Rates of adherence to cancer treatment guidelines in Australia and the factors associated with adherence

A systematic review

Bierbaum, Mia; Rapport, Frances; Arnolda, Gaston; Tran, Yvonne; Nic Giolla Easpaig, Brona; Ludlow, Kristiana; Clay-Williams, Robyn; Austin, Elizabeth; Laginha, Bela; Lo, Chi Yhun; Churruca, Kate; van Baar, Lieke; Hutchinson, Karen; Chittajallu, Renuka; Owais, Syeda Somyyah; Nullwala, Ruqaiya; Hibbert, Peter; Fajardo Pulido, Diana; Braithwaite, Jeffrey

Published in:
Asia-Pacific Journal of Clinical Oncology

DOI:
10.1111/ajco.13948

Published: 01/12/2023

Document Version
Publisher's PDF, also known as Version of record

Received: 1 December 2022 | Revised: 1 February 2023 | Accepted: 3 February 2023

DOI: 10.1111/ajco.13948

REVIEW

WILEY

Rates of adherence to cancer treatment guidelines in Australia and the factors associated with adherence: A systematic review

Mia Bierbaum[1] | Frances Rapport[1] | Gaston Arnolda[1,2] | Yvonne Tran[1,2] | Brona Nic Giolla Easpaig[1,2] | Kristiana Ludlow[1,3] | Robyn Clay-Williams[1] | Elizabeth Austin[1] | Bela Laginha[1] | Chi Yhun Lo[1] | Kate Churruca[1] | Lieke van Baar[1] | Karen Hutchinson[1] | Renuka Chittajallu[1,4,5] | Syeda Somyyah Owais[1] | Ruqaiya Nullwala[1,6] | Peter Hibbert[1,7,8] | Diana Fajardo Pulido[1,9] | Jeffrey Braithwaite[1,2]

[1]Australian Institute of Health Innovation, Macquarie University, North Ryde, New South Wales, Australia

[2]Centre for Research Excellence in Implementation Science in Oncology, AIHI, Macquarie University, Sydney, Australia

[3]School of Psychology, The University of Queensland, Brisbane, Queensland, Australia

[4]Riverina Cancer Care Centre, Wagga Wagga, New South Wales, Australia

[5]GenesisCare, Kingswood, New South Wales, Australia

[6]North Eastern Public Health Unit, Eastern Health, Melbourne, Victoria, Australia

[7]IIMPACT in Health, Allied Health and Human Performance, University of South Australia, Adelaide, Australia

[8]South Australian Health & Medical Research Institute (SAHMRI), Adelaide, Australia

[9]Pontificia Universidad Javeriana, Bogotá, Colombia

Correspondence
Mia Bierbaum, Australian Institute of Health Innovation, Macquarie University, 75 Talavera Rd, North Ryde, NSW, Australia.
Email: mia.bierbaum@hdr.mq.edu.au

Funding information
Australian Institute of Health Innovation, Macquarie University, Grant/Award Number: 9100002

Abstract

Adherence to cancer treatment clinical practice guidelines (CPGs) varies enormously across Australia, despite being associated with improved patient outcomes. This systematic review aims to characterize adherence rates to active-cancer treatment CPGs in Australia and related factors to inform future implementation strategies. Five databases were systematically searched, abstracts were screened for eligibility, a full-text review and critical appraisal of eligible studies performed, and data extracted. A narrative synthesis of factors associated with adherence was conducted, and the median adherence rates within cancer streams calculated. A total of 21,031 abstracts were identified. After duplicates were removed, abstracts screened, and full texts reviewed, 20 studies focused on adherence to active-cancer treatment CPGs were included. Overall adherence rates ranged from 29% to 100%. Receipt of guideline recommended treatments was higher for patients who were younger (diffuse large B-cell lymphoma [DLBCL], colorectal, lung, and breast cancer); female (breast and lung cancer), and male (DLBCL and colorectal cancer); never smokers (DLBCL and lung cancer); non-Indigenous Australians (cervical and lung cancer); with less advanced stage disease (colorectal, lung, and cervical cancer), without comorbidities (DLBCL, colorectal, and lung cancer); with good-excellent Eastern Cooperative Oncology Group performance status (lung cancer); living in moderately accessible places (colon cancer); and; treated in metropolitan facilities (DLBLC, breast and colon cancer). This review characterized active-cancer treatment CPG adherence rates and associated factors in Australia. Future targeted CPG implementation strategies should account for these factors, to redress unwarranted variation particularly in vulnerable populations, and improve patient outcomes (Prospero number: CRD42020222962).

KEYWORDS
guideline adherence, medical oncology, practice guideline, radiation oncology, surgical oncology

1 | INTRODUCTION

Adherence to clinical practice guideline (CPG) recommendations for cancer treatment has been associated with improved patient survival outcomes. This has previously been demonstrated across various cancers including sarcoma,[1] multiple myeloma[2] and cancers of the breast,[3–6] cervix,[7] lung,[8] head and neck,[9] and colon.[10] Despite this, wide variation in practice patterns persist across cancer streams internationally, with adherence rates ranging from 54% to 77% in breast cancer,[11,12] 35% to 56% in lung cancer,[13–16] 42% to 54% in cervical cancer,[7] 22% to 85% in non-muscle invasive bladder cancer,[17,18] 24% to 85% in ovarian cancer,[19,20] 67% to 81% in prostate cancer,[21,22] and 36% to 96% in colon cancer.[23,24] CPG nonadherence, specifically underutilization of guideline recommended treatment (GRT) has been identified as an issue in Australia, including radiotherapy (RT) treatment,[25–28] brachytherapy (BT),[29–31] chemotherapy (CTx),[27,32–35] and endocrine therapy[27,36] for a broad range of cancers. Similarly, overutilization of treatments that are unnecessary or associated with harm leads to wasteful healthcare spending and increased burden on the healthcare system.[37]

A plethora of variables influences adherence to cancer treatment CPGs, including factors related to CPG development. These include content and format, agreement with the underlying evidence, the applicability of GRT to individual patients, CPG currency, and prescriptiveness of the recommendations.[38,39] Similarly, organizational and clinician factors, such as disciplinary preferences and biases, access to treatment options, clinical culture of peer review and multidisciplinary care coordination, and patient specific factors influence adherence.[38,39]

Patient and health specific factors, such as older patient age and comorbidities, also influence adherence to CPGs across a variety of cancers,[40,41] including cancers of the breast,[3,12] lung,[42] colon,[10] and head and neck.[9] Older and less healthy patients are underrepresented in clinical trials, which may reduce clinician confidence in the evidence underpinning some CPG recommendations and contribute to low rates of adherence.[3,38] Eastern Cooperative Oncology Group (ECOG) Performance status,[12,14] cancer stage,[7,9,16] patient race,[13,43] and socioeconomic status (SES)[43] have also been associated with low rates of CPG adherence within specific cancer groups.

Barriers to effective CPG implementation are context specific,[44] and it is unknown whether the factors associated with cancer treatment CPG adherence are common across different cancers in the Australian setting. A better understanding of the impact of poor adherence across cancer streams in Australia, and the patterns of factors associated with CPG adherence (receipt of GRT), is needed to guide the implementation of tailored interventions. This knowledge will address the care gaps and distally contribute to reducing variation in treatment and patient outcomes across the cancer healthcare system. This review aims to (i) determine the rates of receipt of cancer GRT in Australia across various cancer streams, (ii) identify factors associated with cancer GRT in Australian studies, highlighting factors common across cancer streams, and (iii) examine whether receipt of cancer GRT impacts on patient outcomes.

2 | METHODOLOGY

The review[45] was conducted according to the Preferred Reporting Items for Systematic Reviews and Meta-analysis (27 item checklist)[46] (see Additional file 1).

2.1 | Search strategy, abstract, and full-text review

The search strategy was developed in consultation with a research librarian to search literature across five online databases (Medline, Embase, PsycInfo, Scopus, Web of Science core collection). The initial search was conducted by the lead author in August 2021 and updated in June 2022. Search terms are presented in Additional file 2. Abstracts identified by the search were collated in EndNote X9, and duplicates removed. Unique abstracts were then exported to Microsoft Excel V2208 and assessed for eligibility (see criteria below). All titles and abstracts were reviewed in pairs, by the lead author (MB) and a second reviewer (FR, GA, YT, BNGE, KL, RCW, EA, BL, CYL, KC, DFP, LvB, KH, RC, SSO, RN, or PH). Titles and abstracts were assessed for eligibility against predefined criteria, and eligible publications were then selected for full review. The lead author reviewed all full texts, paired with the 17 other reviewers. The acceptability of the interrater reliability scores of reviewing pairs was calculated using Cohen's Kappa score.[47] Disagreements on full texts were resolved through discussions with MB and GA. Reasons why publications were excluded at the full text stage are described in Figure 1. The reference lists of included studies were also searched for additional eligible studies.

2.2 | Eligibility criteria for abstracts and full-text review

Studies were eligible for inclusion if they reported adherence rates to cancer treatment CPGs, using Australian data. For the purpose of this review, 'Guideline adherence' includes terms such as *receipt of GRT or compliance, concordance, or adherence* with a recommendation in a cancer CPG, protocol, or CPG-based quality indicator. All treatment types reported in studies were included. The review had no publication year limits.

Studies were excluded if they *did not*

1. include active-cancer treatment CPG adherence as a reported measure (e.g., studies focusing on adherence to CPGs for cancer

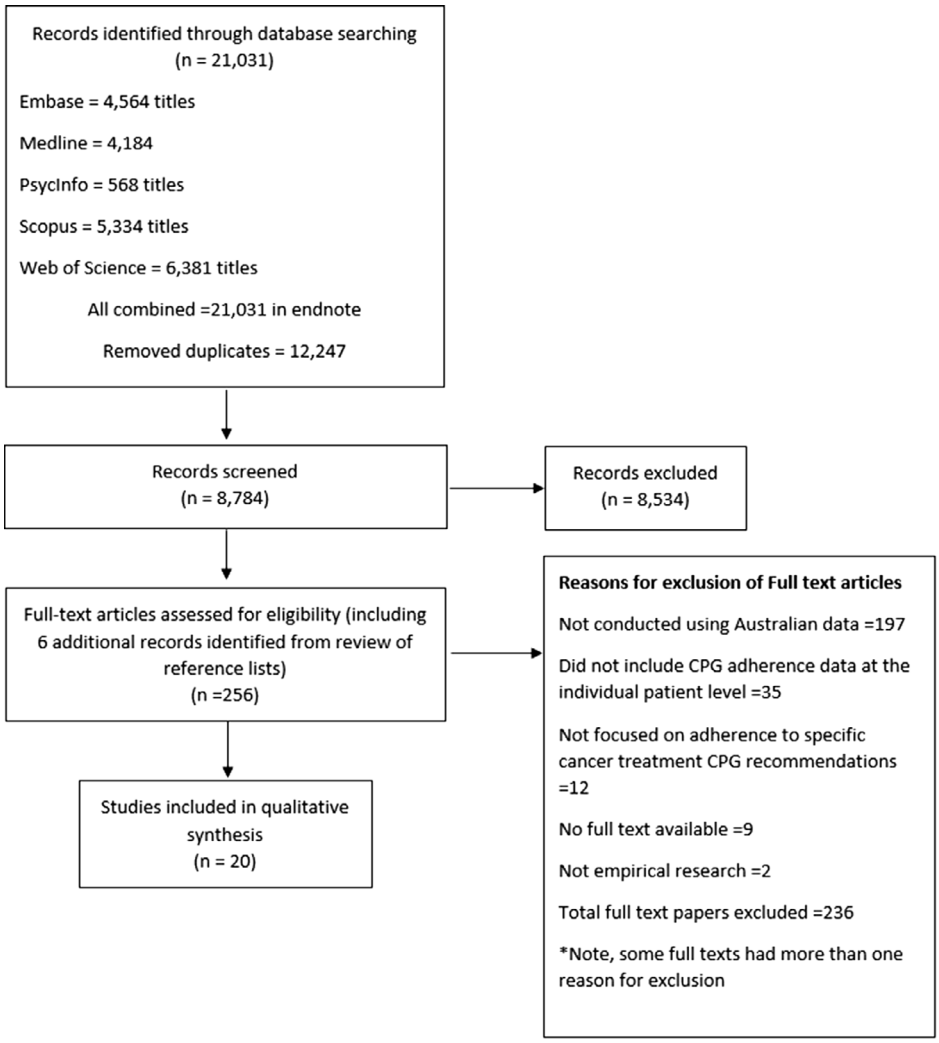

FIGURE 1 Preferred Reporting Items for Systematic Reviews and Meta-analysis (PRISMA) Study selection process.

prevention, or the treatment of side effects such as pain management antiemetic prophylaxis, or palliation);
2. clearly report Australian patient care data (i.e., independently to data from other countries);
3. clearly define which CPG was being adhered to;
4. publish in English;
5. report quantitative and qualitative data separately;
6. report empirical research;
7. include full texts (e.g., conference abstracts); and
8. publish in peer-reviewed journals (no gray literature was reviewed).

If more than one publication described results from an eligible study, the publication which reported results most relevant to the review was included, or both were included if they reported separate treatments or different results.

2.3 | Data extraction

Information on study characteristics (demographics including cancer type, number of participants, proportion of males/females, mean participant age, as well as study location, study length/year, study type/cohort design, eligibility criteria, data source/s, CPG/s cited, origin of CPG/s), and key findings such as adherence rates, factors associated with adherence and patient outcomes such as survival rates, were extracted by MB using a data collection template specifically developed for this study.

2.4 | Study quality assessment

The Joanna Briggs Institute (JBI) checklist for prevalence studies[48] was used to appraise the quality of each study. The tool comprises nine items. Each study was independently assessed by two authors (MB and SS), with any discrepancies resolved through discussion with GA.

2.5 | Data analysis

A narrative synthesis approach[49] was used to analyze CPG adherence rates and associated factors. The World Health Organization's (WHO) five dimensions of adherence framework (*which includes patient factors*, *health condition factors*, *health care system and team factors*,

socioeconomic factors, as well as factors related to medical therapy)[50] guided the categorization of factors identified in this study. This framework has also been applied to CPG adherence in other health areas.[51,52] Given the variety of cancers, subgroups, and treatment types and changes in CPGs over time, meta-analysis was not conducted.[53]

3 | RESULTS

3.1 | Included studies

After abstracts were downloaded, titles that did not meet the eligibility criteria were excluded, and the full texts of eligible studies (and their reference lists) were reviewed, identifying 20 eligible studies[54–72,118] (Figure 1). Data from included studies was extracted using a predefined template.

3.2 | Interrater reliability scores

The 17 pairs of reviewers who reviewed title and abstracts had acceptable interrater reliability scores, with 3/17 achieving *near perfect agreement* (.81–.99), 9/17 pairs achieving *substantial agreement* (.61–.80), 4/17 achieving *moderate agreement* (.41–.60), and one pair achieved *fair agreement* (.21–.40).[47] The lead author (MB) reviewed all title abstracts and full texts. Disagreements were resolved by consensus with GA, minimizing the significance of any low Kappa scores.

3.3 | Characteristics of included studies, quality assessment, and risk of bias assessments

Of the 20 studies included in the final analysis, the majority of studies assessed adherence to lung cancer treatment CPGs ($n = 6$[54–58,118]), cervical cancer ($n = 4$[58–61]), colorectal cancer (CRC) ($n = 4$[62–65]), and breast cancer ($n = 3$[66–68]). Two studies assessed adherence to lymphoma CPGs,[69,70] another assessed melanoma CPGs,[71] and another one assessed prostate cancer CPGs.[72] One study assessed adherence to both cervical and lung cancer[58] (Table 1).

This review included various study designs: population-based cohort studies that typically used registry data ($n = 12$[57–59,62–65,67–69,71,118]), multicenter cohort studies ($n = 4$[54,56,61,66]), and case-series which followed patients from a single institution ($n = 4$[55,60,70,72]) (Table 1). The studies were conducted in New South Wales (NSW) and the Australian Capital Territory (ACT) ($n = 10$[54–56,59,61,65–67,71,118]), South Australia (SA) ($n = 4$[62,63,70,72]), Victoria (VIC) ($n = 3$[57,60,69]), Australia-wide ($n = 2$[64,68]), and Queensland (QLD) ($n = 1$[58]). The Australia Cancer Network (ACN) CPGs (which were developed in partnership with the National Health and Medical Research Council (NHMRC)) ($n = 7$), National Comprehensive Cancer Network (NCCN) CPGs ($n = 7$), and NHMRC CPGs ($n = 5$) were the most commonly used CPGs across the 20 included studies (with 7 studies referring to more than 1 CPG) (Table 1). The data included in each study spanned the years from 1997 to 2018, with half of the studies reporting data from a time period that included 2006 (see Additional file 3). Three quarters of the studies were published after 2014 (see Additional file 4). Assessment using the JBI prevalence study critical appraisal tool demonstrated that the included studies were of high quality (see Additional file 5).

3.4 | Rates of receipt of cancer guideline recommended treatment (GRT)

All studies reported CPG adherence (receipt of cancer GRT) as a measure, with varying rates of adherence reported across the different cancer streams. The most notable feature is that the studies differed considerably in whether they examined adherence to a few indicators or many, and whether they stratified by subgroup or not. Adherence rates were also variable (Table 2). As a result of this heterogeneity, meta-analysis was not possible. This was the case even for the four of the lung cancer studies that looked at one CPG, because they looked at different patient subgroups. The CPGs referred to by each study are presented in Table 1, whereas the CPG recommendations are outlined in Table 2.

The median cancer treatment CPG adherence rate was 57% (29% to 66%[54,56–58,118]) across the lung cancer studies, and 83% (54%[59] to 86%[58]) across the cervical cancer studies. Only one study in each of the breast,[67] colon,[63] rectum, melanoma,[71] prostate,[72] diffuse large B-cell lymphoma (DLBCL),[69] and early-stage Hodgkin lymphoma (ESHL)[70] cancer streams reported overall adherence rates, and so a median adherence rate was not calculated (Table 3, Figure 2). CPG adherence varied widely across subgroups within different cancer sites, ranging from 0% to 100% for subgroups within breast cancer,[66–68] 74% to 100% for prostate cancer subgroups,[72] 58% for DLBCL subgroups,[69] 83% to 100% for ESHL subgroups,[70] 35% for melanoma subgroups,[71] 23% to 98% for lung cancer subgroups,[54,56–58,118] 0% to 100% for cervical cancer subgroups,[58–60] 29% to 98% for colon cancer subgroups,[63,65] and 7% to 94% for rectal cancer subgroups[62–65] (Table 2).

3.5 | Factors significantly associated with receipt of GRT

Of the 20 included studies, 16 assessed factors associated with receipt of GRT,[54,56–65,67–69,71,118] whereas 4 studies did not[55,66,70,72] (Table 4). Factors associated with receipt of GRT have been categorized according to the WHO's five dimensions of adherence framework: patient factors, health condition factors, healthcare system and team factors, socioeconomic factors, and medical therapy factors[73] (Table 4 and Figure 3).

The most commonly reported factor significantly associated with receipt of GRT was patient age, reported in 12 studies (across breast cancer,[66,67] DLBCL,[69] lung cancer,[54,56–58,118] cervical cancer,[59] and CRC[62,63,65]), followed by cancer stage in 7 studies (across lung cancer,[54,56,57,118] cervical cancer,[59] and CRC[62,63]), patient comorbidities in 5 studies (across DLBCL,[69] CRC,[63] and lung cancer[56–58]),

TABLE 1 Characteristics of 20 included studies

Study	Cancer type and stage	*N* of participants	Study location	Data year/study length	Participant age and gender	Study type	Eligibility criteria	Data source	CPG	CPG origin
Craft 2010[66]	Breast *Early stage*	$n = 2081$	ACT and SE NSW	July 1997–June 2006	Mean age 57.2 ± 11.9 years (ACT), 60.3 ± 12.3 years (SENSW); F: 100%	Prospective cohort study	Women with unilateral invasive EBC undergoing potentially curative surgical resection for breast cancer within the ACT and SE NSW regions were included	An audit study of women treated in metropolitan Canberra and rural settings in the region	Quality indicators from ANBC Audit	Aust
Jung 2019[67]	Breast *TNM stages I or II, early stage*	$n = 604$	ACT	2008–2016	50–69 years ($n = 767$, F: 65.5%); <50 years ($n = 211$), <70 years ($n = 193$); F: 100%	Cohort study (medical record review)	Female cases with histologically proven nonmetastatic early-stage breast cancer who received adjuvant whole breast RT at the Department of Radiation Oncology, Canberra Health Services	ACT and SE-NSW BCTG prospective cohort Quality Assurance study and electronic medical records	ASTRO 2010[92]; Cancer Australia 2011[93] and 2015[94]	USA, Aust
Lomma 2020[68]	Breast *Stages I–III*	$n = 99{,}768$	Aust	1 October 2006–30 September 2016	Mean age of males 67.5 years (range: 24.6–94.3) and females 60.8 years (range: 15.4–102.4); F: 99.4%	Retrospective population-based cohort study	Breast cancer cases in BQA dataset. Excluded: cases with de novo metastatic disease or non-recorded gender	BQA	NCCN 2018[95]	USA
Wong Doo 2019[69]	DLBCL *Limited stages I and II, extensive III and IV*	$n = 1442$: 624 (2008–2009), 818 (2012–2013)	VIC	1 January 2008–31 December 2009 and 1 January 2012–31 December 2013	<60 years 26% ($n = 379$), 60–79 years 52% ($n = 751$), >80 years 22% ($n = 312$); M: 58%	Retrospective population-based cohort study	All new pathologically confirmed DLBCL cases, aged ≥18 years	VCR Victorian Cancer registry	ESMO 2015[96]; NCCN 2017[97]	Euro, USA
Roos 2017[70]	ESHL *Stages IA, IB, IIA, IIB*	$n = 60$	SA	July 2009–July 2014	Median age 39 years (range 18–79 years); M: 48%	Retrospective case-series (medical record review)	All ESHL cases receiving RT	Electronic medical records database at the Royal Adelaide Hospital	eviQ 2015[98]	Aust
Freeman 2015[72]	Prostate *Stages T1–T2a, T2b, and T2c, T3 and T4, Tx*	$n = 215/1089$ eligible cases	SA	1 October 2011–30 September 2012	Median age 71 years (range: 46-91 years); gender not reported	Retrospective case-series (medical record review)	All carcinoma of the lung and bronchus cases	Electronic medical records database at the Royal Adelaide Hospital	NCCN 2014[99]; eviQ 2009[100]	Aust, USA

(Continues)

TABLE 1 (Continued)

Study	Cancer type and stage	N of participants	Study location	Data year/study length	Participant age and gender	Study type	Eligibility criteria	Data source	CPG	CPG origin
Varey 2017[71]	Melanoma Primary in situ or invasive cutaneous	$n = 1754/2590$ lesions (67% with complete margin data)	NSW	23 October 2006–22 October 2007	Not reported	Retrospective population-based cohort study	Histopathologically confirmed Melanoma cases (primary in situ, invasive cutaneous, unknown primary site)	NSW Cancer Registry	NHMRC 1999[101]	Aust
Boxer 2016[54]	Lung *Stages I, II, IIIA, IIIB, IV NSCLC; limited and extensive stage SCLC*	$n = 791/808$ (newly diagnosed lung cancer patients discussed at MDM)	NSW	1 December 2005–31 December 2010	Median age 68 years (range: 35–93 years); M: $n = 503$, F: $n = 288$	Retrospective multicenter cohort study (medical record review)	All lung cancer cases (primary; NSCLC, SCLC), newly diagnosed, who were discussed at the MDM. Recurrent disease excluded	Lung cancer MDM Liverpool and Macarthur Cancer Therapy Centres in SWS	ACN 2004[102]	Aust
Conron 2007[55]	Lung *Stages I–IIIA, IIb, IV NSCLC; limited SCLC*	$n = 257$	NSW	September 2002–September 2004	Mean age 68.0 ± 11.2 years (range 22–92 years); M: 70.1%	Retrospective case-series (medical record review)	All cases with known or suspected lung, pleural, or mediastinal malignancies discussed by lung cancer MDC	St Vincent's Hospital lung cancer MDC	ACN 2004[102]	Aust
Duggan 2016[118]	Lung *Stages I–IIIA, and IIIB NSCLC*	$n = 592$	NSW	January 2006–December 2011	>70 years, 51%; median age 70 years, M: 61%	Retrospective population-based cohort study	All newly diagnosed NSCLC cases	SWS and Sydney LHD Clinical Cancer Registry	ACN 2004[102]	Aust
Vinod 2010[56]	Lung *Stages I–IV NSCLC, limited, extensive SCLC*	$n = 335$	NSW	1 December 2005–31 December 2007	Median age 69 years; M: 65%	Retrospective multicenter cohort study (MDM medical record review)	All newly diagnosed lung cancer cases presented to the MDM	MDM at Liverpool and Macarthur Cancer Therapy Centres (SWS, NSW)	NCCAC nd[103]; RCRCOIN 1999[104]; ACCPHSPC 2003[105]; ACN 2004[102]; NCCN 2006 V1[106]; NCCN 2006 V2[107]	Aust, USA, UK
Wah 2020[57]	Lung *Stages I–IV, NSCLC; limited SCLC stages I–III, extensive SCLC stage IV*	$n = 4854$	VIC	2011–2018	<60 years $n = 951$; 60–69 years $n = 1492$; 70–79 years $n = 1659$; 80 years $n = 752$; M: $n = 2780/4854$	Retrospective population-based cohort study	All NSCLC and SCLC cases. Excluded cases with unknown clinical stages or invalid residential addresses	Victorian Lung Cancer Registry	NCCN 2017[97,108]	USA
Whop 2017[58]	Lung/cervical *Localized, regional stages*	$n = 199$ NSCLC; $n = 105$ cervical	QLD	January 1998–December 2004	56.4% of Indigenous and 61.4% of non-Indigenous NSCLC cases were >60 years, 17.9% of Indigenous and 12.2% non-Indigenous cervical cancer cases were >60 years; F: 100%	Retrospective population-based cohort study	All Indigenous cases diagnosed with NSCLC or cervical cancer and a matched comparison group of non-Indigenous cases	QLD Cancer Registry	GMCT 2009[109]; ACN 2004[102]	Aust

(Continues)

TABLE 1 (Continued)

Study	Cancer type and stage	N of participants	Study location	Data year/study length	Participant age and gender	Study type	Eligibility criteria	Data source	CPG	CPG origin
Chiew 2017[59]	Cervical *Stages IA, IB1, IIA, IB2, IIB–IVA*	$n = 208$	NSW	1 July 2005–31 December 2011	Mean and median age was 53 and 50 years; F: 100%	Retrospective population-based cohort study	All newly diagnosed cervical cancer cases	SWSLHD and SLHD Clinical Cancer Registry	NCCN 2015[110]; ESMO 2010[111]; JSGO 2007[112]; SIGN 2008[113]	Various
Thompson 2015[61]	Cervical cancer + uterine malignancies *FIGO stage IA1, IB, IC, IIA, IIB, IIIA, IIIB, IIIC, IVA, and IVB*	$n = 163$	NSW	Treated in 2003	Mean age 65 years (range: 42–88 years); F: 100%	Retrospective multicentered observational cross-sectional cohort study	All diagnosed cases of malignancy of the uterine corpus (in NSW residents) treated with BT. Excluded: cases with cancer of the uterine cervix	Electronic medical records from nine radiation oncology departments in NSW that deliver BT	NSW GOSG 2004[114]	NSW
Kang 2015[60]	Cervical cancer *FIGO stages IA1, IA2, IB and IIA, IIB and IVA, IVB*	$n = 385$	VIC	1999–2008	All female; age-distribution not reported	Case-series (medical record review)	All patients who received their first cervical cancer treatment at the Royal Women's Hospital, Melbourne in the study period (approx. 25% of Victorian incident cases in the period)	Royal Women's Hospital in Melbourne	GMCT 2009[109]	Aust
Adelson 2018[62]	CRC *Stage C Colon; Stage B, C Rectal*	$n = 738$ colon stage C cases eligible for GRT; $n = 792$ rectal stages B and C cases eligible for GRT; $n = 4273$ CRC cases treated	SA	2000–2010	<40 years $n = 14$ colon, 17 rectal; 40–49 years $n = 35$ colon, 45 rectal; 50–59 years $n = 97$ colon, 132 rectal; 60–69 years $n = 170$ colon, 217 rectal; 70–79 years $n = 258$ colon, 244 rectal; 80 years $n = 164$ colon, 134 rectal; M: $n = 366$; F: $n = 372$ colon cancer; M: $n = 480$; F: $n = 312$ rectal cancer	Retrospective population-based cohort study	Patients treated for CRC at four tertiary SA referral hospitals with cancer centers	SACCR	NHMRC 1999[115]; ACN 2005[116]	Aust
Beckmann 2014[63]	CRC *Stages A, B, C, D rectal and colon*	$n = 4641$	SA	January 2003–December 2008	50–79 years (50-59 years 20.7%, 60–69 years 34.5%, 70–79 years 44.8%); M: 57.5%	Retrospective population-based cohort study with data linkage	SA residents aged 50 and 79 years diagnosed with CRC	South Australian Cancer Registry (SACR)	ACN 2005[116]	Aust

(Continues)

TABLE 1 (Continued)

Study	Cancer type and stage	*N* of participants	Study location	Data year/study length	Participant age and gender	Study type	Eligibility criteria	Data source	CPG	CPG origin
Young 2007[65]	CRC *Duke's stages A, B, C, D*	$n = 560$	NSW	November 2012–May 2013	Mean age 68 years (SD = 12); M: 60%	Retrospective population-based cohort study	All adult cases residing in NSW diagnosed with incident primary CRC. Excluded: cases with a life expectancy <6 months, past CRC malignancy, or hospital or nursing home residents (long term)	NSW Bowel Cancer Care Survey; NSW Cancer Registry	NHMRC 1999[115]	Aust
McGrath 2004[64]	CRC *Duke's stages A, B, C, D*	$n = 1911$	Aust	February–April 2000	80% aged over 60 years; M: 57.4% (1097/1911)	Retrospective population-based cohort study	New CRC cases reported across Australia between February and April 2000, post operation	State based registries and survey to surgeons	NHMRC 1999[115]	Aust

Abbreviations: ACCPHSPC, American College of Chest Physicians, Health and Science Policy Committee; ACN, Australian Cancer Network; ACT, Australian Capital Territory; ANBCA, Australian National Breast Cancer Audit; ASTRO, American Society for Radiation Oncology; Aust, Australia; BCTG, Breast Cancer Treatment Group; BQA, BreastSurgANZ Quality Audit; BT, brachytherapy; CPG, clinical practice guideline; CRC, colorectal cancer; DLBCL, diffuse large B-cell lymphoma; EBC, early breast cancer; ESHL, early-stage Hodgkin lymphoma; ESMO, European Society of Medical Oncology; F, female; FIGO, International Federation of Obstetrics and Gynecology (Federation Internationale de Gynecologie et d'Obstetrique); GMCT, Greater Melbourne Clinical Taskforce; GOSG, NSW Gynecological Oncology Study Group; GRT, guideline recommended treatment; JSGO, Japan Society of Gynecologic Oncology; M, male; MDC, Multidisciplinary Committee; MDM, Multidisciplinary Meeting; NCCAC, National Collaborating Centre for Acute Care; NCCN, National Comprehensive Cancer Network; ND, no date; NHMRC, National Health and Medical Research Council; NSCLC, non-small cell lung cancer; NSW, New South Wales; QLD, Queensland; RCRCOIN, The Royal College of Radiologists Clinical Oncology Information Network; RT, radiotherapy; SA, South Australia; SACCR, South Australian Clinical Cancer registry; SACR, South Australian Cancer Registry; SCLC, non-small cell lung cancer; SE, South Eastern; SIGN, Scottish Intercollegiate Guidelines Network; SLHD, Sydney Local Health District; SWS, South Western Sydney; TNM, Tumor Node Metastasis staging system; VIC, Victoria.

TABLE 2 Overall reported adherence rates to active cancer clinical practice guideline (CPG) recommendations

Cancer stream	Study	Overall adherence rate reported	Subgroup adherence rates	Predictors of GRT	CPG	CPG recommendations	Treatment types				
							CTx	RT	Sx	ET	IMT
Breast	Craft 2010[66]	93.5% GRT (axillary Sx or SLNB), 6.5% (137/2102) non-GRT 97.6% GRT (attainment of clear surgical margins), 2.4% (51/2094) non-GRT 95.6% GRT (RT after breast-conserving Sx), 4.4% (45/1022) non-GRT 91.2% GRT (ET for ER or PR +ve tumors), 8.8% (152/1723) non-GRT 93.9% GRT (CTx for node +ve, age <65 years), 6.1% (37/608) non-GRT		Age, tumor size, tumor grade, HR status, axillary node status, year of diagnosis, treatment in metropolitan hospital	QIs from an Australian National Breast Cancer audit	1. SLNB, axillary lymph node sampling or clearance, 2. RT following breast-conserving Sx, 3. Attainment of clear margins at final Sx, 4. ET for estrogen receptor (ER) or PR positive cases, and 5. CTx for node-positive patients aged less than 65 years	x	x	x	x	
	Jung 2019[67]	46.2% GRT (HF-WBRT) (279/604): 17.2% (21/122) in 2008 56.3% GRT (36/64) in 2010 31.8% GRT (42/132) in 2011 53.0% GRT (80/151) in 2013 74.1% GRT (100/135) in 2015		Age, tumor size, grade, node status, remoteness	ASTRO 2010, Cancer Australia 2011, 2015	CPG criteria for HF-WBRT (HF-WBRT (>50 years N0 tumor, no CTx indicated) defined as external beam RT; dose delivery of >2.0 Gy per fraction per day to the whole breast		HF-WBRT			
	Lomma 2020[68]	HR−, HER2+, size >10 mm or node positive: 100% GRT, males, 79% GRT, females (CTx, trastuzumab) HR+, HER2+, size 6–10 mm, node negative: 100% GRT, males, 81% GRT, females (ET ± CTx/trastuzumab) HR+, HER2+, size >10 mm or node positive: 53% GRT, males, 62% ($p = .296$) GRT, females (CTx, trastuzumab + ET) HR+, HER2−, node positive: 56% GRT, males, 64% ($p = .021$) GRT, females (CTx + hormonal) Triple negative, tumor ≤5 mm and node negative: 0% GRT, males, 36% GRT, females (no treatment) Triple negative, >10 mmor node positive: 50% GRT, males, 85% ($p = .006$) GRT, females (CTx)		Gender	NCCN 2018	NCCN 6 various treatment recommendations: 1. HR negative (HR−), HER2+, size >10 mm or node positive: CTx and trastuzumab 2. HR+, HER2+, size 6–10 mm, node negative: ET and/or CTx/trastuzumab 3. HR+, HER2+, size >10 mm or node positive: CTx + trastuzumab + ET 4. HR+, HER2−, node positive: CTx + ET 5. Triple negative, tumor ≤5 mm and node negative: no treatment 6. Triple negative, >10 mm or node positive: CTx	x			x	X

(Continues)

TABLE 2 (Continued)

Cancer stream	Study	Overall adherence rate reported	Subgroup adherence rates	Predictors of GRT	CPG	CPG recommendations	Treatment types				
							CTx	RT	Sx	ET	IMT
DLBCL	Wong Doo 2019[69]	58% GRT (830/1442) 35% GRT (323/624) in 2008 62% GRT (507/818) in 2012		Age, gender, smoking status, comorbidities, year of diagnosis, SES, treatment in a public hospital, metropolitan hospital	ESMO, NCCN	'R-CHOP 6–8 cycles ± RT, R-CHOP-like 68 cycles (including R-mini CHOP consisting of reduced doses of cyclophosphamide doxorubicin and prednisone as well as capping of vincristine, rituximab, cyclophosphamide, etoposide, vincristine, prednisone [R-CEOP] in which etoposide replaces doxorubicin and rituximab, cyclophosphamide, doxorubicin, etoposide, prednisone [R-CHEP] in which etoposide replaces vincristine), rituximab, hyper-fractionated cyclophosphamide, vincristine, doxorubicin, dexamethasone (R-hyperCVAD) 6 cycles, rituximab-dose adjusted etoposide, prednisone, vincristine, cyclophosphamide, doxorubicin (R-DA-EPOCH) 6 cycles, rituximab, methotrexate, doxorubicin, cyclophosphamide, vincristine, prednisone, bleomycin (R-MACOPB) and rituximab, cyclophosphamide, doxorubicin, methotrexate alternating with ifosfamide, etoposide, cytarabine (R-CODOX-M IVAC). If disease stage was I–II, optimal treatment could also include R-CHOP ≥3 cycles with RT. Suboptimal treatment: R-CHOP or R-CHOP variants <6 cycles (other than stages I–II as described before), or any other CTx-immunotherapy regimen.'[69]	x				x

(Continues)

TABLE 2 (Continued)

Cancer stream	Study	Overall adherence rate reported	Subgroup adherence rates	Predictors of GRT	CPG	CPG recommendations	Treatment types				
							CTx	RT	Sx	ET	IMT
ESHL	Roos 2017[70]	100% GRT (54/54) (type of CTx) 87% GRT (47/54) (number of cycles of CTx) 83% GRT (50/60) (RT dose) 98% GRT (59/60) (RT volume) 100% GRT (54/54) (RT timing)		NR	eviQ protocol treatment	RT dose: favorable 20 Gy; unfavorable 30 Gy RT volume: involved site Timing of RT: RT should commence between 3 and 6 weeks after the last dose of CTx CTx: favorable ABVDx2; unfavorable ABVDx4	x	x			
Melanoma	Varey 2017[71]	35% GRT (margin excision) Of the 65% non-GRT (margin excision); 45% were overtreated, 21% undertreated		Breslow thickness, caseload	NHMRC 1999	Initial performance of an excision biopsy with 2 mm clinical margins (to confirm the diagnosis) followed by a WLE at a second operation. Clinical surgical excision margins for the WLE (Breslow thickness, mm and CPG surgical margin, mm); in situ: 5 mm; >0–1.5: 10 mm; >1.5–4.0: 10–20 mm; >4.0: 20–30 mm[71]			x		
Prostate	Freeman 2015[72]	85% (176/207) GRT (guideline concordant treatment modality) 100% GRT (EBRT monotherapy and EBRT + HDR boost) 100% GRT (37/37)(WPRT) 94% GRT (98/104) of eligible high-risk cases (ADT) 56% GRT (5/9) of eligible high or intermediate risk cases (EBRT < 73.8 Gy + ADT) 95% GRT (58/61) high-risk monotherapy cases (long-term ADT) 96% GRT (198/207) (ADT): 91% GRT (87/96) high-risk 100% GRT (84/84) interm-risk 100% GRT (27/27) low risk	By risk group 100% GRT (27/27) low-risk cases (EBRT alone or LDR BT alone without ADT and without WPRT) 74% GRT (62/84) intermediate-risk cases 91% GRT (87/96) high-risk cases (EBRT alone or combined with HDR boost) RT dose guideline concordance 92% GRT (125/136) (EBRT monotherapy dose (73.8–81 Gy) alone; 95% high-risk, 91% intermediate-risk and 50% low-risk patients) 94% GRT (32/34) (EBRT dose of 40–50 Gy + HDR boost) 100% GRT (45/45) (LDR monotherapy; iodine-125 implants 145 Gy)	NR	NCCN 2014, eviQ 2009	Appropriate treatment modality option by risk group: *High risk*, EBRT with long term (2–3 years) concurrent ADT (or 4–6 months in presence of single high risk adverse feature) or EBRT + BT ± concurrent long term ADT and consider use of WPRT *Intermediate risk*: EBRT alone or EBRT + BT or EBRT + short term (3–8 months) concurrent ADT consider use of WPRT (NCCN only) *Low risk*: EBRT alone or BT alone Appropriate RT doses: EMBRT ± ADT: 73.8–81 Gy at 1.8–2.0 Gy/fraction (eviQ) if the EBRT monotherapy dose prescribed was <73.8 Gy, for high and intermediate risk patients, concurrent ADT was used (eviQ) EBRT + HDR boost: 40–50 Gy EBRT dose (NCCN)		x		x	

(Continues)

TABLE 2 (Continued)

Cancer stream	Study	Overall adherence rate reported	Subgroup adherence rates	Predictors of GRT	CPG	CPG recommendations	CTx	Treatment types RT	Sx	ET	IMT
						LDR 1–1.35 alone: 145 Gy (NCCN) EBRT beam energy should be ≥6 MV using three-dimensional conformal RT (3D-CRT) or intensity-modulated RT (IMRT) ideally with joint CTx/MRI planning with dose–volume histogram (DVH) constraints on the rectum and bladder and daily on-line image matching to fiducials (eviQ/NCCN) Appropriate maximum waiting times (departmental consensus based upon 'acceptable' upper limits) were EBRT monotherapy 3 months, EBRT mono + ADT 6 months, EBRT + HDR boost 3 months, EBRT + HDR + ADT 6 months, LDR along 3 months[72]					

Lung cancer	Study	Overall adherence rate reported	NSCLC treatment CPG adherence rate	SCLC treatment CPG adherence rate	Predictors of GRT	CPG	CPG recommendations	CTx	RT	Sx	ET	IMT
Lung cancer	Boxer 2016[54]	54% GRT (435/808)	NR	NR	Age, stage, ECOG,	A.C.N. 2004	**A.C.N. 2004** ECOG 0–2 NSCLC stage I Sx OR curative RT NSCLC stage II Sx + Adj CTx OR curative RT + CTx NSCLC stage IIIA Sx + CTx (Adj /neo-Adj) ± RT OR curative RT + CTx NSCLC stage IIIB RT + CTx (curative or palliative) NSCLC stage IV palliative CTx ± palliative RT SCLC limited stage curative CTx + RT SCLC extensive stage palliative CTx ± palliative RT	x	x	x		

(Continues)

TABLE 2 (Continued)

Lung cancer		Overall adherence rate reported	NSCLC treatment CPG adherence rate	SCLC treatment CPG adherence rate	Predictors of GRT	CPG	CPG recommendations	CTx	RT	Sx	ET	IMT
	Conron 2007[65]	NR	Stage I–IIIA NSCLC: 98% GRT (Macroscopically complete surgical resection) Stage IIIB NSCLC: 84% GRT (Completion of 60-Gy RT)	85% GRT (Thoracic RT with CTx)	NR	A.C.N. 2004	(A.C.N. 2004 continued) ECOG 3-4 NSCLC stage 1 best supportive care NSCLC stage II best supportive care with or without palliative RT to symptomatic sites ECOG 4 SCLC limited stage best supportive care SCLC extensive stage palliative RT to symptomatic sites[54,56,58,65,102]	x	x	X		
	Duggan 2016[118]	66% GRT (389/592)	Stage I: 81% GRT (152/187) Stage II: 79% GRT (87/110) Stage IIIA: 60% GRT (102/171) Stage IIIB: 39% GRT (48/124)	NR	Age, birthplace, stage, ECOG, discussed by an MDT, SES	A.C.N. 2004		x	x	X		
	Whop 2017[58]	28.6% GRT (57/199) 22.7% GRT of Indigenous cases; 36.4% GRT of non-Indigenous cases, $p = .04$	Localized NSCLC (stage I and II): 44.4% GRT Regional/distant NSCLC (stage IIIA and IIIB/IV): 24.2% GRT, $p < .01$	NR	Age, regional/ distant, comorbidities	A.C.N. 2004		x	x	x		
	Vinod 2010[56]	68% GRT (228/335) (RT); 60% (201/335) MDM Recommended 78% GRT (260/335) (CTx); 60% (200/335) MDM Recommended 9% GRT (29/335) MDM Recommended (Sx)	NR	NR	Age, stage, comorbidities	A.C.N. 2004; NCCAC nd; RCRCOIN 1999; ACCPHSPC 2003; NCCN 2006		x	x	X		
	Wah 2020[57]	60.36% GRT (2930/4854) NSCLC: GRT (2630/4467) SCLC: GRT (300/387)	*Stage I–II*: 74.41% GRT (756/1016): Sx only (49.7%) Sx + CTx (12.8%) SBRT only (7.68%) Sx + Conv RT + CTx (2.46%) Sx + Conv RT (1.77%) *Stage III locally advanced NSCLC*: 47.48% GRT (583/1228): Sx + CTx (7.82%) Conv RT + CTx (36.24%) Sx + Conv RT + CTx (3.42%) *Stage IV NSCLC*: 58.07% GRT (1291/2223): Conv RT + CTx (28.43%) CTx only (27.49%) Conv RT + CTx + Sx (.67%) CTx + Sx (1.48%)	*Limited stage SCLC stage I–III*: 63.12% GRT (89/141): Sx + CTx (1.42%) Conv RT + CTx (58.16%) Sx + Conv RT + CTx (3.55%) *Extensive SCLC stage IV*: 85.77% GRT (211/246): Conv RT + CTx (28.46%) CTx (57.32%)	Smoking status, stage, comorbidities, cancer site, ECOG, physician caseload, year of diagnosis, SES, treatment in private hospital	NCCN 2017	NSCLC: 1. Localized (stages I–II): Sx ± additional treatments and/or SBRT ± additional treatments 2. Locally advanced (stage III): Sx + CTx ± additional treatments and/or RT (any regimen) + CTx ± additional treatments 3. Advanced (stage IV): CTx ± additional treatments SCLC: 1. Limited (stages I–III): Sx + CTx ± additional treatments and/or RT (any regimen) + CTx ± additional treatments 2. Extensive (stage IV): CTx ± additional treatments[57]	x	x	X		

(Continues)

TABLE 2 (Continued)

Cervical cancer		Overall adherence rate reported	Localized cervical cancer treatment CPG adherence rate	Regional/distant cervical cancer treatment CPG adherence rate	Predictors of GRT	CPG	CPG recommendations	CTx	RT	Sx	ET	IMT
Cervical cancer	Whop 2017[58]	85.7% GRT (90/105) By Indigenous Status 76.8% GRT, of eligible Indigenous cases; 95.9% GRT, of eligible non-Indigenous cases, $p < .01$	93.3% GRT	75.6% GRT	Regional/ distant tumor, race	GMCT 2009, NHMRC 2004	**GMCT 2009** FIGO stage IA1: total hysterectomy, or conization, or modified radical hysterectomy + PL, or BT (depending on clinical indications) IA2: Modified radical hysterectomy + PL, or total hysterectomy + PL, or radical trachelectomy + PL, or radical RT (depending on clinical indications) IB1–IIA: modified Radical hysterectomy + PL, or Radical RT, or Radical hysterectomy + PL + Adj pelvic RT, or Radical hysterectomy + PL + Adj CTxRT, or RT, or primary CTxRT, or Radical hysterectomy + PL ± Adj RT, or neo-Adj CT + radical hysterectomy + PL ± Adj RT/CTxRT, OR RT (depending on clinical indications) IIB1–IVA: CTxRT, or RT (depending on clinical indications) IVB: CTx, or RT or CTxRT (depending on clinical indications)[60]					
	Kang 2015[60]	Adherence rates of GRT by FIGO stage	FIGO **IA1**: 74.0% GRT (.64–.83) FIGO **IA2**: 69.0% GRT (.41–.89) FIGO **IB–IIA, non-bulky, not HR** IB1: 68.0% GRT (.58–.77); FIGO subgroups: IB2: 100.0% GRT (.29–1.00); IIA: .0% GRT (.00–.00) FIGO **IB–IIA, non-bulky, HR, good PS** IB1: 69.0% GRT (.41–.89); FIGO subgroups: IB2: .0% GRT (.00–.00); IIA: .0% GRT (.00–.00) FIGO **IB–IIA, non-bulky, HR, poor PS** IB1: 69.0% GRT (.32–.84); FIGO subgroups: IB2: .0% GRT (.00–.00); IIA: .0% GRT (.00–.00)	FIGO **IIB–IVA, good PS** IIB: 63.0% GRT (.49–.76); FIGO subgroups: IIIA: 50.0% GRT (.19–.81); IIIB: 54.0% GRT (.34–.72) FIGO IVA: 33.0% GRT (.10–.65) FIGO **IIB–IVA, poor PS** IIB: 85.0% GRT (.72–.93); FIGO subgroups: IIIA: 100.0% GRT (.69–1.00); IIIB: 71.0% GRT (.51–.87); IVA: 67.0% GRT (.35–.90); FIGO IVB: 80.0% GRT (.28–.99)	NR	GMCT 2009		x	x	x		

(Continues)

TABLE 2 (Continued)

Cervical cancer		Overall adherence rate reported	Localized cervical cancer treatment CPG adherence rate	Regional/distant cervical cancer treatment CPG adherence rate	Predictors of GRT	CPG	CPG recommendations	CTx	RT	Sx	ET	IMT
			FIGO **IB–IIA, bulky, good PS** IB1: 100.0% GRT (.29–1.00); FIGO subgroups: IB2: 74.0% GRT (.56–.87); IIA: 43.0% GRT (.10–.82) FIGO **IB–IIA, bulky, poor PS** IB1: 100.0% GRT (.29–1.00); FIGO subgroups: IB2: 82.0% GRT (.65–.93); IIA: 57.0% GRT (.18–.90)									
	Chiew 2017[59]	54.1% GRT (72/133)	NR	NR	Age, stage, remoteness	NCCN 2015, ESMO 2010, JSGO 2007, SIGN 2008	FIGO stage IA1, IA2: conization, radical trachelectomy, or hysterectomy depending on pathological features IB1, IIA: Radical hysterectomy and pelvic lymph node dissection (radical trachelectomy acceptable if tumor <2 cm and no LVSI) IB1, IIA: RT if not receiving Sx I, IIA, and 2 lymph nodes positive IB2, IIB–IVA: Adj CTxRT IB2, IIB–IVA: CTxRT IB2, IIB–IVA: CTxRT with cisplatin IB2, IIB–IVA: CTxRT with OTT for RT <56 days IB2, IIB–IVA: CTxRT with EBRT and BT IB2, IIB–IVA: CTxRT with total RT dose and 80 Gy IA–IVB: Discussion of management by an MDT[59]	x	x	x		
	Thompson 2015[61]	83% GRT (55/66) (Adj RT dose)	NR	NR	Caseload	NSW GOSG 2004	Adj monotherapy doses: LDR BT 50–60 Gy, HDR BT 30–40 Gy in 4–6 fractions. Combined modality treatment doses: 45–54 Gy EBRT in 1.8–2.0 Gy fractions with BT boost by LDR 20 Gy, or by HDR 15–18 Gy/2–4 fractions, EQD2 ($\alpha/\beta = 10$) = 67–76 Gy[61]		X			

(Continues)

TABLE 2 (Continued)

Colorectal cancer		Overall adherence rates	Colon cancer, stages A, B, C, and D treatment CPG adherence rate	Rectal cancer stages A, B, C, and D treatment CPG adherence rate	Predictors of GRT	CPG	CPG recommendations	CTx	RT	Sx	ET	IMT
CRC	Adelson 2018[62]	NR	60% GRT ($n = 443/738$) of eligible stage C (Dukes stage C) cases	Stage A: 45.8% GRT (363/792) Stage B: 7.3% GRT (131/351) Stage C: 52.6% GRT (232/441)	Age, stage, cancer site, remoteness	NHMRC 1999; ACN 2005	Postoperative CTx (colon cancer cases) Combined CTxRT Adj therapy (rectal cancer cases) or Adj or neo-Adj RT alone (rectal cancer cases)	x	x			
	Beckmann 2014[63]	NR	83.3% (2370/2979) of eligible cases received GRT ACP Stage A: 98.1% (524/526) Stage B: 97.0% (989/1011) Stage C: 59.8% (525/872) Stage D: 80.4% (352/438) cases	55.8% GRT (847/1662) Stage A: 94.4% (384/407) Stage B: 27.9% (119/427) Stage C: 37.4% (177/473) Stage D: 79.2% (167/211)	Age, gender, tumor grade and stage, comorbidities, cancer site, year of diagnosis, SES, area of residence	ACN 2005	Sx for stages A–C CRC (or local excision for low-grade stage A CRC) CTx for stage C colon, CTxRT for stages B and C rectal cancers Sx or CTx provided any time after diagnosis for stage D colon cancers Sx or RT provided at any time after diagnosis for stage D rectal cancers. Includes CTxRT for all Dukes' B including low risk[63]	x	x	x		
	Young 2007[65]	*NR*	Cases with low anterior resection or ultralow anterior resection: 29.1% GRT (169/581; 23.4%–35.5%) (colonic pouch reconstruction) Dukes' C cases who had Sx with curative intent: 76.0% offered GRT (367/483; 69.4%–81.6%) (Adj CTx or combined modality therapy)	T3 and T4 high-risk rectal cancer cases: 59.8% *offered* GRT (208/348; 52.4%–66.7%) (Adj RT alone or as combined modality therapy) Fixed or tethered rectal cancer cases: 59.3% GRT (67/113; 47.4%–70.3%) (preoperative RT)	Age, gender, caseload, treated in a metropolitan hospital	NHMRC 1999	1. Colonic pouch reconstruction is recommended following resection of low rectal cancer 2. Patients with resected node-positive colon cancer should be offered Adj therapy 3. Combined modality therapy or RT is indicated for patients with high-risk rectal cancer 4. Preoperative RT is indicated for patients with fixed or tethered rectal cancer if it is felt that down-staging will enable successful resection Referral of a patient for Adj therapy (CTx or RT), or declined referral was also considered GRT. Other recommendations needed to be followed to be considered GRT	x	x			

(Continues)

TABLE 2 (Continued)

Colorectal cancer	Overall adherence rates	Colon cancer, stages A, B, C, and D treatment CPG adherence rate	Rectal cancer stages A, B, C, and D treatment CPG adherence rate	Predictors of GRT	CPG	CPG recommendations	CTx	RT	Sx	ET	IMT
McGrath 2004[64]	NR	Node-positive (Dukes C/Stage III) cases: 80.1% GRT (346/432)(CTx)	35.4% GRT (64.6%, $n = 338$ non-GRT) (TME)	NR	NHMRC 1999	Avoid TME until more evidence available (expert opinion) Adj CTx for all node-positive colon cancer cases (Level I)	x		x		

Abbreviations: ACCPHSPC, American College of Chest Physicians, Health and Science Policy Committee; ACN, Australian Cancer Network; Adj, adjuvant; ADT, androgen deprivation therapy; ASTRO, American Society for Radiation Oncology; BT, brachytherapy; Conv, conventional; CRC, colorectal cancer; CTx: chemotherapy; DLBCL, diffuse large B cell lymphoma; EBRT, external beam radiation therapy; ECOG, Eastern Cooperative Oncology Group; ER, endocrine receptor status; ESHL, early-stage Hodgkin lymphoma; ESMO, European Society of Medical Oncology; ET, endocrine therapy or hormonal therapy; FIGO, International Federation of Obstetrics and Gynecology (Federation Internationale de Gynecologie et d'Obstetrique; GMCT, Greater Melbourne Clinical Taskforce; GOSG, NSW Gynecological Oncology Study Group; Gy, gray unit; HDR, high dose-rate; HER2, human epidermal growth factor receptor 2; HF-WBRT, hypofractionated whole-breast radiation therapy; HR, hormone receptor; IMT, immunotherapy or immune targeted therapy; Interm, intermediate; JSGO, Japan Society of Gynecologic Oncology; LDR, low-dose-rate; MDM, multidisciplinary team meeting; MDT, multidisciplinary team; MRI, magnetic resonance imaging; NCCAC, National Collaborating Centre for Acute Care; NCCN, National Comprehensive Cancer Network; NHMRC, National Health and Medical Research Council; NSCLC, non-small cell lung cancer; NSW, New South Wales; OTT, overall treatment time; PL, pelvic lymphadenectomy; PR, progesterone receptor; RCRCOIN, The Royal College of Radiologists Clinical Oncology Information Network; RT, radiotherapy; SCLC, small cell lung cancer; SES, socioeconomic status; SIGN, Scottish Intercollegiate Guidelines Network; SLNB, sentinel lymph node biopsy; Sx, surgery; TME, total mesorectal excision; WLE, wide local excision; WPRT, whole pelvic RT.

patient gender in 5 studies (across breast cancer,[68] DLBCL,[69] lung cancer,[57] and CRC[63,65]), caseload in 4 studies (across melanoma,[71] lung cancer,[57] cervical cancer,[61] and CRC[65]), year of diagnosis in 4 studies (across breast cancer,[66] DLBCL,[69] lung cancer,[57] and CRC[63]), and SES reported in 4 studies (across DLBCL,[69] lung cancer,[54,57,118] and CRC[63]) (Table 4, Figure 3).

3.5.1 | Patient factors

Patient factors (age, gender, smoking status, birthplace, and Indigenous status) were significantly associated with DLBCL, CRC, breast, lung, and cervical cancer GRT (Figure 3, Additional file 6).

Patient age was associated with GRT across 12 studies, with younger patients more likely to receive GRT in 1 breast cancer study,[66] 1 DLBCL study,[69] 4 lung cancer studies,[54,56,58] and 3 CRC studies.[62,63,65] Patient gender was significantly associated with GRT in five studies. Female cases were significantly more likely to receive GRT in one breast cancer study,[68] and one lung cancer study,[57] whereas male DLBCL cases were more likely to receive GRT,[69] as were male stage C CRC cases,[63] and male high-risk rectal cancer cases GRT.[65] Ex-smokers, compared to people who never smoked, were less likely to receive GRT in one DLBCL study[69] and one lung cancer study.[57] Non-small cell lung cancer and cervical cancer cases who identified as Indigenous were significantly less likely to receive GRT in one study.[58]

3.5.2 | Health condition factors

Health condition factors (cancer stage, cancer site/histology, tumor size, node status, histologic grade, endocrine receptor [ER] status and Progesterone Receptor status, Chest Wall Separation Distance, Breslow thickness, distant tumors, comorbidities, ECOG status, weight loss, and prior cancer) were significantly associated with CRC, DLBCL, melanoma, breast, lung, and cervical cancer GRT (Figure 3, Additional file 6). More advanced stage cancer cases were significantly less likely to receive GRT in three lung cancer studies,[54,57,118] one cervical cancer study,[59] and one CRC study.[63] Cases with comorbidities were significantly less likely to receive GRT in one DLBCL study,[69] two lung cancer studies,[57,58] and one CRC study.[63] ECOG performance was significantly associated with GRT in three lung cancer studies. In two studies, cases with good-excellent ECOG performance status (0–1) were more likely to receive GRT than cases with borderline ECOG status (2), but less likely than cases with poor ECOG status (3–4).[54,118] In another study, cases with excellent ECOG (0) status were more likely to receive GRT than cases with a poorer ECOG status of ≥1 (good, borderline, or poor).[57]

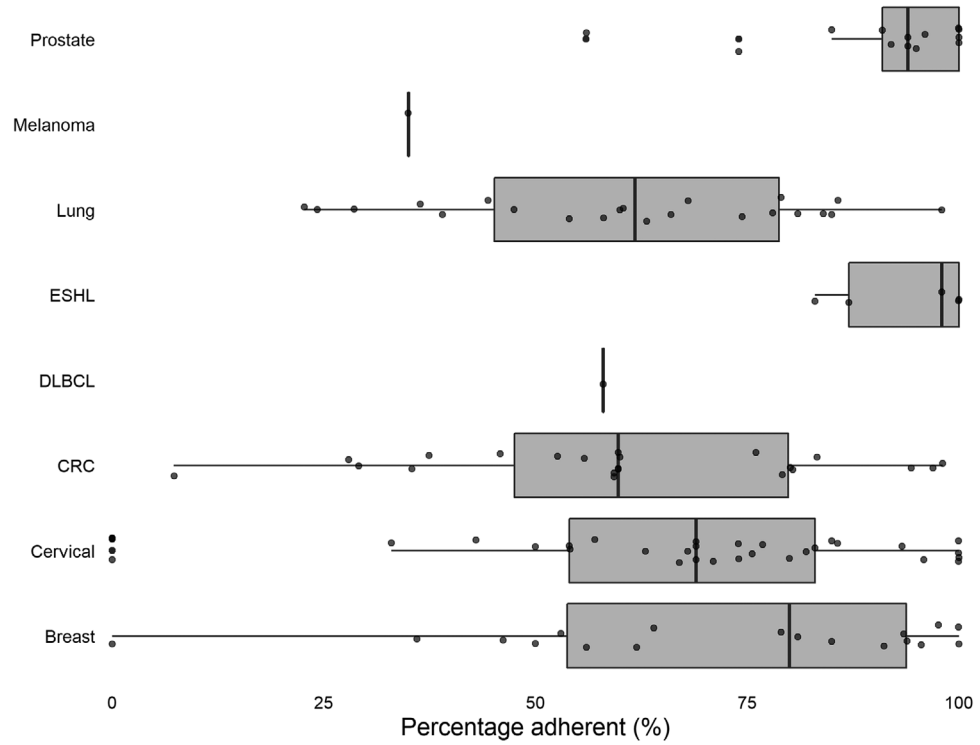

FIGURE 2 Overall and subgroup cancer treatment clinical practice guideline (CPG) adherence rates by cancer stream in Australia.

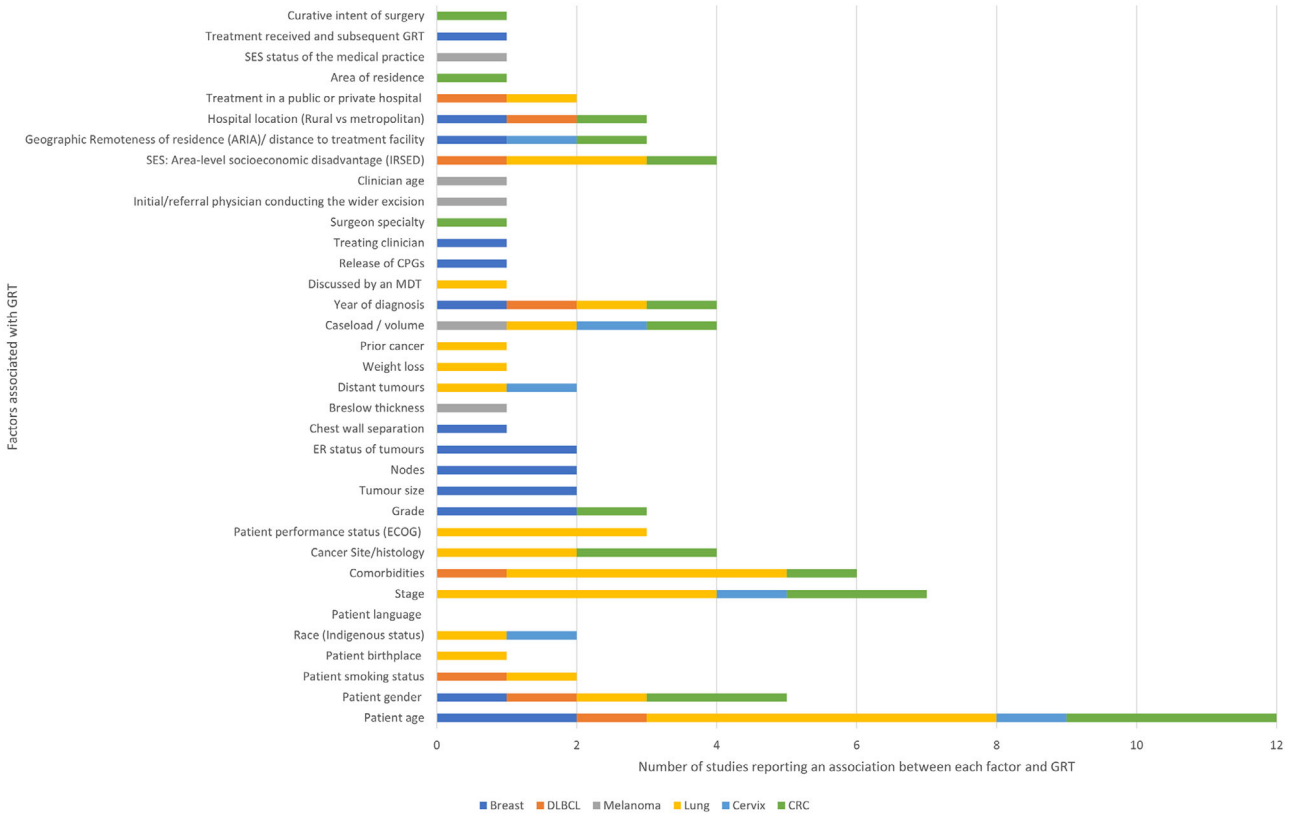

FIGURE 3 Factors associated with guideline recommended treatment (GRT) across six cancer streams. [Colour figure can be viewed at wileyonlinelibrary.com]

TABLE 3 Median clinical practice guideline (CPG) adherence rates across cancer streams

Cancer	No. studies[a]	No. with overall adherence estimate	Median overall adherence estimate	Range of overall adherence estimates	Ranges of subgroup adherence estimates
Breast	3	1	46.2% (HF-WBRT)	N/A	Male: 0%–100% Female: 36%–85%
Lung	6	4	57.18%	29%–66%	Localized NSCLC: 44%–98% Regional/distant NSCLC: 24%–84%
Cervical	4	3	83%	54%–86%	Localized: 0%–100% Regional/distant: 33%–100%
CRC	4	1	83% (colon) 56% (rectal)	N/A	Colon Stage C (Dukes' C): 60%–80% Rectal cancer Stage A: 46%–94% Stage B: 7%–28% Stage C: 37%–53%
Melanoma	1	1	35%	N/A	N/A
Prostate	1	1	85%	N/A	N/A
Lymphoma	2	1	58% (DLBCL)	58%; 83%–100%	DLBCL: 58% ESHL: 83%–100%

Abbreviations: CRC, colorectal cancer; ESHL, early-stage Hodgkin lymphoma; HF-WBRT, hypofractionated whole-breast radiation therapy; NSCLC, non-small cell lung cancer.
[a]One study reports adherence to lung and cervical cancer CPGs.

3.5.3 | Healthcare system and team factors

Healthcare system and team factors (caseload, year of diagnosis, being discussed by a multidisciplinary team meeting [MDM], release of CPGs, treating clinician, surgeon specialty, referral physician conducting the excision, and clinician age) were associated with CRC, breast, melanoma, lung, and cervical cancer GRT (Figure 3, Additional file 6).

Caseload was significantly associated with GRT in four studies, although there was no clear trend across cancers. In one melanoma study, cases treated by clinicians with lower caseload were significantly less likely to receive GRT,[71] and cervical cancer cases treated by gynecological BT departments with higher caseloads were more likely to receive GRT.[61] Lung cancer cases who were notified at higher volume hospitals were less likely to receive GRT,[57] and high-risk rectal cancer cases treated by surgeons with lower caseloads were more likely to receive GRT.[65] Rates of GRT increased over time in one breast cancer study,[66] one DLBCL,[69] and one lung cancer study.[57] Rates of GRT (CTx) for stage C colon cancer cases decreased overtime in one CRC study.[63]

3.5.4 | Socioeconomic factors and Medical factors

Socioeconomic factors (area-level socioeconomic disadvantage as measured by the Index of Relative Socioeconomic Disadvantage [IRSD], geographic remoteness of residence as measured by the Accessibility/Remoteness Index of Australia score [ARIA]/distance to treatment facility, treatment in a public or private hospital, hospital location [rural vs. metropolitan], area of residence and SES of the medical practice) were found to be significantly associated with CRC, melanoma, DLBCL, breast, lung, and cervical cancer GRT (Figure 3, Additional file 6). Medical Factors (treatment received, and curative intent of surgery [Sx]) were found to be associated with GRT in one breast cancer study[67] and one CRC study.[65]

Lung cancer cases from the fifth SES quintile group (the least disadvantaged) were more likely to receive GRT than cases from more disadvantaged areas.[57,118] This trend was not seen in other cancer streams; DLBCL cases from SES quintile 4 were more likely to receive GRT than those from fifth quintile group,[69] whereas cases with stages B and C rectal cancers from lower SES quintile groups (first, second, and third quintile groups) were more likely to receive GRT than the least disadvantaged group (fifth quintile).[63]

Stage C colon cancer patients who lived in areas of moderate accessibility (where access to services is significantly limited) were more likely to receive GRT than those in highly accessible areas.[62] Breast cancer cases who traveled greater distances to access treatment services (more than 50 km) were also more likely to receive GRT.[67] Conversely, cervical cancer cases who lived 5–10 km from their treatment facility were less likely to receive GRT than those living closer.[59]

The location of hospitals was significantly associated with GRT in three studies, with cases treated in rural facilities for breast cancer,[66] DLBCL,[69] or node-positive colon cancer,[65] being less likely to receive GRT (compared to those treated in metropolitan areas).

3.6 | Cancer GRT and patient survival rates

Of the 20 included studies, only six reported survival rates in relation to GRT; survival benefits were found for GRT in patients with DLBCL,[69] breast,[66] lung,[54] cervical,[59] and colon[62] cancer. Patients who received GRT had longer median survival times (lung[118] cancer) and improved 1- and 2-year survival rates (lung[54] cancer), 5-year survival rates (cervical[59] and colon[62] cancer), and 10-year survival rates (colon[62] cancer) (see Additional file 7).

TABLE 4 Factors associated with guideline recommended treatment (GRT)

WHO five factors framework	Cancer stream		Breast	Breast	Breast	DLBCL	Melanoma	Lung	Lung	Lung	Lung	Lung/cervical	Cervical	Cervical cancer	CRC	CRC	CRC
			Craft		Lomma	Wong Doo	Varey	Boxer	Duggan	Vinod	Wah	Whop	Chiew	Thompson	Adelson	Beckmann	Young
	Factors	*No. studies*	2010[66]	Jung 2019[67]	2020[68]	2019[69]	2017[71]	2016[54]	2016[118]	2010[56]	2020[57]	2017[58]	2017[59]	2015[61]	2018[62]	2014[63]	2007[65]
Patient factors	Patient age	12	Y	Y	–	Y	–	Y	Y	Y	Y	Y(L), NS(C)	Y	–	Y	Y	Y
	Patient gender	5	–	–	Y	Y	–	NS	NS	–	Y	NS	–	–	NS	Y	Y
	Patient smoking status	2	–	–	–	Y	–	–	–	–	Y	–	–	–	–	–	–
	Patient birthplace	1	–	–	–	NS	–	NS	Y	–	–	–	NS	–	–	–	–
	Race (Indigenous status)	1	–	–	–	–	–	–	–	–	–	Y, Y	–	–	–	–	–
	Patient language	0	–	–	–	–	–	NS	–	–	–	–	–	–	–	–	–
Health condition factors	Stage	7	–	–	–	NS	–	y	Y	Y	Y		Y	–	Y	Y	–
	Comorbidities	6	–	–	–	Y	–	Y	–	Y	Y	Y(L), NS(C)	–	–	–	Y	–
	Cancer Site/histology	4	–	–	–	–	–	NS	Y	–	Y	–	–	–	Y	Y	–
	Patient performance status (ECOG)	3	–	–	–	–	–	Y	Y	–	Y	–	–	–	–	–	–
	Grade	3	Y	Y	–	–	–	–	–	–	–	–	–	–	–	Y	–
	Tumor size	2	Y	Y	–	–	–	–	–	–	–	–	–	–	–	–	–
	Nodes	2	Y	Y	–	–	–	–	–	–	–	–	–	–	–	–	–
	ER status of tumors	2	Y	Y	–	–	–	–	–	–	–	–	–	–	–	–	–
	Chest wall separation distance	1	–	Y	–	–	–	–	–	–	–	–	–	–	–	–	–
	Breslow thickness	1	–	–	–	–	Y	–	–	–	–	–	–	–	–	–	–
	Distant tumors	1	–	–	–	–	–	–	–	–	–	Y, Y	–	–	–	–	–
	Weight loss	1	–	–	–	–	–	–	–	Y	–	–	–	–	–	–	–
	Prior cancer	1	–	–	–	–	–	–	–	Y	–	–	–	–	–	–	–
Healthcare system and team factors	Caseload/volume	4	–	–	–	–	Y	–	–	–	Y	–	–	Y	–	–	Y
	Year of diagnosis	4	Y	–	–	Y	–	NS	–	–	Y	–	–	–	NS	Y	
	Discussed by an MDT	1	–	–	–	–	–	–	Y	–	NS	–	–	–	–	–	–
	Release of CPGs	1	–	Y	–	–	–	–	–	–	–	–	–	–	–	–	–
	Treating clinician	1	–	Y	–	–	–	–	–	–	–	–	–	–	–	–	–
	Surgeon specialty	1	–	–	–	–	–	–	–	–	–	–	–	–	–	–	Y
	Initial/referral physician conducting the wider excision	1	–	–	–	–	Y	–	–	–	–	–	–	–	–	–	
	Clinician age	1	–	–	–	–	Y	–	–	–	–	–	–	–	–	–	–

(Continues)

TABLE 4 (Continued)

WHO five factors framework	Cancer stream		Breast Craft 2010[66]	Breast Jung 2019[67]	Breast Lomma 2020[68]	DLBCL Wong Doo 2019[69]	Melanoma Varey 2017[71]	Lung Boxer 2016[54]	Lung Duggan 2016[118]	Lung Vinod 2010[56]	Lung Wah 2020[57]	Lung/cervical Whop 2017[58]	Cervical Chiew 2017[59]	Cervical cancer Thompson 2015[61]	CRC Adelson 2018[62]	CRC Beckmann 2014[63]	CRC Young 2007[65]
	Factors	***No. studies***															
Socioeconomic factors	Area-level socioeconomic disadvantage (IRSED)	4	–	–	–	Y	–	–	Y	–	Y	NS	NS	–	–	Y	
	Geographic remoteness of residence (ARIA)/distance to treatment facility	3	–	Y	–	–	–	–	–	–	NS	NS	Y	–	Y	–	–
	Hospital location (rural vs. metropolitan)	3	Y	–	–	Y	–	–	–	–	–	–	–	–	–	–	Y
	Treatment in a public or private hospital	2	–	–	–	Y	–	–	–	–	Y	–	–	–	–	–	–
	Area of residence	1	–	–	–	NS	–	–	–	–	–	–	–	–	NS	Y	–
	SES status of the medical practice	1	–	–	–	–	y	–	–	–	–	–	–	–	–	–	–
Medical therapy factors	Treatment received and subsequent GRT	1	–	Y	–	–	–	–	–	–	–	–	–	–	–	–	–
	Curative intent of surgery	1	–	–	–	–	–	–	–	–	–	–	–	–	–	–	Y
	Cancer stream		Breast	Breast	Breast	DLBCL	Melanoma	Lung	Lung	Lung	Lung	Lung/cerv	Cervical	Cervical cancer	CRC	CRC	CRC

Note: NS: not significantly associated with GRT; –: association between factor and GRT not reported.

Abbreviations: ARIA, Accessibility/Remoteness Index of Australia; CPG, clinical practice guideline; CRC, colorectal cancer; DLBCL, diffuse large B-cell lymphoma; ECOG, Eastern Cooperative Oncology Group; ER, endocrine receptor status; IRSED, Index of Relative Socioeconomic Disadvantage; MDT, multidisciplinary team; SES, socioeconomic status; WHO, World Health Organization.

4 | DISCUSSION

The implementation of evidence into practice is fundamental to enhance patient outcomes and efficiency of healthcare and research expenditure. This review demonstrates the large degree of adherence variability across active-cancer treatment CPG recommendations in Australia and characterizes the factors associated with GRT. GRT was associated with increased survival rates for patients with breast cancer,[66] DLBCL,[69] lung cancer,[54,118] cervical cancer,[59] and colon cancer.[62]

Of the 20 studies included in this review, 15 reported factors associated with CPG adherence across 6 cancer streams (breast, melanoma, DLBCL, lung, cervical, and CRC). GRT was higher for some characteristics (e.g., younger age, non-Indigenous status, never smoked, lower stage disease, no comorbidities, good-excellent compared to poor ECOG performance status, and treatment in metropolitan hospitals compared to rural hospitals). Some characteristics that were examined in two or more studies showed different patterns depending on the cancer. For example, female patients had higher GRT for breast and lung cancer, but lower for DLBCL and CRC; other characteristics that had mixed results included clinical caseload, patient SES, and distance traveled to access treatment.

Recent research has identified perceived barriers (such as outdated recommendations) and facilitators (such as multidisciplinary peer review) to cancer treatment CPG adherence in Australia,[39] and internationally,[38] and demonstrated that clinician adherence to CPGs is influenced by a multitude of factors, including the quality of CPG development, frequency of updates, patient, clinician and organizational factors, as well as dissemination, and implementation strategies.[38,39,74] These findings add texture by highlighting CPG adherence factors specific to various cancer streams, and in combination, these local contextual factors will inform cancer treatment CPG implementation strategies to address the barriers specific to CPG adherence in Australia, as guided by the Knowledge to Action framework[75] or other implementation frameworks.

Various factors associated with CPG adherence rates in this review are interrelated: patient age, cancer stage, presence of comorbidities, ECOG performance status, SES status, and geographical location of hospitals, and are discussed later in combination, due to the confounding nature of the variables. For example, the association between poorer rates of GRT and older age, advanced disease stage, comorbidities, and borderline ECOG status is supported by recent qualitative findings, which identified the clinician perception that patient age, frailty, and comorbidities were significant considerations when making treatment decisions.[39] This supports the need for further generation of real-world data[76] to build the evidence base to guide cancer treatments for older patients, those with later stage disease and comorbidities, in addition to the healthier and younger patients typically included in clinical trials.[38]

Low SES was associated with poor GRT in lung cancer[57,118]; however, the opposite was true for stages B and C rectal cancer patients, potentially as a result of patient preference, or clinical factors that influence treatment decisions.[63] The association between low SES and poorer GRT for lung cancer is unsurprising given lower SES has been previously associated with limited access to curative Sx[77] and reduced cancer survival in Australia, despite universal healthcare coverage.[77,78] Patients with low SES also tend to have more comorbidities,[77] potentially limiting treatment options and CPG adherence. Poorer health literacy and education amongst lower SES groups also impact patient understanding of, and adherence to, cancer treatment.[79]

GRT was poorer for breast cancer cases,[66] DLBCL cases,[69] and CRC cases[65] treated in rural centers. Limited access to RT facilities as well as inadequate numbers of resident medical oncologists, radiation oncologists, and surgical oncologists may influence CPG adherence in non-metropolitan centers.[80] Patients with low SES are disproportionately located in rural areas in Australia,[77] resulting in increased distance to travel (and associated time and costs) to access healthcare.[81] Patient nonadherence as a result of travel burdens[39] may be addressed with further adoption of shared-care and telehealth technologies.[82,83] GRT was higher for colon cancer patients who lived in moderately accessible compared to highly accessible areas,[62] and for breast cancer patients who traveled more than 50 km to access treatment,[67] possibly as a result of subsidized travel programs supporting such patients to travel to major referral hospitals for treatment.[62] Given over a quarter of the Australian population (7 million people) live in rural and remote areas,[84] factors contributing to geographic variation in treatment and CPG adherence are important to consider.

Systematic considerations of equity during the development of CPGs will contribute to ensuring treatments are equitably provided to disadvantaged groups,[85] reducing the variation in adherence rates identified across low SES, rural, and older populations. In addition, multifaceted implementation and dissemination strategies that target clinicians treating disadvantaged populations may reduce barriers to CPG adoption and adherence and enhance delivery of evidence-based practice across these groups.

Use of patient navigators[86] may encourage tailored treatment plans to support patients' individualized needs and have previously been identified as a facilitator of cancer CPG adherence in Australia.[39] Other strategies that enhance CPG implementation by increasing clinician awareness and CPG uptake include education and opinion leaders,[87] CPG reminders, and audit and feedback of adherence rates,[88,89] particularly via Computerized Clinical Decision Support Systems (CDSSs) such as cancer therapy prescribing systems. In addition to enabling systematic audit and feedback processes, CDSSs are useful tools to support treatment decision-making and improve care and have been shown to improve adherence to cancer CPGs.[90] Further integration of CDSSs into local Australian systems would better enable systematic audits to provide feedback to hospitals and clinicians. These tailored CPG implementation strategies need to be feasible, and acceptable for use in the target populations, to increase uptake of CPGs.

The findings from this review advocate for the collection and inclusion of real-world evidence that reflect the patient population[91] to support CPG recommendations that cater for a broader range of patient complexities. Implementation strategies should be tailored to specific populations that experience high rates of CPG nonadherence such as older, rural, and low SES populations and incorporate the

wealth of implementation science knowledge as well as patient representation when developing, implementing, and disseminating cancer treatment CPGs.

4.1 | Strengths and limitations

A strength of this review is the use of multiple reviewers to screen and assess studies, with generally strong interrater reliability scores. The main challenge of such reviews is the inconsistent definition of CPG adherence across the Australian studies included, with studies reporting CPG adherence rates, nonadherence rates, compliance with quality indicators, and receipt of GRT. Multiple cancer streams were included in this review, with a small number of studies in each stream. This provides an overview of trends in adherence rates and factors associated with adherence, across streams; however, the heterogeneity of results across studies indicated that it was inappropriate to conduct a meta-analysis. It should be noted that the factors reported to be adherent with GRT are limited by the factors investigated in the included Australian studies and are not an exhaustive list of factors associated with GRT. While only studies published in English were included, this is to be expected when assessing Australian data. This study contributes to the literature by characterizing the rates of adherence to cancer treatment CPGs across Australia, and mapping the factors associated with adherence across a variety of cancer streams, enabling more tailored approaches to CPG implementation that will help to overcome barriers to uptake.

AUTHOR CONTRIBUTIONS

Mia Bierbaum conceptualized the study and produced the first draft of the manuscript. Frances Rapport, Gaston Arnolda, Brona Nic Giolla Easpaig, Kristiana Ludlow, Yvonne Tran, and Jeffrey Braithwaite reviewed the study design and provided feedback, whereas Renuka Chittajallu provided clinical advice regarding the study findings. Mia Bierbaum and Gaston Arnolda devised the search strategy, which was carried out by Mia Bierbaum. Mia Bierbaum, in pairs with Frances Rapport, Gaston Arnolda, Brona Nic Giolla Easpaig, Kristiana Ludlow, Yvonne Tran, Robyn Clay-Williams, ELizabeth Austin, Bela Laginha, Chi Yhun Lo, Kate Churruca, Lieke van Baar, Karen Hutchinson, Renuka Chittajallu, Syeda Somyyah Owais, Ruqaiya Nullwala, Diana Fajardo Pulido, and Peter Hibbert completed the review of abstracts. Mia Bierbaum carried out the full-text review, in pairs with Gaston Arnolda, Brona Nic Giolla Easpaig, Kristiana Ludlow, Yvonne Tran, Robyn Clay-Williams, ELizabeth Austin, Bela Laginha, Chi Yhun Lo, Kate Churruca, Lieke van Baar, Karen Hutchinson, Renuka Chittajallu, Syeda Somyyah Owais, Ruqaiya Nullwala, Diana Fajardo Pulido, and Peter Hibbert. Mia Bierbaum designed the data extraction template and completed data extraction, with data extraction from a five study sample validated by Syeda Somyyah Owais. Mia Bierbaum and Syeda Somyyah Owais completed the quality assessment of included articles. All authors contributed to revisions of subsequent drafts of the manuscript and approved the final submission.

ACKNOWLEDGMENTS

The authors would like to thank the librarian (Mary Simons) for their support in developing the database search strategy. This work was supported by an Australian Government's Research Training Program Scholarship, associated with the Australian Institute of Health Innovation, Macquarie University, Grant Number ID: 9100002 awarded to MB.

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

CONFLICT OF INTEREST STATEMENT

The authors declare that they have no conflict of interests.

DATA AVAILABILITY STATEMENT

All data is presented in the tables and additional files.

ETHICS STATEMENT

No ethics approval was sought for this systematic review.

ORCID

Mia Bierbaum https://orcid.org/0000-0002-7037-4708
Frances Rapport https://orcid.org/0000-0002-4428-2826
Gaston Arnolda https://orcid.org/0000-0003-4948-7633
Yvonne Tran https://orcid.org/0000-0002-1741-4205
Brona Nic Giolla Easpaig https://orcid.org/0000-0001-6787-056X
Kristiana Ludlow https://orcid.org/0000-0001-7284-5625
Robyn Clay-Williams https://orcid.org/0000-0002-6107-7445
Elizabeth Austin https://orcid.org/0000-0002-8438-2362
Bela Laginha https://orcid.org/0000-0002-2856-1542
Chi Yhun Lo https://orcid.org/0000-0001-7695-3148
Kate Churruca https://orcid.org/0000-0002-9923-3116
Karen Hutchinson https://orcid.org/0000-0002-1353-3100
Renuka Chittajallu https://orcid.org/0000-0001-6856-3967
Syeda Somyyah Owais https://orcid.org/0000-0003-0865-2268
Peter Hibbert https://orcid.org/0000-0001-7865-343X
Diana Fajardo Pulido https://orcid.org/0000-0002-9804-2289
Jeffrey Braithwaite https://orcid.org/0000-0003-0296-4957

REFERENCES

1. Rossi C, Vecchiato A, Mastrangelo G, et al. Adherence to treatment guidelines for primary sarcomas affects patient survival: a side study of the European CONnective TIssue CAncer NETwork (CONTICANET). *Ann Oncol*. 2013;24(6):1685-1691. doi:10.1093/annonc/mdt031
2. Puyade M, Defossez G, Guilhot F, Leleu X, Ingrand P. Age-related health care disparities in multiple myeloma. *Hematol Oncol*. 2018;36(1):224-231. doi:10.1002/hon.2422
3. Miller K, Kreis IA, Gannon MR, et al. The association between guideline adherence, age and overall survival among women with non-metastatic breast cancer: a systematic review. *Cancer Treat Rev*. 2022;104:102353. doi:10.1016/j.ctrv.2022.102353
4. Hill DA, Friend S, Lomo L, et al. Breast cancer survival, survival disparities, and guideline-based treatment. *Breast Cancer Res Treat*. 2018;170(2):405-414. doi:10.1007/s10549-018-4761-7

5. Cheng SH, Wang CJ, Lin J-L, et al. Adherence to quality indicators and survival in patients with breast cancer. *Med Care*. 2009;47(2):217-225. https://www.jstor.org/stable/40221862
6. Ricci-Cabello I, Vásquez-Mejía A, Canelo-Aybar C, et al. Adherence to breast cancer guidelines is associated with better survival outcomes: a systematic review and meta-analysis of observational studies in EU countries. *BMC Health Serv Res*. 2020;20(1):1-12. doi:10.1186/s12913-020-05753-x
7. Putri NQ, Permata TBM, Wulandari NA. Relationship of adherence to cervical cancer treatment guideline towards patients' five-year survival: systematic review of follow-up trials. *Cancer Manage Res*. 2020;12:12649. doi:10.2147/CMAR.S267824
8. Shafiq J, Hanna T, Vinod S, Delaney G, Barton M. A population-based model of local control and survival benefit of radiotherapy for lung cancer. *Clin Oncol*. 2016;28(10):627-638. doi:10.1016/j.clon.2016.05.006
9. Dronkers EA, Mes SW, Wieringa MH, van der Schroeff MP, de Jong RJB. Noncompliance to guidelines in head and neck cancer treatment; associated factors for both patient and physician. *BMC Cancer*. 2015;15(1):1-10. doi:10.1186/s12885-015-1523-3
10. Zhao H, Zhang N, Ho V, et al. Adherence to treatment guidelines and survival for older patients with stage II or III colon cancer in Texas from 2001 through 2011. *Cancer*. 2018;124(4):679-687. doi:10.1002/cncr.31094
11. Nino de Guzman E, Song Y, Alonso-Coello P, et al. Healthcare providers' adherence to breast cancer guidelines in Europe: a systematic literature review. *Breast Cancer Res Treat*. 2020;181(3):499-518. doi:10.1007/s10549-020-05657-8
12. Vyas AM, Aroke H, Kogut S. Guideline-concordant treatment among elderly women with HER2-positive metastatic breast cancer in the United States. *J Natl Compr Canc Netw*. 2020;18(4):405-413. doi:10.6004/jnccn.2019.7373
13. Shugarman LR, Mack K, Sorbero ME, et al. Race and sex differences in the receipt of timely and appropriate lung cancer treatment. *Med Care*. 2009;47(7):774-781. https://www.jstor.org/stable/40221952
14. De Rijke J, Schouten L, Ten Velde G, et al. Influence of age, comorbidity and performance status on the choice of treatment for patients with non-small cell lung cancer; results of a population-based study. *Lung Cancer*. 2004;46(2):233-245. doi:10.1016/j.lungcan.2004.03.011
15. Wang S, Wong ML, Hamilton N, Davoren JB, Jahan TM, Walter LC. Impact of age and comorbidity on non-small-cell lung cancer treatment in older veterans. *J Clin Oncol*. 2012;30(13):1447. doi:10.1200/JCO.2011.39.5269
16. Nadpara PA, Madhavan SS, Tworek C, Sambamoorthi U, Hendryx M, Almubarak M. Guideline-concordant lung cancer care and associated health outcomes among elderly patients in the United States. *J Geriatr Oncol*. 2015;6(2):101-110. doi:10.1016/j.jgo.2015.01.001
17. MacLennan S, Duncan E, Skolarus TA, et al. Improving guideline adherence in urology. *Eur Urol Focus*. 2022;8:1545-1552. doi:10.1016/j.euf.2021.10.007
18. Mori K, Miura N, Babjuk M, et al. Low compliance to guidelines in nonmuscle-invasive bladder carcinoma: a systematic review. *Urol Oncol*. 2020;38(10):774-782. doi:10.1016/j.urolonc.2020.06.013
19. White KM, Seale H, Harrison R. Enhancing ovarian cancer care: a systematic review of guideline adherence and clinical variation. *BMC Public Health*. 2019;19(1):1-13. doi:10.1186/s12889-019-6633-4
20. Bristow RE, Chang J, Ziogas A, Anton-Culver H. Adherence to treatment guidelines for ovarian cancer as a measure of quality care. *Obstet Gynecol*. 2013;121(6):1226-1234. doi:10.1097/AOG.0b013e3182922a17
21. Leyh-Bannurah S-R, Budäus L, Zaffuto E, et al. Adherence to pelvic lymph node dissection recommendations according to the National Comprehensive Cancer Network pelvic lymph node dissection guideline and the D'Amico lymph node invasion risk stratification. *Urol Oncol*. 2018;36(2):e17-81.e24. doi:10.1016/j.urolonc.2017.10.022.81
22. Herranz-Amo F, Hernández-Fernández C, Olmo JC, et al. Adherence to the lymphadenectomy recommendations of the 2009 clinical guidelines in the 2010 National Prostate Cancer Registry. *Actas Urol Esp*. 2015;39(9):546-552. doi:10.1016/j.acuroe.2015.05.013
23. Chagpar R, Xing Y, Chiang Y-J, et al. Adherence to stage-specific treatment guidelines for patients with colon cancer. *J Clin Oncol*. 2012;30(9):972. doi:10.1200/JCO.2011.39.6937
24. Rayson D, Urquhart R, Cox M, Grunfeld E, Porter G. Adherence to clinical practice guidelines for adjuvant chemotherapy for colorectal cancer in a Canadian province: a population-based analysis. *J Oncol Pract*. 2012;8(4):253-259. doi:10.1200/JOP.2012.000578
25. Delaney G, Jacob S, Featherstone C, Barton M. The role of radiotherapy in cancer treatment: estimating optimal utilization from a review of evidence-based clinical guidelines. *Cancer*. 2005;104(6):1129-1137. doi:10.1002/cncr.21324
26. Delaney G, Jacob S, Barton M. Estimating the optimal external-beam radiotherapy utilization rate for genitourinary malignancies. *Cancer*. 2005;103(3):462-473. doi:10.1002/cncr.20789
27. Delaney G, Shafiq J, Chappell G, Barton M. Establishing treatment benchmarks for mammography-screened breast cancer population based on a review of evidence-based clinical guidelines. *Cancer*. 2008;112(9):1912-1922. doi:10.1002/cncr.23384
28. Featherstone C, Delaney G, Jacob S, Barton M. Estimating the optimal utilization rates of radiotherapy for hematologic malignancies from a review of the evidence: Part I—Lymphoma. *Cancer*. 2005;103(2):383-392. doi:10.1002/cncr.20754
29. Thompson SR, Delaney GP, Gabriel GS, Jacob S, Barton MB. Estimation of the optimal brachytherapy utilisation rate in the treatment of vaginal cancer and comparison with patterns of care. *J Med Imaging Radiat Oncol*. 2012;56(4):483-489. doi:10.1111/j.1754-9485.2012.02392.x
30. Thompson S, Delaney G, Gabriel GS, Jacob S, Das P, Barton M. Estimation of the optimal brachytherapy utilization rate in the treatment of carcinoma of the uterine cervix: review of clinical practice guidelines and primary evidence. *Cancer*. 2006;107(12):2932-2941. doi:10.1002/cncr.22337
31. Thompson SR, Delaney G, Gabriel GS, Jacob S, Das P, Barton M. Estimation of optimal brachytherapy utilization rate in the treatment of malignancies of the uterine corpus by a review of clinical practice guidelines and the primary evidence. *Int J Radiat Oncol Biol Phys*. 2008;72(3):849-858. doi:10.1016/j.ijrobp.2008.01.022
32. Jacob S, Hovey E, Ng W, Vinod S, Delaney GP, Barton MB. Estimation of an optimal chemotherapy utilisation rate for lung cancer: an evidence-based benchmark for cancer care. *Lung Cancer*. 2010;69(3):307-314. doi:10.1016/j.lungcan.2009.11.017
33. Jacob S, Ng W, Asghari R, Delaney GP, Barton MB. Chemotherapy in rectal cancer: variation in utilization and development of an evidence-based benchmark rate of optimal chemotherapy utilization. *Clin Colorectal Cancer*. 2011;10(2):102-107. doi:10.1016/j.clcc.2011.03.005
34. Jacob S, Ng W, Asghari R, Delaney GP, Barton MB. Estimation of an optimal chemotherapy utilisation rate for colon cancer: an evidence-based benchmark for cancer care. *Eur J Cancer*. 2009;45(14):2503-2509. doi:10.1016/j.ejca.2009.05.023
35. Ng W, Delaney GP, Jacob S, Barton MB. Estimation of an optimal chemotherapy utilisation rate for breast cancer: setting an evidence-based benchmark for the best-quality cancer care. *Eur J Cancer*. 2010;46(4):703-712. doi:10.1016/j.ejca.2009.12.002
36. Fong A, Ng W, Barton MB, Delaney GP. Estimation of an evidence-based benchmark for the optimal endocrine therapy utilization rate in breast cancer. *Breast*. 2010;19(5):345-349. doi:10.1016/j.breast.2010.02.006

37. Levinson W, Kallewaard M, Bhatia RS, et al. 'Choosing Wisely': a growing international campaign. *BMJ Qual*. 2015;24(2):167-174. https://doi.org/10.1136/bmjqs-2014-003821
38. Bierbaum M, Rapport F, Arnolda G, et al. Clinicians' attitudes and perceived barriers and facilitators to cancer treatment clinical practice guideline adherence: a systematic review of qualitative and quantitative literature. *Implement Sci*. 2020;15:1-24. doi:10.1186/s13012-020-00991-3
39. Bierbaum M, Rapport F, Arnolda G, et al. Clinical Practice Guideline adherence in oncology: a qualitative study of insights from clinicians in Australia. *PLoS One*. 2022;17(12):e0279116. doi:10.1371/journal.pone.0279116
40. Puts M, Tu H, Tourangeau A, et al. Factors influencing adherence to cancer treatment in older adults with cancer: a systematic review. *Ann Oncol*. 2014;25(3):564-577. doi:10.1093/annonc/mdt433
41. Fang P, He W, Gomez DR, et al. Influence of age on guideline-concordant cancer care for elderly patients in the United States. *Int J Radiat Oncol Biol Phys*. 2017;98(4):748-757. doi:10.1016/j.ijrobp.2017.01.228
42. Salloum RG, Smith TJ, Jensen GA, Lafata JE. Factors associated with adherence to chemotherapy guidelines in patients with non-small cell lung cancer. *Lung Cancer*. 2012;75(2):255-260. doi:10.1016/j.lungcan.2011.07.005
43. Karanth S, Fowler ME, Mao X, et al. Race, socioeconomic status, and health-care access disparities in ovarian cancer treatment and mortality: systematic review and meta-analysis. *JNCI Cancer Spectr*. 2019;3(4):pkz084. doi:10.1093/jncics/pkz084
44. Harrison MB, Légaré F, Graham ID, Fervers B. Adapting clinical practice guidelines to local context and assessing barriers to their use. *Can Med Assoc J*. 2010;182(2):E78-E84. https://doi.org/10.1503/cmaj.081232
45. Bierbaum M, Rapport F, Arnolda G, et al. Adherence to clinical practice guidelines (CPGs) for the treatment of cancers in Australia and the factors associated with adherence: a systematic review protocol. *BMJ Open*. 2021;11(9):e050912;doi:10.1136/bmjopen-2021-050912
46. Page MJ, McKenzie JE, Bossuyt PM, et al. The PRISMA 2020 statement: an updated guideline for reporting systematic reviews. *Syst Rev*. 2021;10(1):1-11. doi:10.1186/s13643-021-01626-4
47. Viera AJ, Garrett JM. Understanding interobserver agreement: the kappa statistic. *Fam Med*. 2005;37(5):360-363.
48. Munn Z, Moola S, Lisy K, Riitano D, Tufanaru C. Methodological guidance for systematic reviews of observational epidemiological studies reporting prevalence and cumulative incidence data. *Int J Evid-Based Healthc*. 2015;13(3):147-153. doi:10.1097/XEB.0000000000000054
49. Popay J, Roberts H, Sowden A, et al. Guidance on the conduct of narrative synthesis in systematic reviews. A product from the ESRC methods programme. *Version*. 2006;1(1):b92.
50. World Health Organization. *Adherence to Long-Term Therapies: Evidence for Action*. World Health Organization; 2003. https://apps.who.int/iris/handle/10665/42682
51. Loew L, Brosseau L, Kenny GP, et al. Factors influencing adherence among older people with osteoarthritis. *Clin Rheumatol*. 2016;35(9):2283-2291. doi:10.1007/s10067-015-3141-5
52. Peh KQE, Kwan YH, Goh H, et al. An adaptable framework for factors contributing to medication adherence: results from a systematic review of 102 conceptual frameworks. *J Gen Intern Med*. 2021;36(9):2784-2795. doi:10.1007/s11606-021-06648-1
53. Higgins JP, Thomas J, Chandler J, et al. *Cochrane Handbook for Systematic Reviews of Interventions*. John Wiley & Sons; 2022. V6.3.
54. Boxer MM, Duggan KJ, Descallar J, Vinod SK. Do patients discussed at a lung cancer multidisciplinary team meeting receive guideline-recommended treatment? *Asia-Pac J Clin Oncol*. 2016;12(1):52-60. doi:10.1111/ajco.12421
55. Conron M, Phuah S, Steinfort D, Dabscheck E, Wright G, Hart D. Analysis of multidisciplinary lung cancer practice. *Intern Med J*. 2007;37(1):18-25. doi:10.1111/j.1445-5994.2006.01237.x
56. Vinod SK, Sidhom MA, Delaney GP. Do multidisciplinary meetings follow guideline-based care? *J Oncol Pract*. 2010;6(6):276-281. doi:10.1200/JOP.2010.000019
57. Wah W, Stirling RG, Ahern S, Earnest A. Association between receipt of Guideline-Concordant lung cancer treatment and individual-and area-level factors: a spatio-temporal analysis. *Cancer Epidemiol Prev Biomarkers*. 2020;29(12):2669-2679. doi:10.1158/1055-9965.EPI-20-0709
58. Whop LJ, Bernardes CM, Kondalsamy-Chennakesavan S, et al. Indigenous Australians with non–small cell lung cancer or cervical cancer receive suboptimal treatment. *Asia-Pac J Clin Oncol*. 2017;13(5):e224-e31. doi:10.1111/ajco.12463
59. Chiew KL, Chong S, Duggan KJ, Kaadan N, Vinod SK. Assessing guideline adherence and patient outcomes in cervical cancer. *Asia-Pac J Clin Oncol*. 2017;13(5):e373-e80. doi:10.1111/ajco.12605
60. Kang Y-J, O'Connell DL, Tan J, et al. Optimal uptake rates for initial treatments for cervical cancer in concordance with guidelines in Australia and Canada: results from two large cancer facilities. *J Cancer Epidemiol*. 2015;39(4):600-611. doi:10.1016/j.canep.2015.04.009
61. Thompson SR, Delaney GP, Gabriel GS, Barton MB. Patterns of care study of brachytherapy in New South Wales: malignancies of the uterine corpus. *J Contemp Brachyther*. 2015;7(3):224. doi:10.5114/jcb.2015.52623
62. Adelson P, Fusco K, Karapetis C, et al. Use of guideline-recommended adjuvant therapies and survival outcomes for people with colorectal cancer at tertiary referral hospitals in South Australia. *J Eval Clin Pract*. 2018;24(1):135-144. doi:10.1111/jep.12757
63. Beckmann KR, Bennett A, Young GP, Roder DM. Treatment patterns among colorectal cancer patients in South Australia: a demonstration of the utility of population-based data linkage. *J Eval Clin Pract*. 2014;20(4):467-477. doi:10.1111/jep.12183
64. McGrath DR, Leong DC, Armstrong BK, Spigelman AD. Management of colorectal cancer patients in Australia: the National Colorectal Cancer Care Survey. *ANZ J Surg*. 2004;74(1-2):55-64. doi:10.1046/j.1445-1433.2003.02891.x
65. Young JM, Leong DC, Armstrong K, et al. Concordance with national guidelines for colorectal cancer care in New South Wales: a population-based patterns of care study. *MJA*. 2007;186(6):292-295. doi:10.5694/j.1326-5377.2007.tb00903.x
66. Craft PS, Buckingham JM, Dahlstrom JE, et al. Variation in the management of early breast cancer in rural and metropolitan centres: implications for the organisation of rural cancer services. *Breast*. 2010;19(5):396-401. doi:10.1016/j.breast.2010.03.032
67. Jung KYK, Shadbolt B, Rezo A. Temporal impact of the publication of guidelines and randomised evidence on the adoption of hypofractionated whole breast radiotherapy for early-stage breast cancer. *Med Imaging Radiat Oncol*. 2019;63(4):530-537. doi:10.1111/1754-9485.12897
68. Lomma C, Chan A, Chih H, Reid C, Peter W. Male breast cancer in Australia. *Asia-Pac J Clin Oncol*. 2021;17(2):e57-e62. doi:10.1111/ajco.13299
69. Wong Doo N, White VM, Martin K, et al. The use of optimal treatment for DLBCL is improving in all age groups and is a key factor in overall survival, but non-clinical factors influence treatment. *Cancers*. 2019;11(7):928. doi:10.3390/cancers11070928
70. Roos DE, Tee HC. Quality indicators for early stage Hodgkin's lymphoma. *J Med Imaging Radiat Oncol*. 2017;61(4):550-556. doi:10.1111/1754-9485.12602
71. Varey AH, Madronio CM, Cust AE, et al. Poor adherence to national clinical management guidelines: a population-based, cross-sectional study of the surgical management of melanoma in New South Wales. *Aust Ann Surg Oncol*. 2017;24(8):2080-2088. doi:10.1245/s10434-017-5890-7

72. Freeman AR, Roos DE, Kim L. Quality indicators for prostate radiotherapy: are patients disadvantaged by receiving treatment in a 'generalist' centre? *J Med Imaging Radiat Oncol*. 2015;59(2):255-264. doi:10.1111/1754-9485.12252
73. Sabaté E, Sabaté E. *Adherence to Long-Term Therapies: Evidence for Action*. World Health Organization; 2003
74. Gurses AP, Marsteller JA, Ozok AA, Xiao Y, Owens S, Pronovost PJ. Using an interdisciplinary approach to identify factors that affect clinicians' compliance with evidence-based guidelines. *Crit Care Med*. 2010;38:S282-S291. doi:10.1097/CCM.0b013e3181e69e02
75. Graham ID, Logan J, Harrison MB, et al. Lost in knowledge translation: time for a map? *J Contin Educ Health Prof*. 2006;26(1):13-24;doi:10.1002/chp.47
76. Bullement A, Podkonjak T, Robinson MJ, et al. Real-world evidence use in assessments of cancer drugs by NICE. *Int J Technol Assess Health Care*. 2020;36(4):388-394. doi:10.1017/S0266462320000434
77. Yu XQ, O'Connell DL, Gibberd RW, Armstrong BK. Assessing the impact of socio-economic status on cancer survival in New South Wales, Australia 1996–2001. *Cancer Causes Control*. 2008;19(10):1383-1390. doi:10.1007/s10552-008-9210-1
78. Bentley R, Kavanagh AM, Subramanian S, Turrell G. Area disadvantage, individual socio-economic position, and premature cancer mortality in Australia 1998 to 2000: a multilevel analysis. *Cancer Causes Control*. 2008;19(2):183-193. doi:10.1007/s10552-007-9084-7
79. Bouchardy C, Verkooijen HM, Fioretta G. Social class is an important and independent prognostic factor of breast cancer mortality. *Int J Cancer*. 2006;119(5):1145-1151. doi:10.1073/pnas.162086599
80. Underhill C, Bartel R, Goldstein D, et al. Mapping oncology services in regional and rural Australia. *Aust J Rural Health*. 2009;17(6):321-329.
81. Jong KE, Smith DP, Yu XQ, O'Connell DL, Goldstein D, Armstrong BK. Remoteness of residence and survival from cancer in New South Wales. *Med J Aust*. 2004;180(12):618-622. doi:10.5694/j.1326-5377.2004.tb06123.x
82. Fox P, Boyce A. Cancer health inequality persists in regional and remote Australia. *Communities*. 2014;201(8):445-446. doi:10.5694/mja14.01217
83. Burbury K, Wong ZW, Yip D, et al. Telehealth in cancer care: during and beyond the COVID-19 pandemic. *Intern Med J*. 2021;51(1):125-133. doi:10.1111/imj.15039
84. Australian Institute of Health and Welfare. *Rural and Remote Health*. Australian Institute of Health and Welfare; 2022. Available at www.aihw.gov.au/reports/rural-remote-australians/rural-and-remote-health
85. Shi C, Tian J, Wang Q, et al. How equity is addressed in clinical practice guidelines: a content analysis. *BMJ Open*. 2014;4(12):e005660. https://doi.org/10.1136/bmjopen-2014-005660
86. Bush ML, Kaufman MR, Shackleford T. Adherence in the cancer care setting: a systematic review of patient navigation to traverse barriers. *J Cancer Educ*. 2018;33(6):1222-1229. doi:10.1007/s13187-017-1235-2
87. Fischer F, Lange K, Klose K, Greiner W, Kraemer A. Barriers and strategies in guideline implementation—a scoping review. *Healthcare*. 2016;4(3):36. doi:10.3390/healthcare4030036
88. Grimshaw J, Ivers N, Linklater S, et al. Reinvigorating stagnant science: implementation laboratories and a meta-laboratory to efficiently advance the science of audit and feedback. *BMJ Qual*. 2019;28(5):416-423. https://doi.org/10.1136/bmjqs-2018-008355
89. Tomasone JR, Kauffeldt KD, Chaudhary R, Brouwers MC. Effectiveness of guideline dissemination and implementation strategies on health care professionals' behaviour and patient outcomes in the cancer care context: a systematic review. *Implement Sci*. 2020;15(1):1-18. doi:10.1186/s13012-020-0971-6
90. Klarenbeek SE, Weekenstroo HH, Sedelaar J, Fütterer JJ, Prokop M, Tummers M. The effect of higher level computerized clinical decision support systems on oncology care: a systematic review. *Cancers*. 2020;12(4):1032. doi:10.3390/cancers12041032
91. Di Maio M, Perrone F, Conte P. Real-world evidence in oncology: opportunities and limitations. *Oncologist*. 2020;25(5):e746-e52. doi:10.1634/theoncologist.2019-0647
92. Smith BD, Bentzen SM, Correa CR, et al. Fractionation for whole breast irradiation: an American Society for Radiation Oncology (ASTRO) evidence-based guideline. *Int J Radiat Oncol Biol Phys*. 2011;81(1):59-68. doi:10.1016/j.ijrobp.2010.04.042
93. Cancer Australia. *Recommendations for Use of Hypofractionated Radiotherapy for Early (Operable) Breast Cancer*. Cancer Australia; 2011. https://guidelines.canceraustralia.gov.au/guidelines/hypofractionated_radiotherapy
94. Cancer Australia. *Hypofractionated Radiotherapy for Early (Operable) Breast Cancer*. Cancer Australia; 2015
95. Gradishar WJ, Anderson BO, Balassanian R, et al. Breast cancer, version 4.2017, NCCN clinical practice guidelines in oncology. *J Natl Compr Canc Netw*. 2018;16(3):310-320. doi:10.6004/jnccn.2018.0012
96. Tilly H, Da Silva MG, Vitolo U, et al. Diffuse large B-cell lymphoma (DLBCL): eSMO Clinical Practice Guidelines for diagnosis, treatment and follow-up. *Ann Oncol*. 2015;26:v116-v25. https://doi.org/10.1093/annonc/mdv304
97. National Comprehensive Cancer Network. *Clinical Practice Guidelines in Oncology: Small Cell Lung Cancer V3*. NCCN; 2017. https://www.nccn.org/home
98. eviQ Cancer Treatments Online. *Radiation Oncology, Haematology Protocols, Version 2*. Cancer Institute New South Wales; 2015. www.eviq.org.au
99. National Comprehensive Cancer Network. *NCCN Clinical Practice Guidelines in Oncology. Prostate Cancer. Version 1.2014*. NCCN; 2013. https://www.nccn.org/home
100. eviQ Cancer Treatments Online. *Radiation Oncology, Prostate Adenocarcinoma*. Cancer Institute of NSW; 2009. www.eviq.org.au/radiation-oncology/urogenital/prostate
101. National Health and Medical Research Council. *Clinical Practice Guidelines for the Management of Melanoma, CP68*. NHMRC; 1999
102. Australian Cancer Network Management of Lung Cancer Guidelines Working Party. *Clinical Practice Guidelines for the Prevention, Diagnosis and Management of Lung Cancer*. The Cancer Council Australia, Australian Cancer Network, and National Health and Medical Research Council; 2004
103. National Collaborating Centre for Acute Care. *The Diagnosis and Treatment of Lung Cancer*. NCCAC; no date http://www.rcseng.ac.uk/new_rcseng/content/publications/docs/lung_cancer.html, cited in Vinod SK, Sidhom MA, Delaney GP. Do multidisciplinary meetings follow guideline-based care? J Oncology Practice. 2010; 6(6):276-81.
104. The Royal College of Radiologists Clinical Oncology Information Network. Guidelines on the non-surgical management of lung cancer. *Clin Oncol (R Coll Radiol)*. 1999;11:S1-S53; cited in Vinod SK, Sidhom MA, Delaney GP. Do multidisciplinary meetings follow guideline-based care? J Oncology Practice. 2010; 6(6):276-81
105. American College of Chest Physicians; Health and Science Policy Committee. Diagnosis and management of lung cancer: aCCP evidence-based guidelines. *Chest*. 2003;23:S1-337;
106. National Comprehensive Cancer Network. *NCCN Clinical Practice Guidelines in Oncology: Small Cell Lung Cancer V1*. NCCN; 2006. https://www.nccn.org/home
107. National Comprehensive Cancer Network. *NCCN Clinical Practice Guidelines in Oncology: Non-Small Cell Lung Cancer V2*. NCCN; 2006. https://www.nccn.org/home
108. National Comprehensive Cancer Network. *Clinical Practice Guidelines in Oncology: Non-Small Cell Lung Cancer V5*. NCCN; 2017. https://www.nccn.org/home
109. Taskforce Greater Metropolitan. *Best Clinical Practice: Gynaecological Cancer Guidelines*. NSW Department of Health; 2009.

110. National Comprehensive Cancer Network. *NCCN Clinical Practice Guidelines in Oncology (NCCN Guidelines)- Cervical Cancer V.I*. National Comprehensive Cancer Network; 2015. https://www.nccn.org/home
111. Haie-Meder C, Morice P, Castiglione M. Cervical cancer: eSMO Clinical Practice Guidelines for diagnosis, treatment and follow-up. *Ann Oncol*. 2010;21:v37-v40. doi:10.1093/annonc/mdq162
112. Nagase S, Inoue Y, Umesaki N, et al. Evidence-based guidelines for treatment of cervical cancer in Japan: Japan Society of Gynecologic Oncology (JSGO) 2007 edition. *Int J Clin Oncol*. 2010;15(2):117-124. doi:10.1007/s10147-010-0061-x
113. Scottish Intercollegiate Guidelines Network. *Management of Cervical Cancer*. A National Clinical Guideline. SIGN; 2008. http://www.sign.ac.uk
114. NSW Gynaecological Oncology Study Group. *Gynaecological Oncology Clinical Practice Guidelines*. NSW Gynaecological Oncology Study Group; 2004
115. National Health and Medical Research Council. *Guidelines for the Prevention, Early Detection and Management of CRC (Rescinded)*. National Health and Medical Research Council; 1999
116. Australian Cancer Network Colorectal Cancer Guidelines Revision Committee. *Guidelines for the Prevention, Early Detection and Management of Colorectal Cancer*. The Cancer Council Australia Australian Cancer Network; 2005
117. Duggan, KJ, Descallar, J, Vinod, SK. Application of Guideline Recommended Treatment in Routine Clinical Practice: A Population-based Study of Stage I–IIIB Non-small Cell Lung Cancer. *Clinical Oncology*. 2016;28(10):639–647. https://doi.org/10.1016/j.clon.2016.04.045

SUPPORTING INFORMATION

Additional supporting information can be found online in the Supporting Information section at the end of this article.

How to cite this article: Bierbaum M, Rapport F, Arnolda G, et al. Rates of adherence to cancer treatment guidelines in Australia and the factors associated with adherence: A systematic review. *Asia-Pac J Clin Oncol*. 2023;1-27. https://doi.org/10.1111/ajco.13948