for a median of 12 months prior to a diagnosis of ovarian cancer, with persistent abdominal distention being a key symptom linked to an ovarian cancer diagnosis (Bankhead et al., 2008). A lack of recognition of symptoms was identified as contributing in a delay in seeking medical attention (Bankhead et al., 2008). A study by Hamilton et al. further investigated symptoms of ovarian cancer that women presented to primary care with (Hamilton et al., 2009). They found abdominal pain, abdominal distention and urinary frequency, with abdominal distention having a positive predictive value for ovarian cancer of 2.5%, identifying the need for rapid investigation if women present with this symptom to primary care (Hamilton et al., 2009). Diagnosing women with earlier stage disease may also have an impact on their performance status, as they have less cancer burden at diagnosis. However, until there is a reliable way to screen for ovarian cancer, this is unlikely to change significantly.

4.1 | Limitations

Both in-hospital and out-of-hospital records are required to identify variation in care across the complete cancer pathway. This study was limited to accessing in-hospital records and clinical records in specialists' rooms, which primarily outlined the tertiary pathway of care, as these are more readily available than primary care records, as well as tertiary care being the primary focus for the Cancer Institute NSW at the time of the study.

Data on the pre-hospital pathway—such as date of onset of symptoms, type of symptom and first doctor seen in relation to these symptoms—were, in some cases able to be collected, depending on the completeness of GP referral letters and medical

histories documented in the medical record. It was beyond the scope of this study to include an audit of the out-of-hospital medical records.

The authors acknowledge the limitation of the study investigating approximately 35% of women with ovarian cancer for the period defined and acknowledge the impact on the generalisability of the results. A key limitation of the study is that the sites that were not included treated fewer cases of ovarian cancer, a disease where the international evidence highlights a volume outcome relationship (Woo et al., 2012). There is also a limitation in the generalisability of the results, given that missing data were identified as non-adherence to pathway.

Ovarian cancer may be an incidental finding for a gynaecologist or general surgeon at surgery, particularly in the case of a clinical emergency or where ovarian cancer was not suspected. These factors were not investigated in this study. There is a limitation in only focusing on four events of the optimal care pathway, as well as the limited demographic data able to be captured within the ethics approval for the study.

4.2 | Implications

A number of countries have implemented programmes of centralised care for women with ovarian cancer, improving access to specialist gynaecological oncology hospitals that has led to the improvement in outcomes for women with ovarian cancer (Aune et al., 2012; Keyver-Paik et al., 2016; Oberaigner & Stühlinger, 2006; Vernooij et al., 2009). In the United Kingdom, specialised gynaecological oncology centres were established following the publication of a policy framework in 1995 for the commissioning of cancer services in the NHS, with a focus on improving unwarranted clinical variation in the treatment of cancer (Calman & Hine, 1995). In NSW, efforts have been made to improve access to specialist care for women with ovarian cancer through identifying gynaecological oncology specialist hospitals and recommending that women with ovarian cancer in NSW receive care at these hospitals (Cancer Institute NSW, 2019). This study identified that there are more risks for particular members of the population in access to pathway adherent care, for the pathway events investigated. Ensuring a patient-centred approach in access to appropriate care for these women is a priority and may not easily fit within a centralised model of care for women who are older in age or who live in rural areas.

5 | CONCLUSION

This is the first study to investigate adherence in four events of the optimal care pathway for women with ovarian cancer in NSW. Variation was identified in receipt of timely treatment, as well as treatment in specialist gynaecological oncology hospitals. While this study has investigated adherence to the optimal care pathway for women with ovarian cancer, in lieu of a current Australian clinical guideline for

ovarian cancer, the international evidence has demonstrated improved outcomes for women who receive guideline adherent care (Aune et al., 2012; Bristow et al., 2013; Lee et al., 2015).

This study identified that there is variation in the receipt of adherent care of four events in the pathway in NSW. Deviation from effective care is problematic in terms of the quality of care received (Institute of Medicine, 2001). This study sought to establish the nature and extent of deviation from effective care in an ovarian cancer context. Given that the evidence available demonstrates improved outcomes for women who receive guideline adherent care, NSW should focus on a programme of work to improve awareness and understanding within the community, both for women, primary care providers, general surgeons and gynaecologists, of the optimal care pathway for ovarian cancer. The development of system performance reporting of the timeliness of care received, as well as continued development of reporting care provided in a specialist gynaecological oncology hospital, may lead to improved outcomes for women with ovarian cancer in NSW (White et al., 2019). In future study's, investigating survival for the cohort of this current study will assist in understanding the level of impact in receiving care that is not adherent to the national optimal care pathway for women with ovarian cancer and that deviates from effective care.

ACKNOWLEDGEMENTS

Open access publishing facilitated by University of New South Wales, as part of the Wiley - University of New South Wales agreement via the Council of Australian University Librarians.

CONFLICT OF INTEREST

The authors declare that they have no competing interests.

DATA AVAILABILITY STATEMENT

The datasets generated and/or analysed during the current study are not publicly available due to privacy and ethics considerations but are available from the corresponding author on reasonable request.

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How to cite this article: White, K. M., Walton, R. J., Kwedza, R. K., Rushton, S., Currow, D. C., Seale, H., & Harrison, R. (2022). Variation in ovarian cancer care in Australia: An analysis of patterns of care in diagnosis and initial treatment in New South Wales. *European Journal of Cancer Care*, 31(6), e13649. <https://doi.org/10.1111/ecc.13649>