APPENDIX 1: Search strategies

1. EMBASE database search strategy performed 18.08.2017

Database: Embase <1974 to 2017 August 17>

Search Strategy:

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1 exp general practitioner/ (82004)

2 exp general practice/ (76694)

3 general practitioner.mp. (92535)

4 family physician*.mp. (16431)

5 exp physician/ (578706)

6 physician/ or hospital physician/ or oncologist/ or pulmonologist/ or surgeon/ (349327)

7 ((cardiothoracic or thoracic) adj1 surgeon).mp. [mp=title, abstract, heading word, drug trade name, original title, device manufacturer, drug manufacturer, device trade name, keyword, floating subheading word] (1483)

8 1 or 2 or 3 or 4 or 5 or 6 or 7 (654316)

9 exp primary health care/ (139227)

10 exp general practice/ (76694)

11 general practi*.mp. (177732)

12 exp secondary health care/ (4521)

13 exp health care delivery/ (2623537)

14 secondary healthcare.mp. (304)

15 exp tertiary care center/ (28587)

16 exp health care availability/ (10866)

17 hospital/ or community hospital/ or field hospital/ or general hospital/ or high volume hospital/ or hospital bed capacity/ or hospital building/ or "hospital subdivisions and components"/ or low volume hospital/ or magnet hospital/ or private hospital/ or public hospital/ or safety net hospital/ or teaching hospital/ (521219)

18 gp*.mp. (206264)

19 9 or 10 or 11 or 12 or 13 or 14 or 15 or 16 or 17 (3112911)

20 8 or 18 (832934)

21 exp lung cancer/ (238284)

22 exp lung tumor/ (294205)

23 exp non small cell lung cancer/ or exp lung carcinoma/ (90376)

24 lung carcinoma/ or lung adenocarcinoma/ (58973)

25 exp respiratory tract tumor/ (374198)

26 lung cancer.mp. (233992)

27 21 or 22 or 23 or 24 or 25 or 26 (425912)

28 exp time factor/ (13292)

29 exp time to treatment/ (9223)

30 timeliness.mp. (4772)

31 (interval* adj5 (primary or secondary or diagnostic or treatment)).mp. [mp=title, abstract, heading word, drug trade name, original title, device manufacturer, drug manufacturer, device trade name, keyword, floating subheading word] (20028)

32 diagnosis/ or diagnostic procedure/ or delayed diagnosis/ or diagnostic test/ or early diagnosis/ or tumor diagnosis/ (1460853)

33 exp early cancer diagnosis/ (1989)

34 exp patient referral/ (84518)

35 exp consultation/ (91634)

36 28 or 29 or 30 or 31 or 32 or 33 or 34 or 35 (1659975)

37 19 and 20 and 27 and 36 (1635)

38 limit to EMBASE status (347)

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2. MEDLINE database search strategy performed 18.08.2017

Database: Ovid MEDLINE(R) 1946 to Present with Daily Update

Search Strategy:

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1 General Practitioners/ (5744)

2 general practitioners/ or physicians, family/ (21713)

3 Physicians, Primary Care/ (2390)

4 Pulmonologists/ (19)

5 exp Oncologists/ (131)

6 exp Thoracic Surgery/ (12219)

7 thoracic physician*.mp. (24)

8 exp Primary Health Care/ (135392)

9 exp General Practice/ (72298)

10 (family adj5 (physician* or doctor*)).mp. [mp=title, abstract, original title, name of substance word, subject heading word, keyword heading word, protocol supplementary concept word, rare disease supplementary concept word, unique identifier, synonyms] (31644)

11 Health Services Accessibility/ (64505)

12 secondary healthcare.mp. (171)

13 exp Secondary Care centers/ or exp tertiary care centers/ (7596)

14 hospitals/ or hospitals, community/ or hospitals, general/ or hospitals, group practice/ or hospitals, high-volume/ or hospitals, low-volume/ or hospitals, private/ or hospitals, public/ or hospitals, rural/ or hospitals, satellite/ or hospitals, special/ or hospitals, teaching/ or hospitals, urban/ (151114)

15 GP*.mp. (153136)

16 cardiothoracic surgeon.mp. (138)

17 thoracic surgeon*.mp. (2778)

18 cardiothoracic surgeon*.mp. (471)

19 oncologist*.mp. (12981)

20 1 or 2 or 3 or 4 or 5 or 6 or 7 or 8 or 9 or 10 or 11 or 12 or 13 or 14 or 15 or 16 or 17 or 18 or 19 (591332)

21 "referral and consultation"/ or gatekeeping/ or remote consultation/ or distance counseling/ or Secondary Care/ or tertiary healthcare/ (66926)

22 Time Factors/ (1141931)

23 Time-to-Treatment/ (3199)

24 time factor*.mp. (1143534)

25 referral*.mp. (123754)

26 exp "Early Detection of Cancer"/ (17856)

27 timeliness.mp. (3117)

28 (interval* adj5 (primary or secondary or diagnostic or treatment)).mp. [mp=title, abstract, original title, name of substance word, subject heading word, keyword heading word, protocol supplementary concept word, rare disease supplementary concept word, unique identifier, synonyms] (12451)

29 "appointments and schedules"/ or waiting lists/ (18109)

30 diagnosis/ or clinical decision-making/ or delayed diagnosis/ or "diagnostic techniques and procedures"/ or diagnostic imaging/ or early diagnosis/ or "early detection of cancer"/ or incidental findings/ (112976)

31 (diagnosis adj5 (early or delayed or late)).mp. [mp=title, abstract, original title, name of substance word, subject heading word, keyword heading word, protocol supplementary concept word, rare disease supplementary concept word, unique identifier, synonyms] (107865)

32 diagnostic imaging/ or diagnostic techniques, respiratory system/ or diagnostic tests, routine/ (49275)

33 21 or 22 or 23 or 24 or 25 or 26 or 27 or 28 or 29 or 30 or 31 or 32 (1475517)

34 lung cancer*.mp. (113369)
35 lung neoplasm*.mp. (197003)
36 exp Respiratory Tract Neoplasms/ (266452)
37 lung carcinoma.mp. (17722)
38 bronchial neoplasms/ or carcinoma, bronchogenic/ or carcinoma, non-small-cell lung/ or small cell lung carcinoma/ (66572)
39 Carcinoma, Squamous Cell/ or lung adenocarcinoma.mp. (130292)
40 lung neoplasms/ or bronchial neoplasms/ or carcinoma, bronchogenic/ (207606)
41 34 or 35 or 36 or 37 or 38 or 39 or 40 (384328)
42 20 and 33 and 41 (929)

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3. SCOPUS database search strategy performed 18.08.2017

1 TITLE-ABS-KEY ("lung cancer*" OR "lung carcinoma" OR "lung neoplasm*")
2 TITLE-ABS-KEY ("time factor*" OR "time delay*" OR "time interval*" OR "timeliness" OR "diagnostic delay*" OR "treatment delay*" OR "waiting time*" OR "waiting list*")
3 TITLE-ABS-KEY ("Primary Care" OR "Secondary Care" OR "referral pattern*" OR "tertiary care" OR "health service*")
4 1 and 2 and 3 (233 results)

APPENDIX 2: Data extraction chart

#	BIBLIOMETRICS	STUDY DESIGN Region, Year	DATA SOURCE	AIMS	OUTCOME MEASURES OF INTEREST / DEFINITIONS	RESULTS: Patient Demographics	Time Intervals in lung cancer pathway by Olesen's definitions [1] or equivalent									SUGGESTED FACTORS RESPONSIBLE FOR DELAY	Guidelines applied on target times?	Involvement of Fast Track System?
							GP-LCS interval	Doctor Interval	System Interval	PCI	SCI	Diagnostic Interval	Treatment Interval	Total interval	Other relevant intervals / findings			
1.	Zikovic et al., 2014(1)	Retrospective study Montenegro, 2009-10	Medical records	Investigate whether delays in diagnosis and treatment of patients with lung cancer impacts prognosis and survival.	Total interval Other: GP delay = first consultation to first LCS visit Lung Specialist delay = first LCS visit to diagnosis	N=206 M:F ratio 5:1 46% NSCLC				MEAN 2.07 weeks (range 1-20 weeks)				MEAN 4.22 weeks (range 1-23 weeks)	LCS to Dx= mean 2.37 weeks	5.1 1.13	BTS(2)	No
2.	Prades et al., 2011(3)	Mixed methods study including prospective quantitative + qualitative data collection Catalonia, Spain 2006 - 2009	Hospital data and semistructured interviews with primary and specialised health professionals and health administrators	To analyse the implementation and overall effectiveness of the Cancer Fast-track Programme for breast, colorectal and lung cancer annually over 4 year period	Total interval	N= 3841 for 2009 Qualitative study based on 83 semi-structured interviews with health professionals								Means(in days)for different years 2006 = 31 2007 = 39 2008 = 32 2009 = 37		2.4 3.3 (a) 2.3 1.15 5.6 5.5 5.3	CFP 30 day policy target from suspicious presentation to treatment start: 50% lung cancer cases overall equally divided between two longest wait categories % <30 days: 2006 = 63% 2007 = 48% 2008 = 58% 2009 = 51%	Yes - Cancer Fast-track Programme

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							GP-LCS interval	Doctor Interval	System Interval	PCI	SCI	Diagnostic Interval	Treatment Interval	Total interval	Other relevant intervals / findings			
3.	Murphy et al., 2015(4)	Prospective cluster randomised controlled trial Texas 2015	Electronic health records	Evaluate whether electronic health-record based trigger algorithms could prevent delays in diagnostic evaluation for cancer.	Other: First suspicious investigation to diagnostic evaluation (referral to specialist/repeat scan or lung procedure)	N=19 (lung) but ? numbers in each group M 50% (control) M 56% (trigger) for all cancers (lung, colorectal, prostate)									First scan to Dx (median n=65 (trigger), 93 days (control).No sig difference.	2.7 1.6 (a) 1.6 (b) 3.8		Prospective electronic trigger-based intervention
4. 3	Mitchell et al., 2013(5)	Qualitative synthesis of significant event audit reports North of England Cancer Network 2003 - 2009	Significant event audits (SEA) in Primary Care practice	Gain insights into the diagnostic process for lung cancer	Primary Care Interval	N=132 M=48.5% mean age 68yrs North of England Cancer Network				>31days (n=45)						4.2(a) 1.9 1.11 1.6b 1.6a 1.10 1.19a 2.3 4.4 2.1 1.10c 2.6	2 week wait rule (6)	TWW
5.	Mansson et al., 1994(7)	Retrospective file review Sweden (1980-1984)	Swedish Cancer Registry	To study role of GP in the diagnostic process for lung cancer.	Diagnostic interval	N=39 M=67% Swedish pts						Mean = 12.5 weeks (87.5 days) (range 0-104 weeks)			No significant difference in diagnostic intervals for GPs versus LCS	1.15 1.14		
6. 4	Leiro Fernandez et al., 2014(8)	Prospective analysis of impact on rapid diagnostic unit on lung cancer diagnostic intervals; Pontevedra, Spain 2008 - 2010	Electronic medical records	To assess Lung Cancer Rapid Diagnostic Unit (LCRDU) system for alerting pulmonologists by radiologists to a radiological suspicion of lung cancer	Other: First alert of suspicious scan to diagnosis	N = 47 (57%) malignant M 67%									Median 13 days for all patients (IQR 7.3 – 30)	1.13 3.1 4.5 3.7		Lung Cancer Rapid Diagnostic Unit (LCRDU).
7.	Largey et al., 2016(9)	Retrospective medical audit in one principal referral hospital in Victoria AUS, 2013	Medical records	To compare lung cancer diagnostic and treatment intervals with agreed target measures across three large public health services in Victoria	Treatment Interval Secondary Care interval Other: GP referral to diagnosis	N=78 Mean age was 68 years Non-small cell lung cancer diagnosed in 76%					Mean = 61.5 ± 58.2 days		Mean = 30.4 ± 45.3 days		Mean interval from GP referral to diagnosis 28.4 ± 56.5 days	3.3 (a) 1.20 4.8 1.10 4.9 3.6 5.1 3.2	The Victorian Lung Cancer Registry (10)and Danish Lung Cancer Group and Registry(11): (1) referral to-diagnosis target = 28 days; (2) treatment interval target =14 days; and (3) Secondary Care interval target = 42 days. Mean SCI (44% within target), mean treatment interval (45% within target), mean GP referral to Dx = (68% within target)	No
8.	Kaergaard Starr et al., 2013(12)	Cohort study 2001–2008 Denmark	Danish Lung Cancer Registry	To examine possible associations between socioeconomic position and surgical treatment of patients with early-stage NSCLC	Other: Time between GP referral and diagnosis	N = 5538 Stage I = 58% Median age (men) = 67 years, 69 years (women)									47% (2585/5538) took ≥ 28 days from referral to diagnosis (49% in short education population, 45% in high education population)	3.3 (a) 4.7	Yes: Time from referral to diagnosis ≤ 28 days by national guidelines	
9.	Jiwa et al., 2004(13)	Review of medical records at one urban group practice serving a mixed population of deprived and affluent communities in UK 1990 - 2003	Primary Care records	To explore the circumstances in which the diagnosis of cancer is delayed with reference to the Primary Care records and by a structured investigation of clinical records in one practice.	Primary Care Interval Diagnostic Interval Other: GP referral to Diagnosis	N = 6				Mean = 40 days		Mean = 95 days			Mean time from referral to diagnosis = 55 days	1.9 1.10 1.11 1.15 1.16 1.6 2.3 2.7 2.9 2.11 2.5 (a) 3.1 3.2 (a) 3.4 3.7 3.8 3.10 (b) 3.11 (b) 3.12 4.1 4.2 5.9	Yes: NHS guidelines on 2-week wait criteria	

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							GP-LCS interval	Doctor Interval	System Interval	PCI	SCI	Diagnostic Interval	Treatment Interval	Total interval	Other relevant intervals / findings			
10.	Hsieh et al., 2012(14)	Retrospective questionnaire	Patient questionnaires and one-on-one interviews from patients with lung cancer in medical centre in Taiwan 2007-2011	Understand delay in the diagnosis of lung cancer under the referral-free healthcare system in Taiwan, and to identify the factors associated with it	Diagnostic Interval	N=840 Mean age 63yrs M 55.9% Stage IV 40%						Mean = 52.1 days				3.7 4.5 5.3 5.7 (b) 1.7 (a) 1.2 (b) 1.1 (a) 1.22 (a) 1.23 (a) 1.24	No	No
11.	Hall et al., 2008(15)	Retrospective file review Western Australia 2005	WACR (Western Australia Cancer Registry)	To compare patterns of diagnostic testing, stage and specialist referral between rural and metropolitan areas and to exposure barriers to quality care	Other: First GP to first LCS	N Rural = 22 64% male 63.3 yrs 14% St IV N metro = 21 57% male Age 63.8yrs 5% St IV				Rural: Mean 24.7 days (SD 30.2) Metropolitan mean 19.1 days (SD 18.4)						1.18 (a) 3.2 3.10 (a) 5.6 3.4 1.15 2.3 2.8 4.1 4.4 3.5 (a) 4.6		
12.	Billing et al., 1996(16)	Retrospective study 1993, Papworth, UK	Medical records	to assess the length and cause of delay from the first presentation of lung cancerto surgery and to identify the stages at which such delay occurs.	Total interval PCI Doctor interval GPLCS interval	N 38 Mean age 61 76% male	Mean 15 days (95%CI 11-19)	Mean 26 days (95%CI 14-38)		Mean 32 days (95%CI 21-42)				Mean 109 days (95%CI 92-127)		3.1 4.1 3.6 2.3 4.7 5.1 4.8		
13.	Dalton et al., 2011(17)	Denmark 2001-2008	Danish Lung Cancer Registry		GP referral to Dx	N 18103 54% male									Median GP referral to Dx = 20 days	1.2 (a) 1.7 (b) 1.1 1.13 1.10	Danish National Cancer Plan: GP referral to Dx < 28d	
14.	Iachina et al., 2017 (18)	Retrospective cohort study Denmark 2008 - 2012	Danish Lung Cancer Registry	To explore impact of fast track transfer pathways between hospitals on times to diagnosis and treatment of Non-Small Cell Lung Cancer (NSCLC).	Treatment interval Secondary Care interval Other: Referral to Dx	N 11273 (total) 100% NSCLC 52% male Transfer 4434 Not transferred 6839					Mean 38.38(SD 15.42)		Mean 16.9 (SD 10.64)		Referral to Dx mean 21.47 (SD 12)	5.4 1.2 (a) 1.13 1.10 (c) 1.8	Danish National Board of Health	
15.	Ringbaek et al., 1999(19)	Denmark 1991 - 1993		To examine the diagnostic process for suspected lung cancer patients at Bispebjerg Hospital	GP LCS interval LCS to Dx	N 467 Mean age 78 years 64% men	Mean 7.6 days						26 days		LCS to Dx Mean 43.1 days	1.2 3.8 1.19 (b) 4.7 1..6	98% patients GPLCS<1 month	
16.	Cattaneo et al., 2014(20)	Report Annapolis, Maryland, USA 2010	Medical records	To assess effect of Rapid Access Chest and Lung Assessment Program (RACLAP) at Anne Arundel Medical Center (AAMC) in Annapolis.	Other: Scan to diagnosis	N 72 (lung cancer patients) (N processed through RACLAP =121) StIV 31%									Median time from Scan to diagnosis = 16 days	5.6		Yes
17.	Yoshida et al., 2012(21)	Retrospective study 1999 – 2000 Japan	Radiology information system	To identify the CT characteristics of early lung cancer in relation to chronic interstitial pneumonia on serial images obtained from the time of no identifiable tumor to clinical diagnosis of overt lung cancer.	Other: Scan to diagnosis	N 22 82% male Age 70yrs St IV 8.7%									Median time from Other: Scan to diagnosis = 409 days (range 0 – 1301)	4.2		
18.	Bowen et al., 2002(22)	Prospective pilot study UK 2002	Patient questionnaires	To document the time between occurrence of symptoms and presentation to GP for patients presenting with lung cancer to two NHS trusts with 'rapid access clinics'.	Other: GP visit to LCS visit interval	N 37 Mean age 65 yrs 51% male									Other: First GP visit to LCS visit: Median 8 weeks (56 days) range 0 to >25 weeks)	1.15 2.4 2.3 2.7	NHS / DOH (23)	Yes: TWW
19.	Yorio et al., 2009(24)	Retrospective analysis Texas 2000 to 2005	Medical records and hospital tumour registries	Examine the predictors and impact of lung cancer diagnostic and treatment intervals in a setting representative of the diversity and complexities of the contemporary American health care system	Treatment Interval Other: Time from initial suspicious imaging to diagnosis (image-diagnosis interval)	N=482 Mean age 63.6yrs 83% NSCLC All Stage I-III			Median=59 days (IQR 34 - 93)				Median=33 days (IQR 20 - 53)		Median image-diagnosis = 16 days (IQR6 - 43); significantly associated with hospital and insurance type	1.2 (a) 1.3 (c) & (d) 3.5 (a) 3.1 4.1		No

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							GP-LCS interval	Doctor Interval	System Interval	PCI	SCI	Diagnostic Interval	Treatment Interval	Total interval	Other relevant intervals / findings			
					Time from image to treatment initiation (image-treatment interval)													
20.	Shershneva M et al., 2013(25)	Mixed-methods study Wisconsin, 2013	Patient, physician interviews and medical records	Measure delays in lung cancer care across multiple health care systems	Primary Care interval GP-LCS interval Other = First to last diagnostic test delay LCS visit to treatment start delay = 1. *Specialist delay* = LCS visit to referral by LCS for treatment 2. *Specialist treatment delay* = Referral by LCS for treatment to treatment start	N= 36	Median 5 days (range 0 – 39)			Median =14 days (range 0 – 800)				Median = 50 (Range 5 – 2000)	Median LCS to treatment start delay = 27.5 days (2 – 96) Median Specialist delay = 14 days Median Specialist treatment delay =14 days Median first–last diagnostic test = 15 days	1.6 1.11 1.14 2.1 2.3 2.5(a) 3.4 2.0 2.4	BTS(2) RAND (26)	No
21.	Winget M et al., 2007(27)	Stakeholder workshop consensus Three Canadian provinces (Alberta, Saskatchewan and Manitoba), 2004	Provincial /territorial Deputy Ministries colorectal and lung cancer data	1) Identify a set of criteria and variables needed to create comparable measures of important time-to cancer care intervals 2) Compare time-to-care across provinces for lung and colorectal cancer patients	Treatment interval Other: Diagnosis to first LCS visit First LCS visit to treatment start	N = 2936 Alberta: N 1585, 53% male Saska N 567, 54% male Manitoba N 784, 52% male							Medians = Alberta 31 Saska =41 Manitoba = 36		Diagnosis to first LCS visit: Range of medians = 25 – 30 days First LCS visit to treatment start: Range of medians = 8 – 10 days		Health Council of Canada(28)	No
22.	Wang L et al., 2009(29)	Population based retrospective study Michigan 1992 - 2004	Medical records	To determine effect of time to treatment (TTT) on overall survival (OS) in patients with unresectable Stage III non–small cell lung cancer (NSCLC)	Treatment Interval	N=237 32% adenocarcinoma 14% large cell 72% Male Median age 65 years All = Stage III NSCLC							Median = 57 days (range 0 – 377)			1.2 (a) 1.7 (b) 1.8 3.5		No
23.	Vidaver R et al., 2016(30)	Mixed-methods study Wisconsin and North Carolina 2012 - 2014	Patient reports from telephone interviews, questionnaires	To explore when and why delays occur and to compare timeliness between two states	Total interval System interval Primary Care interval GP-LCS interval Diagnostic interval Treatment interval Other: LCS visit to treatment First to last diagnostic test Treatment consultation to treatment start Patient informed of Diagnosis to treatment	N=347 Age 30-92yrs 69% NSCLC	Median 4.5 days (0 – 119)		Median n=36.5 days (1-69)	Median n=9.5 days (0 – 1183)		Median 34 days (0 – 1656)	Median 15 days (0 -180)	Median 52 days (1 – 1687)	Median LCS visit to treatment = 27 days (0 – 47) Median First to last diagnostic test = 13 days (0 – 1680) Median time from treatment consultation to treatment start = 16 days (0 – 1430) Median time from patient being informed of Diagnosis to treatment =15 days	1.3 1.9 1.10 2.1 2.3 1.15 2.0 3.1 2.7 3.3 1.3 1.9 1.10 3.7 2.5 3.4 3.8 4.1 5.2 3.11 (a) 4.7	-BTS(2) -RAND Cooperation (26): optimum initiation of treatment within 42 days of NSCLC diagnosis and within 14 days of SCLC diagnosis = 21% of NSCLC and 5% of SCLC patients in this study would be defined as having experienced treatment delays.	No
24.	Evans S et al., 2016(31)	Retrospective cohort study Victoria, 2011-2014	Victorian Lung Cancer Care Registry (VLCR) with data from 8	To assess factors associated with second-line delays in the management of patients	Treatment interval Secondary Care interval	N=1417 59% Male 18% Stage IV Mean age 71 yrs					Median =53 days (IQR 25 – 106)		Median n=30 days (IQR 6 – 84)		Median time from referral to LCS to diagnosis = 15 days	1.11 (a) 1.12 1.13 1.20 3.5 (a)	NHS(32): Secondary interval target 62 days. This study = median for public patients was 61	No

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							GP-LCS interval	Doctor Interval	System Interval	PCI	SCI	Diagnostic Interval	Treatment Interval	Total interval	Other relevant intervals / findings			
			Victorian hospitals (6 public, 2 private)	diagnosed with NSCLC	Other: Referral to LCS to diagnosis										(IQR 5 – 36)	1.18 (a)	days , with 48% waiting more than 62 days.	
25.	Torring M. et al, 2013(33)	Prospective population based study Aarhus County, Denmark, 2004 - 2005	County Hospital medical database Danish Cancer Registry	To assess the association between the length of the diagnostic interval and five-year mortality for five common cancers, including lung cancer	Diagnostic interval	N=262						Median n=52 days (IQI 30 – 86)				2.3 1.15	None	No
26.	Sulu E et al., 2011(34)	Prospective study Istanbul, Turkey 2009	Patient clinical files	To investigate patterns of delays among patients with NSCLC and to identify reasons for the delays	Treatment interval Total Interval Other: "Diagnosis delay" = hospital admission to diagnosis Referral delay interval (First GP visit to hospital admission for further assessment)	N= 101 90% Males Mean 60yrs							Median = 21 days (95% C.I. 20.8 – 28.6, SD 18.3)	Median = 98 days (95% C.I. 103.7 – 135.5, SD 74.6)	Median referral delay = 13 days Median Diagnosis delay= 13 days	1.14 2.3 3.1 1.0 3.2 4.1 4.5 4.8 3.3 (c) 1.18 (a) 3.7	BTS, Swedish Lung Cancer Study Group (35) and Canadian Study Group (36)recommendations : 46.5% met recommended times for total interval, 53.5% for GP-LCS, 63.4% for "diagnosis delay", 43.6% for Treatment interval delay.	No
27.	Smith M et al., 2013(37)	Secondary data analysis Houston 2013	Tumour registry data-2 large public healthcare systems	To explore system barriers and resilient actions of Primary Care providers in the diagnostic evaluation of cancer	Diagnostic interval	N=12						Median n= 7 weeks (range 15 days to >4 months)				1.6 (a) 2.5 (b) 3.1 3.2 4.1 4.5	No	No
28.	Sawicki M et al., 2013(38)	Population based cohort study Lublin, Poland, 2010 - 2011	Medical records	Analyse differences in periods of time and reasons for delays in diagnosis and initiation of treatment of lung cancer	Total interval	N= 150 Mean age 57 yrs 1:1 urban/rural residents of Lublin								Median n=12 weeks (range 6 – 17 weeks), similar for rural and urban patients		2.3 3.1 4.1 4.7 2.7 3.1 4.1 4.6 1.15 2.11 2.0 2.4 5.6 3.7 3.12	No	No
29.	Salomaa E et al., 2005(39)	Retrospective study of patient records Turku, Finland 2005	Medical records-Turku University Hospital	To measure delays of diagnosis and to assess the causes for those delays	Primary Care Interval GP-LCS interval Treatment interval Other: "Specialist's delay" = First LCS visit to diagnosis	N=132 72% M 81% NSCLC 67% stage IIIB-IV	Median 8 days			Median 16 days			Median 15 days		Median Specialist's Delay = 15 days	1.11 2.3 3.1 4.1 3.3 (a) 1.9 1.8 1.2 (a) 1.19 (b) 4.7 1.13 5.3 5.6	-BTS(2): About 50% fulfilled BTS guidelines. PCI target is 7 days (Median PCI in this study did not meet target; a third waited >30 days.) -Swedish Lung Cancer Study Group(35): 66% fulfilled Specialist's Delay criteria of 4 weeks; 49% fulfilled Treatment Interval criteria -Canadian recommendations(36) : Only 26% fulfilled the 4-week Diagnostic interval limit	No
30.	Rolke H.B. et al, 2007(40)	Questionnaire-based prospective study Southern Norway, 2002-2005	Medical records, Norwegian Cancer Registry	To evaluate the delays in the diagnostic pathways for primary lung cancer in Southern Norway, and to compare results with	Primary Care Interval GP-LCS interval Other: "Specialist's delay" =	N= 479 72% Stage IIIB or IV 79% NSCLC	Median 1 day (IQR 0 – 7)			Median 22 days (IOR 4 – 61)					Median Specialist's delay = 8 days (IQR 3 – 19) Median Informed diagnostic	1.13 1.15 2.5(a) 2.7 5.3 4.5 1.10 (c) 1.17 (a)	BTS(2) Swedish Lung Cancer Group (SLCG)(35) Patients met BTS and SLCG recommendation: – 71% cases met GPLCS52% met Dx delay	No

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							GP-LCS interval	Doctor Interval	System Interval	PCI	SCI	Diagnostic Interval	Treatment Interval	Total interval	Other relevant intervals / findings			
				recommendations from the BTS and Swedish Lung Cancer Group (SLCG)	First LCS visit to diagnosis "Informed diagnostic delay" – Decision to do diagnostic test to informing patient of diagnostic result "Hospital delay" – first LCS visit to treatment start										delay = 14 days (IQR 6 – 25) Median Hospital delay = 25 days (IQR 13– 42)		62% fell within LCs to Rx Target of 31d	
31.	Redaniel et al., 2015(41)	Review of medical records UK, 1998 - 2009	UK Clinical Practice Research Datalink, cancer registries, HES and ONS	To determine associations between diagnostic intervals for common cancers and five-year survival, stratified by NICE-qualifying alert and non-alert symptoms	Diagnostic interval	N=5737 M 59%						Median n=88 days(IQR 34 – 210)				1.16 1.0 3.1 4.1	BTS(2)	No
32.	Radzikowska E. et al, 2013(42)	Review of medical records Warsaw, Poland, 1995 - 1998	National Tuberculosis and Lung Diseases Research Institute, Warsaw, Poland	To evaluate the influence on survival of delays in the diagnosis and treatment in an unselected population of SCLC	Diagnostic interval Treatment interval Total interval Other: First clinical presentation to first LCS visit First LCS visit to diagnosis First LCS visit to bronchoscopy	N= 3,479 Mean age 60 yrs 68% extensive stage						Median 34 days (IQR 19 – 61)	Median 6 days (IQR 6 – 21)	Median 42 days (IQR 15 – 84)	First clinical presentation to first LCS visit = median 19.5 days First LCS visit to diagnosis = median 21 days (IQR 14 – 37) First LCS visit to bronchoscopy = median 10 days	5.6 3.2 1.6 4.7 1.10 4.2 (a) 1.15	BTS (2) with Joint Council for Oncology and ACCP (43, 44) – median diagnostic and treatment intervals meet targets	No
33.	Powell A., et al., 2008(45)	Retrospective chart review survey USA, 2006	Medical records in 133 of Department of Veterans Affairs (DVA) cancer centres	Examine the timeliness of key events between initial radiograph and first treatment	System Interval Secondary Care interval Treatment interval	N= 2463 (total) Stage IV = 34%			Median=71 days (IQI 39 - 121)		Median = 12 days (IQR 5 – 25)		Compoent medians = 2+7+12 Addition of means = 4.5+17.5+19.7 = 41.7			1.6a 1.13 3.1 5.1 1.14 1.18 (a) 4.1 2.7 2.5 3.3 (a) 4.5 1.9	No	No
34.	Ozlu T. et al, 2004(46)	Retrospective analsys Eastern Black Sea Region, Turkey, 1992 - 1999	Medical Records	To determine time interval of symptom onset to diagnosis and treatment	Diagnostic interval Treatment interval Total interval	226 patients 96% male NSCLC: Stage I/II 11.9% Stage IIIa 19% Stage IIIb 34.5% Stage IV 19.5% SCLC: 15.6%						Median 8 days (range 1-210)	Median 17.5 days (0-206).	Median 30 days (1 – 253)		2.8 5.3 3.3 (b) & (c) 4.1 3.7	BTS(2) : Median diagnostic interval: 70% cases within target of 14 days	No
35.	O'Rourke et al, 2000(47)	Single centre prospective audit Glasgow, UK , 1999	Medical records	To investigate natural history of untreated (potentially curable) NSCLC while awaiting radical radiotherapy, as assessed by one consultant	Other: First LCS visit to treatment First LCS to diagnosis First LCS request and treatment Delay between diagnostic and planning CT	N = 29									Median interval from first LCS visit to treatment 94 days (35 – 187). Median time from first LCS to diagnosis = 20 days (1 – 104). Median interval from request to treatment 44 days (23 – 61). Median time between	3.3 (a) & (c) 5.1 1.6 3.6	Joint Council for Clinical Oncology(48): Radical radiotherapy to commenced 14 – 28 days of LCS request; median interval in this study exceeded target. Scottish Intercollegiate Guidelines Network (SIGN) (49): LCS to diagnosis target 14 days and LCS to treatment target = 42 days. Median time from first LCS to diagnosis of 20 days almost met this target. Only 7% of patients met SIGN treatment guidelines.	

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							GP-LCS interval	Doctor Interval	System Interval	PCI	SCI	Diagnostic Interval	Treatment Interval	Total interval	Other relevant intervals / findings			
															diagnostic CT chest and planning scan = 54 days (18 – 131) 21% of potentially curable patients became incurable on the waiting list.			

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							GP-LCS interval	Doctor Interval	System Interval	PCI	SCI	Diagnostic Interval	Treatment Interval	Total interval	Other relevant intervals / findings			
36.	Neal et al., 2014(50)	Retrospective review UK Cohort 1 = patients presenting between 2001 – 2002 Cohort 1 = patients presenting between 2007 - 2008	UK Clinical Practice Research datalink	Compare diagnostic intervals for 15 cancer streams in separate cohorts before and after 2005 NICE referral guidelines for suspected cancer and by NICE-qualifying presenting symptoms	Diagnostic Interval	Cohort 1 (pre-NICE): 1816 patients Cohort 2 (post-NICE): 2851 patients						Cohort 1 (pre-NICE):114 days (IQR 48 – 238) Cohort 2 (post-NICE):112 days (IQR 45 – 251)			Difference between two years's findings: *P = 0.47 (95%CI: -4.1 to 8.8)*	1.15 1.13 5.9 5.3 2.4 2.3 2.7	NHS (23) and NICE 2005 guideline for urgent referral of suspected cancer based on qualifying symptoms(51) .	Yes: NHS urgent referral pathway
37.	Neal et al., 2007(52)	Retrospective review England 2000–2001	Hospital records in one hospital trust	Compare outcomes of cancer patients referred through the urgent referral guidance with those who were not,	GP-LCS interval Other: First LCS to Dx	N (urgent) = 96 St IV 28% N (Other) = 313 St IV 18%	Urgent: Median 10 days (IQR 6 – 13) Other: 10 (4 – 17)								Urgent: Median : First LCS to Dx = 18 days (IQR 8 – 36) Other: 15 (4 – 28)	1.13 2.7	NHS(6): 89% urgent referrals seen within 2 weeks vs 57% non-urgent	Yes: NHS urgent referral pathway
38.	Din, N. et al., 2015(53)	Retrospective review United Kingdom 2007 - 2010	UK Clinical Practice Research datalink	To quantify differences in cancer diagnostic intervals in 15 cancers across different patient subgroups by NICE-qualifying alarm presenting symptoms	Diagnostic Interval	N = 6552 57% M Mean age 72yrs						Median 113 days (IQR 45 – 249)				1.2 (a) 1.7 (a) 1.15	NICE 2005 guideline (51)	
39.	Nadpara et al., 2015(54)	Retrospective review USA 2002 - 2007	SEER Medicare – linked database	Evaluate variations in care and prognosis amongst elderly US patients	GP-LCS interval Doctor Interval Diagnostic Interval Treatment Interval Other: LCS to Diagnosis CXR to LCS interval	N =48,850 86% NSCLC 52% M 87% white 83% metropolitan 19% aged 66 – 69 29% aged 80 or more	Median 1 day (0 – 7) N = 14349	Median 15 d (IQR 0 – 154) N = 37,302				Median 187 days (IQR 36 – 308) N=43833	Median 25 days (IQR 12 – 45) N = 32441		LCS to Diagnosis : Median 14 days (5 – 63) N = 19066 CXR to LCS: Median 14 days (2 – 69) N = 19066	3.3 (a) 1.17 (a) 1.13 1.2 (a) 1.7 (a) 1.4 (a) 1.18 (b) 1.10 1.5 (a) 4.1	BTS (2) RAND (26) 77.5% patients received timely care	
40.	Myrdal et al., 2004(35)	Retrospective review from 2 centres Central Sweden between 1995 -1999	Medical records of patients registered with Regional Cancer Registry	To describe delays and investigate relationship between delays and survival for NSCLC patients	First LCS visit to treatment start	N = 466 M = 58%									First LCS visit to treatment start = 1.6 months (i.e., 49.6 days) (IQR 0.9 to 2.4 months)	3.3 (a) 1.13 3.6 3.7 1.15	Swedish Lung Cancer Study group: all diagnostic tests should be completed within 4 weeks of seeing LCS and treatment should be started within 2 weeks. Only 51% met criteria. (Only 31% all surgical pts)	
41.	Murray et al., 2003(55)	Multi-site Prospective Pilot Randomised Trial to test feasibility 3 District General hospitals and Royal Marsden (Surrey), UK 1998 - 2001	Patient records and EORTC QLQ questionnaires	Randomised pilot study to test feasibility of investigating Rapid Diagnostic System (RDS) compared to conventional diagnostic workup in local chest clinics	Total Interval = Combined Diagnostic + Treatment Interval	N = 88 N for RDS intervention = 45 60% male Median age 70 yrs 80% NSCLC; 25% Stage IV 20% SCLC Control = 43 M 70% Med age 68 NSCLC 78% Stage IV 24% 22% SCLC							RDS = 3 weeks For conventional system = 7 weeks (log rank p value = 0.0025)	No significant difference in time from diagnosis to treatment in patients receiving radical therapy	5.6 5.7 (a)	Whitehouse Report (56) and National Health Service (NHS) Cancer Plan(6): Urgent GP referral to treatment = 2 months Diagnosis to Treatment for all cancers = 1 month. All conventional arm patient met guidelines on time to LCS and time to treatment but no median interval given.	Two-Step Rapid Diagnostic System at Royal Marsden Hospital
42.	Melling et al., 2002(57)	Retrospective case note analysis Yorkshire Cancer Registry database (1993)	Lung cancer cases registered with the former	Determine referral practice compared with recommended time intervals	Treatment interval GPLCS interval Other: LCS to Rx	N=362 M=62.4% Non-Small Cell 51.1%, small 17.1%, clinical 31.8%	Median 7 days						Median in without diagnosis group = 28 days		Median LCS to Rx in with diagnosis group = 35 days Median CXR to LCS referral= 7 days	4.1 3.3 (a) 3.3 (c) 2.4 2.3 3.8	BTS (2) SMAC (56) SIGN (49) Treatment interval = 8 weeks if no histological diagnosis; 23% met target First LCS visit →Treatment = 8 weeks if diagnosis	No

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							GP-LCS interval	Doctor Interval	System Interval	PCI	SCI	Diagnostic Interval	Treatment Interval	Total interval	Other relevant intervals / findings			
															Median CXR to LCS visit = 17 days		obtained; 38% within 8 weeks	

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							GP-LCS interval	Doctor Interval	System Interval	PCI	SCI	Diagnostic Interval	Treatment Interval	Total interval	Other relevant intervals / findings			
43.	Lo et al., 2007(58)	Ontario, Canada. 2004- 2005	Medical records, physician surveys	Study waiting times pre- and post-implementation of Time to Treat (TTT) Program streamlined referral system from GPs to LCS from first 'Suspicion' (clinical OR radiological) of lung cances	GP-LCS interval Other: 'Suspicion' to LCS referral LCS visit to CT scan CT scan to diagnosis 'Suspicion' to diagnosis	N in 2004 pre-TTT: 52 N in 2005 post-TTT: 430 Mean age 66 yrs	Median pre-TTT = 17 Median post - TTT = 4								Median Times BEFORE and AFTER TTT program: 1. From suspicion to referral to LCS decreased from 20 days to 6 days 3. Median LCS visit to CT scan decreased from 52 days to 3 days. 4. Median time from CT scan to diagnosis decreased from 39 days to 6 days. 5. Median time from suspicion to diagnosis decreased from 128 days to 20 days.	5.3 5.5 4.1	For TTT program, the target wait time for referral for a LCS consult was ≤ 5 days. The target wait time for CT scan was ≤10 days. Ontario Provincial Wait Time Strategy (59) measures time from diagnosis until surgery. The same wait time in this study was 23 days.	Yes: Time to Treat Program implementation
44.	Lewis et al., 2005(60)	Retrospective audit of medical records	Medical records from one site (Nottingham City Hospital) UK 1999 - 2002	To examine the impact of the 2-week wait (TWW) principle process on the urgent referral pathway for lung cancer	GP-LCS interval Secondary Care interval Other: GP referral to diagnosis LCS to diagnosis All intervals measured for three different time periods (1999 – 2000 when DoH guidelines were introduced) and subsequent 24 months (2000 – 2001, 2001 – 2002)	For all: 60% male Median age 73 years 80% NSCLC 15% SCLC 1999 – 2000: N = 286 2000 – 2001: N = 352 2001 – 2002: N = 404	1999 – 2000: median 7 days (0 – 124); 2000 – 2001: Median 8 days (0 – 101); 2001 – 2002: Median 9 days (0-98)				1999 – 2000: median 37 days (2 – 228); 2000 – 2001: Median 41 days (2 – 307); 2001 – 2002: Median 42 (0-239)				Introduction of TWW principle resulted in patients waiting longer for their first LCS visit. 58% patients referred via TWW scheme. GP referral to diagnosis: 1999 – 2000: median 26 days (0 – 228); 2000 – 2001: Median 33 days (2 – 307); 2001 – 2002: Median 27 (0-300) LCS to diagnosis: 1999 – 2000: median 15days (0 – 219); 2000 – 2001: Median 21 days (0 – 294); 2001 – 2002: Median 15 (0-300)	5.3 5.4 2.10	1999 – 2000: Department of Health National Standards Local Action '2-week wait' scheme(6) and NICE guidelines (51)	
45.	Larsen et al., 2013(61)	Retrospective population-based study, in several hospitals in Southern Denmark including Vejle. 2007 - 2009	GP Questionnaires	To analyse how the Secondary Care interval changed, in general after the introduction of urgent referral for specific cancers, including lung.	Secondary Care Interval	N (Vejle) = 775 M 35% N (Other) = 5743 M 51%					Vejle: SCI before system = median 31 days (IQR 20 – 41) SCI after = median 29 days (IQR 23 – 65); p=0.39 Other hospitals: SCI					5.3 1.15 2.5 (a)		Urgent referral system based on alarm symptoms, implemented by Danish government in 2008

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							GP-LCS interval	Doctor Interval	System Interval	PCI	SCI	Diagnostic Interval	Treatment Interval	Total interval	Other relevant intervals / findings			
											before = median 37 days (IQR 21 – 64) SCI after = median 33 days (IQR 16-53); p=0.008							

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							GP-LCS interval	Doctor Interval	System Interval	PCI	SCI	Diagnostic Interval	Treatment Interval	Total interval	Other relevant intervals / findings		
46.	Largey et al., 2015(62)	Pilot study of retrospective audit in a single, public outer metropolitan hospital in Victoria, AUS 2009 - 2010	Medical records	To describe diagnostic pathways undertaken by lung cancer patients and identify variations in referral intervals, in a Australian healthcare settings.	GP-LCS interval Diagnostic interval Other: First LCS visit to diagnosis First LCS visit and MDT	Total N = 25 Male 60% Mean age 71 years 52% NSCLC 20% SCLC 28% St IV Cohort 1: Patients who presented to a GP and were subsequently referred to a private clinician (*n* = 12) 13 Cohort 2: Patients who presented to a GP and were subsequently referred to a public hospital (*n*=5)	Cohort 1 = Median 7 days (IQR 3 – 30) Cohort 2 = Median 0 days (IQR 0)					Cohort 1 = Median 19 days (IQR 12 – 36) Cohort 2 = Median 20 days (IQR 7 – 47)			LCS to diagnosis interval: Cohort 1 = median 7 days (IQR 1 – 13) Cohort 2 = Median 20 days (IQR 7 – 47) Patients referred to MDT before diagnosis (*n* = 4, 16%) experienced the longest median interval to MDT (39 days, IQR 22–51)	2.7 1.21 2.3 3.4 4.5 1.14 2.11 3.9	No	No
47.	Krishnasamy et al., 2001(63)	Prospective, national study of patients from 24 hospitals in UK 2001	Questionnaire survey to patients and carers	To describe patients' carers' perceptions of care following a diagnosis of primary lung cancer	Doctor Interval Other: LCS to diagnosis	N = 209 respondents Male = 65% NSCLC = 65% Age 61 – 70 years = 41%		Median 14 days							LCS to diagnosis = median 3 weeks	4.7 5.1 3.4 3.1 4.4 1.15 2.4 4.1 5.6	NHS(6), Yorkshire Thoracic Group (64)and BTS (2) guidelines: First GP visit to CXR = 1 week. CXR to LCS visit and confirmation of diagnosis to patients within = 2 weeks. Treatment interval = 4-6 weeks: GPLCS: 45% within 2 weeks <u>but no median interval given</u>, 9%within 1-3 months Total interval: 14% within 3 weeks, 86% within 1-8 months	
48.	Koyi et al., 2002(65)	Prospective study of timelines to diagnosis in 1 hospital in Gaevle, Sweden 1997 -1998	Patient questionnaires	To prospectively measure the delays from both patient and doctors' perspectives	GP-LCS interval "Specialist delay" / LCS referral receipt to diagnosis First LCS visit to surgery / chemotherapy ,	N = 105 Stage IV = 43% NSCLC = 62% 84 (62.7%) men and 50 (37.3%) women. Mean age in men was 71.6 years and in women 69.8 years	33 days (range 0 – 477)								LCS to Dx= 9 days (range 0-720) Median LCS visit to surgery / chemotherapy = 31 days / 24 days respectively	1.9 3.1 4.7 1.6 2.8 2.3 2.2	None specified	No
49.	Jiwa et al., 2010(66)	Database survey, data linkage and postal survey 2006 - 2007	Western Australian Data Linkage System (WADLS), Lung Cancer Management System (LCMS) and Open Patient Administration System (TOPAS®)	To plot the trajectory of lung cancer patients by linking multiple data sources in Western Australia	PCI	47 GPs				Median 1.2 weeks (range 1-30weeks) (GP survey)						1.11 1.14 1.15		
50.	Hansen et al., 2011(67)	Population-based cohort study Denmark, 2004 – 2005	Registries and GP questionnaires by GP, County of Aarhus, Denmark	Explore patient-GP and system related delay in the interval from first cancer symptom to diagnosis and treatment	Doctor Interval System Interval Secondary Care Interval Treatment interval 'Delay encountered in the primary health care (PHC) sector' = GP-initiated investigation until referral - 'Diagnostic	N=328		Median 0 days IQI 0-9 (n=251)	Median 69 days IQI 47-96 (n=182) System interval when GP not involved = median 51 days IQI 27-76 (n=40)		Median 55 days IQI 36-79 (n=181)		Median 23 days IQI 8-36 (n=182)	Total system delay median 108 days IQI 82-167 (n=128)	Delay encountered in PHC = median 7 days IQI 0-18 (n=250) Diagnostic delay in SHC = median 27 days IQI 14-46 (n=246)	4.1 3.1 5.7 (a)		

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							GP-LCS interval	Doctor Interval	System Interval	PCI	SCI	Diagnostic Interval	Treatment Interval	Total interval	Other relevant intervals / findings			
					delay in secondary health care (SHC) sector' (Referral to SHC to Diagnosis)													
51.	Gonzalez-Barcala et al., 2014(68)	Observational retrospective study Pontevedra, Spain , 2005 - 2008	Complexo Hospitalario de Pontevedra, (CHOP) database	To analyse the delays in the diagnosis and treatment of lung cancer, factors associated with the timeliness of care and possible relationship with survival.	Treatment interval Other: Diagnosis delay = First LCS to diagnosis Hospital delay = LCS to treatment	N=307 Male 87.1%							Median n=14 days		Median Diagnosis delay =18 days Median hospital delay =35 days	1.2 (b) 1.5 (a) 1.7 (a) 1.13 1.10 1.15 3.3 (a) 3.5	BTS: median 18 days exceeds the 2 weeks delay recommended	
52.	Gonzalez et al., 2003(69)	Prospective observational study 2000 - 2001	Hospital medical records, Hospital Universitario de Salamanca, Spain	To study the clinical and demographic factors associated with delays in the diagnosis of lung cancer	Diagnostic interval Other: LCS to Dx (Diagnostic period) First clinical presentation to first LCS visit (defined as Middle Period)	N= 113 Mean age 65yrs Male 91.1% 93% smokers						Range = 5 – 377			Middle Period mean = 37.9 days (SD 63) Diagnostic period mean=18.6 days (SD 19)	1.10 (d) 2.3 2.7 4.1 4.5 1.18 (b) 2.0 3.7 2.12 5.6		
53.	Gomez et al., 2014(70)	Population based study US, 2004 - 2007	Surveillance, Epidemiology, and End Results (SEER)-Medicare and Texas Cancer Registry (TCR)-Medicare databases	To determine if predictors of treatment delay after diagnosis were associated with prognosis	Treatment Interval	N= 28,732 diagnosed with NSCLC in 2004–2007 Age ≥66yrs							Median 27 days			1.1 1.2 (a) 1.4 1.7 (a) 1.10 3.3 (d) 4.8	Yes: Treatment interval should be <35 days (71) – 37% patients faced delays	
54.	Forrest et al., 2015(72)	UK, 2006 - 2010	Northern and Yorkshire Cancer Registry, Hospital Episode Statistics and lung cancer audit data sets	Investigate the factors that may influence the likelihood of post-Primary Care referral, diagnosis and treatment within target times.	GP-LCS interval Treatment interval Secondary Care Other: GPreferral to Dx LCS to Dx	N = 28733 61% NSCLC 13% SCLC 54% male 16% Stage IV No information on proportion of urgent referrals	Median 10 days, IQR 6 - 17				median 56 days (IQR 39–79)		median 35 days (IQR 21–55)		GP referral to Dx Median 13 days (IQR 7 – 24) Median LCS to Dx = 0 (IQR 0 – 0)	1.5 (a) and (b) 1.13 1.17 (a) 1.15 1.2 (a) 3.3 (a)	NHS (6) 70% within GPLCS interval, 43% within Tmt Int target, 61% within SCI target 91% within LCS to Dx target of 17 days	
55.	Fernandez de la Vega et al., 2015(73)	Retrospective descriptive stud Havana, Cuba 2007 - 2010	Administrative data	to assess lung cancer diagnostic delay and to identify its various components	Other: LCS to Dx GP visit to LCS visit	N 54 74% male									LCS to Dx = 31.3 days GP visit to LCS visit = 16.2 days	2.8 4.5 5.9 3.1	Yes but arbitrary and set by authors.	
56.	Emery et al., 2013(74)	Mixed methods study 2009 - 2010	Patient interviews and medical records	to explore factors contributing to longer diagnostic intervals in rural cancer patients in Western Australia (WA), comparing intervals between common cancers, including lung	Primary Care Interval GPLCS interval Diagnostic interval Other: LCS to Dx	N = 8 Mean age 60.5 years	2(IQR -0 – 22)			9 (IQR 0 – 103)		Median 22 days (IQR 0 – 38)			Median LCS to Dx = 11 days (IQR 7 – 15)	1.15 4.2 4.5 3.11 (a) 1.13		
57.	Ellis et al., 2011(75)	Prospective study Ontario, Canada 2010	Structured telephone interviews with patients and medical records	to examine the trajectory of patients from onset of symptoms, initial presentation, diagnostic work up and referral to a regional cancer centre.	Primary Care Interval Other: LCS to Rx	N = 56 Median age 68 yr 77% NSCLC 23% SCLC 6% Stage I 29% Stage IV 58% male				Median 27 days (IQR 12 – 49)					Median LCS to Rx 10 days (IQR 2.5 – 28)	1.15 2.12 4.1 3.7 2.4 5.6 4.4		
58.	Dregan et al., 2013(76)	Cohort study UK2002 – 2006	UK Clinical Practice Research Database (CPRD) with linked Cancer Registry (CR) data in 158 general practices	To evaluate diagnostic time intervals, and consultation patterns after clinical presentation with alarm symptoms	Diagnostic interval	N = 215						35 (IQR 18 – 89)				2.4		

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							GP-LCS interval	Doctor Interval	System Interval	PCI	SCI	Diagnostic Interval	Treatment Interval	Total interval	Other relevant intervals / findings		
59.	Devbhandari et al., 2008(77)	Prospective tracking study UK 2003 - 2005	Medical records	To assess how bronchoscopy results affected waiting times to lung cancer treatment in patients referred by standard (via GP) and non-standard referral pathways	GP-LCS interval Secondary Care interval Treatment interval Other: L CS to Dx	Mean age 68 years N 92 bronch pos (BP) N = 94 bronch neg (BN) BP: 73% male 25% SCLC 72% NSCLC BN: 52% male 12% SCLC 51% NSCLC	BP: Median 1 day (IQR 0 – 5) BN: Median 1 day (IQR 0 – 4)				BP: Median 45 (IQR 37 – 60) BN: Med 75 (54 – 107)		BP: Median 8 (IQR 4 – 13) BN: Med 12 (6 – 25)		Other: L CS to Dx: BP: 33 (24 – 40) BN: 57 (40 – 90)	4.6 4.1 3.1 3.6 4.4 4.7	NHS (6)	Yes: 2-week wait for urgent referrals
60.	Devbhandari et al., 2007(78)	Prospective tracking study UK 2003 - 2005	Medical records		GPLCS interval Secondary Care interval	N 247 64% male 69% NSCLC 13% SCLC Stage IV 65% Stage I 13.8%	Median 1 (IQ 0-5)				Median 60 days (IQR 44 – 85)					4.1 4.6 4.8 3.3 (c) 1.6 4.7 1.18	NHS (6)	Yes: 2-week wait for urgent referrals
61.	Corner et al., 2005(79)	Exploratory retrospective study UK 2005	Patient interviews and medical records	to explore the pathway to diagnosis among a group of patients recently diagnosed with lung cancer.	Diagnostic interval	N 22 55% Male Median age 58 yrs 68% NSCLC 18% SCLC						Median 2 months (62 days), range 0.5 to 8 months (16 - 248 days)				1.0 1.15 1.16		
62.	Comber et al., 2005(80)	Exploratory study 1999 Ireland	Medical records	to test if there were significant differences in waiting times between health board administrative areas for four common cancers	GP LCS interval Secondary Care interval Other: LCS to Rx	NONE AVAILABLE	Median 1 (IQR 3 – 17)				Median 54 (IQR 28 – 100)				LCS to Rx Median 40 (IQR 17 – 85)	1.10		
63.	Campbell et al., 2002(81)	Historical cohort study 1995 – 1996 Scotland	Cancer registry and medical records	To explore if variations in time to treatment of colorectal and lung cancer with socio-economic deprivation and urban/rural residence	Secondary Care	N 661 62% male 63% NSCLC 14% SCLC					Median 34 days					1.18 (b) 1.0 2.0	NHS (6)	
64.	Bozcuk et al., 2001(82)	Retrospective review 1998, UK	Medical records	To analyse survival in relation both to time to treatment (hospital delay) and other known prognosticators, in a cohort of NSCLC patients	GPLCS interval Secondary Care	N 189 100% NSCLC 71% male 31% Stage IV 12%Stage I Age 70 yrs	Median 11 days				Median 48 days					1.15 3.7 3.1		
65.	Bjerager et al., 2006(83)	Population based observational case series Denmark, 2003	Telephone interviews with GPs and patients	To explore diagnostic delay in primary health care among patients with lung cancer	Primary Care interval Doctor Interval (Doctor delay + system delay)	N = 84 Median age 66 years 64% male		Median = 11 days + median 14 days		Median 33 days (IQI 12–68).	.				Where the GP's first action did not lead to a diagnosis = 45-day median delay (IQI 28–111)	4.2 (a) 4.1 3.4 4.4 2.4 4.3 2.1 1.10 2.12	None specified	No
66.	Baughan et al., 2009(84)	Scotland 2005 - 2008	Primary Care audit of cancer referrals	to gain a better understanding of how quickly patients with cancer initially present to their GP, and how they are then referred to Secondary Care for further investigation and treatment.	PCI	N 981				Median 11 days (IQR 28)						5.3 2.3 2.5 (a) 1.15	NHS (85) and Scottish SEHD(86) for SCI.	
67.	Barrett et al., 2008(87)	Retrospective case control study UK, 1998 - 2002	Medical records	To map pathways from first symptom to diagnosis	Primary Care Diagnostic interval	N 246 70% male Mean age 72 years				Median 52 (IQR 7 – 243)		Median 121 (IQR 53 – 261)				3.1 3.7 5.3 2.3	NICE (88)	
68.	Aragoneses FG et al.,2002(89)	Retrospective study using prospectively registered data 1993 – 1997, Madrird Spain	Medical records in Bronchogenic Carcinoma Cooperative Group of the Spanish Society of Pneumology	To analyse the effect of therapeutic delay on the survival of patients with clinical stage I and II NSCLC carcinoma, who underwent surgical intervention.	Treatment interval	1082 patients Median age 65 yrs Stage I 61%							Median 35 days (1–154)			3.3(a) 1.9 4.7 4.8 5.6	CHART steering committee (90): the sum of the diagnostic and therapeutic delay should not exceed 6–8 weeks.	No

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							GP-LCS interval	Doctor Interval	System Interval	PCI	SCI	Diagnostic Interval	Treatment Interval	Total interval	Other relevant intervals / findings			
			and Thoracic Surgery (GCCB-S) registry,															
69.	Alsamarai et al.,2013(91)	Retrospective cohort analysis Veteran Affairs Connecticut Healthcare System USA, 2005 – 2010 Before CCCP: 2005 – 2007 After CCCP: 2007 - 2010	Medical records	Compare timeliness and stage at diagnosis before and after implementation of Cancer Care Coordination Program (CCCP)	System Interval Treatment Interval	352 patients total <u>Before CCCP:</u> N 163 99% male Average age 69 years Stage I 23% Stage IV 37% <u>After CCCP:</u> N 189 95% male Average age 69 years Stage I 41% Stage IV 30%			Median 78 days (range 1 – 757) Mean before:126 Mean after: 101				Median 28 days (0 – 265) Mean 40 for all Mean before: 46 Mean after: 43		Image to Diagnosis: median 37d (range 0 – 757) Mean before: 76 Mean after: 53	1.10 (a) 1.10 (b) 1.15 1.13 1.4 (a) 5.5 5.6 5.1 3.3 (a)	RAND cooperation	CCCP resulted in significantly reducing disparities in Treatment Intervals for white vs non-white and substance abusers vs non-abusers
70.	Guldbrandt et al., 2015(92)	Cluster randomised, controlled, two-arm (1:1) unblended trial Aarhus, Denmark 2011 - 2013	National registries and GP questionnaires	to evaluate the effect of direct access to low-dose computed tomography (LDCT) from general practice in early lung cancer detection on time to diagnosis and stage at diagnosis.	Primary Care interval Diagnostic interval	N = 331 47.4% male 52.6% female Mean age 69.6 years 58.6% Stage IIIB/IV				Median 16 days (IQI 4–56)		Median 39 days (IQI 17 – 93)				2.3 2.4 4.5 4.2 (a) 5.6		Direct access to fast low-dose chest CT combined with specific training
71.	Guldbrandt et al., 2015(93)	National registry-based cohort study Aarhus, Denmark, 2010	National registries and GP questionnaires	Describe the routes to diagnosis, the diagnostic activity preceding diagnosis and the diagnostic intervals for lung cancer	Primary Care interval Diagnostic interval	N 971				Median 7 days (IQI 0–30)		Median 29 days (IQI 12–69)				1.1 1.2 (a) 2.4 2.3 5.6 1.13 1.15		Yes: fast-track system for suspected lung cancder patients to be dse within 3 days
72.	Verma et al., 2015(94)	Retrospective review 2012 – 2014 Singapore		To assess timeliness of lung cancer management, and causes for delays.	System interval Diagnostic interval Total interval Doctor Interval	N 202 13% SCLC 60% NSCLC		Median 13 (range 1 – 399)	Mean 56 (6 – 192)				Median 35 (1 – 150)	Median 74 (range 2 – 438)		2.1 1.11 4.2 1.20 1.10 4.8 3.3 (a) 4.4 1.17 (a) 1.2 (a) 1.7 (b) 3.3 (c) 4.7 1.19 (b) 4.5 4.6 3.7 3.6 5.6 1.13 1.15	Yes: NHS(6) , RAND (26), Swedish Lung Cancer Registry (35)and Danish quality indicators: if System Interval <60 days. 36% waited > 8 weeks target System Interval	
73.	Annakkaya et al., 2007(95)	Peospective tracking study Turkey 2002 - 2005	Medical records and patient interviews	to evaluate the impact of the delayed diagnosis of lung cancer on tumor stage and patient survival and to compare the results with those of	Diagnostic interval Treatment interval	N 103 63 years 93% male 76% NSCLC 26% SCLC 40% StIV						Median 10 days	Median 12 days			1.15 1.1 1.13 5.6 1.17 (a) 1.10	No	No

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							GP-LCS interval	Doctor Interval	System Interval	PCI	SCI	Diagnostic Interval	Treatment Interval	Total interval	Other relevant intervals / findings			
				previous studies.														
74.	Bardell et al., 2006(96)	Retrospective study Denmark, 1994 - 1995	Medical records	to study the correlation between diagnostic delay and the stage of the lung cancer at the time of operation.	Total interval	N 172 65% male								Median 60 days (IQR 28 – 620)		1.0 1.15 1.13 2.2	No	No
75.	Diaconescu et al., 2011(97)	Retrospective analysis Canada	Cancer registry / tumour board and patient charts 2005 – 2007	To evaluating several prognostic factors, including treatment delays in lung cancer	System Interval	N 480 85% NSCLC 15% SCLC			Median 62 (IQR 30 – 108)							1.13 3.4 4.1 3.1 4.6 4.7 4.8		
76.	Dische et al., 1996(90)	Prospective study 10 UK and 3 non-UK centres 1993 - 1994		to determine the interval between first report ofsymptoms and first radiotherapy treatment in patients with NSCLC	Treatment interval Other: First GP visit to First LCS LCS to Dx LCS to Rx	524 patients 74% male 80% Stage IV 100% NSCLC							Median 5 weeks (35 days)(IQR 21days – 63 days)		LCS to Dx: median 21 days (7 to 42 days) LCS to Rx = median 7 days (7 to 21 days) Median first GP visit to First LCS = 4 weeks (IQR 1 – 9 weeks)	3.3 (d)	Yes: 25% > 9 weeks between GP to LCS Standard Medical Advisory CommitteeWorking Group for GP to Rx (total interval) = max 6-8 weeks	
77.	Dransfield et al., 2006(98)	Retrospective review Birmingham Veterans Affairs Medical Center (BVAMC), Alabama, USA1999 - 2003	Electronic medical records	To explore if the resection rate at the Birmingham VA Medical Center would be comparable with US benchmarks since the introduction of a specialized Lung Mass Clinic. We also sought to identify the medical and nonmedical factors that influenced the use of surgery.	Other: LCS to Dx LCS to Rx	N 156 total N Resected 31 Mean age 64.8, 97% male N non resected 125 Mean age 66.8, 74% male 87% NSCLC 10% St IIIA									Median LCS to Dx for resected=70 For non-resected = 8 Median LCS to Rx in resected = 104 days	4.7 5.6 4.8 1.15	Yes: Median exceeded Total Interval is recommended to be 4- to 8-week period recommended by the American College of Chest Physicians (44) and the British Thoracic Society (2)	Yes: a specialized Lung Mass Clinic was established to provide rapid evaluation and triage of possible lung cancer cases.
78.	Faris et al., 2015(99)	Retrospective review USA 2009 - 2013	Hospital and clinical records	To examine baseline preoperative evaluation of suspected lung cancer patients to inform a quality improvement project	System interval Treatment interval	N 614 Mean age 66 yrs 52% male 7% Stage IV 56% Stage I			Median 84 days (IQR 43 – 189)				Median 40 days (IQR 26 – 69)			5.10 3.3 (a) 4.4 4.1	No	No
79.	Brocken et al., 2012(100)	Retrospective study in a university hospital The Netherlands 1999 - 2009	Medical records	To compare various delays in a rapid outpatient diagnostic program (RODP) (including PET-CT) for suspected lung cancer patients with those described in literature and with guideline recommendations, to investigate the effects of referral route and symptoms on delays, and to establish whether delays were related to disease stage and outcome.	GP LCS interval Primary Care delay Secondary Care Delay Treatment interval Other: LCS to Dx	N 280 Mean age 66 yrs 67% male 90% NSCLC 9% SCLC	Median 7 (IQR 5-9)			18 (6 – 46)	36 (26 – 46)		19 (6.5 – 27)		LCS to Dx: 2 (1 – 17.5)	1.13 5.6 3.3 (a) 3.3 (e) 4.6 4.7 4.5	Median GPLCS interval within BTS(2), RAND(26), ACCP(44) but falls short of Dutch guidelines (101): 80% less than diagnostic +treatment interval target 35 days	Yes: rapid outpatient diagnostic program (RODP) for suspected lung cancer patients
80.	Johnston et al., 2004(102)	Registry chart review Nova Scotia, Canada 1992 - 2000	Oncology Patient Information System (OPIS), 1996 electronic national census data file and a postal code conversion file	To study the wait times for cancer patients undergoing radiotherapy	Treatment interval Other: LCS to Rx	N 2725 62% male 36% St IV							Median 42 days / 6 weeks (IQR 28 – 77d)		Median LCS to Rx 14 days / 6 weeks (IQR 7 – 28d)	1.18 (b) 1.13 3.12 3.3 (c) 3.3 (d)	CARO (103)	
81.	Jones et al., 1992(104)	Retrospective chart review	Medical records	To identify a large number of people who had a history	Primary Care interval	N 59	Median 7 days (range 0 – 80)			31 (0 – 713)	37 (2 – 707)			70 (12 – 835)	Other: LCS to Rx 13 (2 – 704)	2.3		

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							GP-LCS interval	Doctor Interval	System Interval	PCI	SCI	Diagnostic Interval	Treatment Interval	Total interval	Other relevant intervals / findings			
		4 districts in Devon, UK 1986 - 1990		of one of six common types of cancer and to determine the times taken from a patient's first presentation at the general practitioner with a symptom or sign of the disease to the start of treatment at the hospital	GP LCS interval Secondary Care interval Total interval Other: LCS to Rx													
82.	Kesson et al., 1998(105)	Retrospective review Glasgow, UK 1991 - 1992	Case notes and cancer registry	To determine local practice and identify resources utilized by this significant group of patients.	Other: LCS to Rx	N 262 66% male 79% NSCLC									Median LCS to Rx 63 days	3.7 3.3 (c) 4.8 4.1 3.3 (a) 5.5		
83.	Knorst et al., 2003(106)	Prospective study Sao Paulo, Brazil 1990 – 1998	Medical records	To evaluate the time required for diagnosis and surgical treatment of lung cancer in a general university hospital	Treatment interval Diagnostic interval Other: LCS to Dx	N 69 NSCLC 96% 77% male Mean age 62 yrs						Median 18 (IQR 7 – 57)	Median 20 days (IQR 0 -36)		Median LCS to Dx 18 days	3.12 3.3 (a)	Whitehouse (56)45% < 15 days target LCS to Dx 30% < target treatment interval of 30 days	
84.	Laroche et al., 1998(107)	Prospective review District hospitals 1995, UK	Medical records	Time from presentation to definitive treatment and surgical resection rates in first year of implementation of a new "two-stop" multidisciplinary service	Other: LCS to Rx	N 209 patients Mean 69 years 62% male 10% SCLC 66% NSCLC 2% Stage IV									Median 35 days (range 7 – 81 days)	5.6		a "two stop" investigation and management service recently established at Papworth Hospital, the regional centre.
85.	Lee et al., 2002(108)	Retrospective audit Department of Thoracic Surgery at the Royal Brompton Hospital (RBH) UK 1997 - 1998	Medical records	To assess the delays in their care against BTS guidelines	Other LCS to Rx	N 90 Median age 65 57% male									Median LCS to Rx 80 days	3.3 (a) 5.6 5.3 3.2 1.0 1.15 1.11 5.7 (a) 2.7 4.5 3.4 2.3 2.2 5.9 5.6 3.7 2.5	BTS (2) – only 29% < 56 days for LCS to Rx	No
86.	Liberman et al., 2006(109)	Observational retrospective study Montreal, Canada 1993 - 2003	Clinical charts	To evaluate the length of various waiting times for surgery as well as their association with surgical stage in patients with	LCS to Rx Total interval Treatment interval Secondary interval	N 256 Stage I 56% Stage IV 9.4% 60% men Mean age 65 years					Median 38 days		Median 80 days	Median 109 days	LCS to Rx = median 82 days	3.3 (a) 4.1 3.7 3.4	BTS (2)	
87.	Loh et al., 2006(110)	Retrospective chart study 1996 – 2004, Malaysia	Clinical charts Two urban hospitals	To investigate patient and doctor-related delays in Malaysia	LCS to Rx	N 122 78% male 98% NSCLC									Median LCS to Rx = 34 days (IQR 18.6 to 74 days)	5.1 3.2 1.13 1.15		
88.	Lovgren et al., 2008(111)	Retrospective study One hospital, Sweden, 2003	Medical records	Explore relationships between lung cancer patients' symptoms triggering health care system (HCS) contact, demographic/clinical characteristics, and time spans in the care trajectory from first symptom(s) to treatment start.	GPLCS interval Primary Care interval Secondary Care interval Other: LCS to Dx LCS to Rx	N 314 49% male Mean age 69 yrs 11.5% SCLC 88% NSCLC St I 23% St IV 37%	Median 16 days (range 0 - 105)			Median 28 days (0 – 653)	Median 58 days				Median LCS to Dx = 9 days (0 – 573) Median LCS to Rx = 94 days	1.15 1.16 1.2 (a) 3.4	All median intervals exceed Swedish national recommendations (112): 27% patients within GPLCS target 7 days, 25 - 56% within LCS-Rx target 31 days	
89.	Porta et al., 1991(113)	Retrospective follow up study Barcelona Spain ?1990	Hospital based tumour registry	To assess the relationship between survival, tumour stage, and the interval from first documented symptom to diagnosis (SDI, or duration of symptoms).	Diagnostic interval	N 410 Mean Age 64 yrs 91.5% male 41% St IV						Median 62 days (IQR 3.93)						

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							GP-LCS interval	Doctor Interval	System Interval	PCI	SCI	Diagnostic Interval	Treatment Interval	Total interval	Other relevant intervals / findings		
90.	Riedel et al., 2006(114)	Retrospective sequential single - institution (Veterans Affairs) cohort study MTOC: 1999 – 2002 Non-MTOC: 2002 - 2003 USA 1999 - 2003		To evaluate the impact of a multidisciplinary clinic on sequential cohorts of lung cancer patients evaluated during the operation of a multidisciplinary thoracic oncology clinic (MTOC) and a subsequent period when the MTOC did not exist.	Diagnostic interval Treatment interval Other: GP visit to first LCS LCS to Dx LCS to Rx (surgery)	MTOC sample: N 244 Median age 68 81% NSCLC 10% SCLC StIV 28% St I/II 42% Non-MTOC sample N 101 Median age 65 81% NSCLC 13% SCLC StIV 28% St I/II 36%						MTOC: Median 45 days Non-MTOC: Median 47 days	MTOC: Median 21 days Non-MTOC: Median 23 days		GP visit to LCS visit: MTOC: Med 25 d Non-MTOC: Med 22 d LCS to Dx: MTOC: Med 12 d Non-MTOC: Med 14 d LCS to Rx (surgery) LCS to Dx: MTOC: Med 50 d Non-MTOC: Med 40 d		BTS (2)	
91.	Saint-Jacques et al., 2008(115)	Retrospective review Nova Scotia, Canada 2005	Medical records	To examine wait times from suspicious imaging study (Detection) to surgery and then adjuvant chemotherapy for patients with early-stage non-small cell lung cancer (NSCLC) who undergo surgical resection.	System Interval (from first suspicious scan to first treatment – for this scoping review: first treatment = surgery) Other: LCS to Rx	N 107 56% male 75% NSCLC			Median 107 days (IQR – 73 – 141)						Median LCS to Rx 52 days (IQR 32 – 78)	Factors associate with delay to surgery (not adjuvant chemo): 1.8 3.3 (a) 3.7 1.10 3.5 3.2 1.5 (b) and (c)		
92.	Schultz et al., 2009(116)	Retrospective cross-sectional study 2002 – 2006 USA	Merged data from three sources: (i) a retrospective chart review conducted at 132VA medical centers (ii) an independent audit of VA oncology programs, and (iii) information collected from the VA website	To evaluate timeliness of lung cancer care and identify institutional characteristics associated with timely care within the Veterans Affairs (VA) health care system.	System interval Treatment interval Other: First suspicious scan to diagnosis	N 2033			Median 63 days (IQR 33 – 111, range 23 – 182)				Median 22 days (IQR 6 – 45) for all patient *(adherence in Table 1 was for VA patient, had med Tm tint of 22 from N 1910 pts)*		Median time from First suspicious scan to diagnosis = 33 days (IQR 13 – 70, range 9 - 146)	1.13 5.10 5.3 3.5 (c) and (d) 3.7 3.8 4.7 5.1	BTS(2), RAND(26) (Table 1): BTS – Scan to LCS 45% adherence LCS to Rx (surgery) 46% adherence RAND: Scan to Dx 69% adherence Treatment interval 63% adherence	
93.	Finlay et al., 2002 (117)	Retrospective case-control study USA 1992 - 1996	the New England Medical Center cancer center database.	To determine if Asian immigrants to the United States present with more advanced lung cancer compared to non-Asians	Treatment interval	Asians: N42 Age 71 yrs 79% male SCLC 9.5% NSCLC 88% Non-Asian SCLC 21% NSCLC 76% N 42 Age 71 79% male							Asians: 31 days Non-Asians 26 days			1,12		
94.	Shea et al., 2008(118)	Medicare data linkage study USA 2003 - 2006	5% representative Medicare claims	To compare patient wait times and travel distances for chemotherapy for common cancers (incl lung) before and after the enactment of the Medicare Prescription Drug, Improvement, and Modernization Act of 2003(MMA)	Treatment interval	2003 sample: N 1930 Latest / 2006 sample: N 1931							2003 sample: Median 21 days (IQR 9 -41) 2006 sample: Median 24 days (IQR 11 -47)			3.12 1.18 (a) 1.4 (a)		
95.	Shin et al., 2013(119)	Cohort study Korea 2006 – 2011	Korean Central Cancer Registry (KCCR).		Treatment interval	N 398 Mean age 63.5yrs St I/II 48% 80% male							Median 20 (range 1 – 302)			1.15 1.18 3.5 (a) 1.5 (a)	Bladder cancer guidelines: maximum wait time of 2–4 weeks to surgery: 29% < 4 weeks	
96.	Simunovic et al., 2001(120)	Ontario, Canada 1993-2000	Databases of the Canadian Institute for Health Information (CIHI) and the Ontario Health	To determine how long patients in Ontario waited for major breast, colorectal, lung or prostate cancer surgery	Other: LCS to Rx (surgery)	N 965									In 2000: Median 34 days	1.2 (a) 1.10	BTS(2)	

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							GP-LCS interval	Doctor Interval	System Interval	PCI	SCI	Diagnostic Interval	Treatment Interval	Total interval	Other relevant intervals / findings			
			Insurance Plan (OHIP)															
97.	Singh et al., 2010(121)	Retrospective cohort design Houston, USA 2004 - 2007	Integrated electronic medical health record	To identify characteristics and predictors of missed opportunities (failure to recognize a predefined clinical clue or failure to complete care procedure within 30 days) for earlier diagnosis of lung cancer.	Diagnostic interval	Missed opportunity (MO): N 222 Age 68 99% male Nil MO: N 365 Age 68 98% male						MO: Median 132 days (range 15 – 2445) Non-MO: (19, range 0 -870)				1.0 3.11 (a) 3.4 4.11 4.5 2.5 2.4 3.8 5.3		
98.	Spurgeon et al., 2000 (122)	Retrospective tracking study 1997 – 1998 UK	Hospital data	To investigate the delays that British cancer patients face, we undertook a retrospective survey of patients with newly diagnosed cancer	GPLCS Secondary Care	Unknown sample numbers for urgent vs non-urgent Total 767	Urgent:Median 7 days (IQR 3 – 13) Non-urgent: med 12 (7 – 22)				Urgent Median 39 days (IQR 21 – 61) Non-urgent 47 (28 – 77)					5.6	NHS (6)	Yes: Two week wait system
99.	Thapa et al., 2014(123)	Prospective cross sectional observational study Manmohan CardioThoracic Vascular and Transplant Center (MCVTC), Nepal 2011 - 2012		Identify the steps through which the patients passed before specialist care and also determine the time lost in each step.	Primary Care interval Other: GP visit to LCS	N 100 Mean age 63 yrs 64% male 93% NSCLC 1% St I 20% St IV 7% SCLC				50 days (range 1 – 372)					GP visit to LCS 7 days (range 1 – 20)	1.18 2.4 2.3 3.2 4.5		
100.	Van de Vosse et al., 2015(124)	Retrospective chart review study BC, Canada 2010 - 2011	Chart review of available electronic medical records accessed via Cancer Agency Information System (CAIS) software (BCCA-EMR).	Examine the time interval lung cancer patients from the interior of British Columbia (BC) experience while undergoing diagnostic evaluation, biopsy, staging, and preparation for treatment.	System Interval GPLCS Other: LCS to Dx LCS to Rx	N 231 77% NSCLC 29% Stage IV	Median 10 (IQR 5 – 18)		Median 65.5 (IQR 41.5 – 104.3)						Median LCS to Rx = 8 (1 – 15)	3.2 1.18 (b) 3.5 3.3 (a) 3.3 (d) 3.11 (a) 4.1 4.8 5.6 5.5		

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							GP-LCS interval	Doctor Interval	System Interval	PCI	SCI	Diagnostic Interval	Treatment Interval	Total interval	Other relevant intervals / findings		
101.	Rose et al., 2015(125)	Survey study by International Cancer Benchmarking Partnership—a collaboration across six countries (Australia, Canada, Denmark, Norway, Sweden, UK) 2012 - 2013	Online survey of GPs management of scenarios relating to the diagnosis of lung, colorectal or ovarian cancer	To GP behaviour and systems affecting timeliness of investigating for cancer and international survival differences.	GP-LCS interval Interval from GP request of CT/X-ray to result	N/A N of PCP responses = 2795 Relevant responses from GPs based in Canada (BC, Manitoba, Ontario) Europe (Denmark, Norway, Sweden) and UK (England, N.Ireland, Wales)	Range = 4.9 – 19.2 days (mean = 7.5)								Time from GP request of CT/X-ray to result was > 4 weeks in most jurisdictions and > 12 weeks in some	2.4 5.3 4.5 2.9 4.4	Nil specified	
102.	Wai et al., 2012(126)	Case control study British Colombia, 1990 - 2000	Medical records	To investigate if delays in care may decrease the curability of patients with stage III NSCLC.	Other: Scan to Dx Dx to LCS referral Dx to LCS visit LCS to Rx	2 unpaired samples: Radically treated (case) N 119 49% male Palliatively treated (control): N 238 53% male 100% Stage III									Median times for CASES: Scan to Dx = 27.5d Dx to LCS referral = 26d Dx to LCS visit = 31d LCS to Rx = 29d (IQR 18 – 56) CONTROLS: Scan to Dx = 21d Dx to LCS referral = 28d Dx to LCS visit = 31.5d LCS to Rx = 11d (IQR 4 – 26)	3.3 (c) 3.3 (d) 2.7 1.15 2.2 1.11 4.5 3.13 4.8		
103.	Yurdakul et al., 2015(127)	Prospective study Turkey 2010 - 2011	Patient interviews and clinical records	To investigate patient and doctor delays in NSCLC and factors affecting such delays	Total interval Treatment interval Other: GP visit to LCS visit LCS to Dx	N 1016 91% male Mean age 62 years							Mean 24.4 days		Other: Mean first GP visit to LCS visit 61.6 days LCS to Dx 20.4 days	3.7 1.13 1.1 1.18 (a) 1.19 4.10 4.8 4.1 1.24 4.6 3.12 3.1	BTS(2) and Canadian guidelines (36) Delay in GP visit to LCS visit > 2 weeks in 65.1% Delay in LCS to Dx > 2 weeks in 37.6% Delay in Treatment interval > 2 weeks in 42.8% Total Interval Delay > 6 weeks in 67.3%	
104.	Chandra et al., 2009(128)	Retrospective review New Delhi, India 2002 - 2008	Medical records	To determine the average time period required at various steps for diagnosing lung cancer from the onset of symptoms at a tertiary referral centre in Northern India	Treatment interval	N 165 84% male Age 57.6 years 86.7% NSCLC 13.3% SCLC 90% St III/IV							Median 20 days (range 1 – 380)			4.5 1.8 1.19 (b) 2.12 1.15 2.2 2.3 4.1 3.3 (b)	BTS, Canadian. Only 4% patients had treatment interval < 1 week but unsure what guideline recommends this.	
105.	Yilmaz et al., 2008(129)	Prospective study Turkey 2005 - 2006	Patient interviews and medical records	To investigate the delays from the first symptom to thoracotomy and to examine whether the delays cause the stage advancement in lung cancer	Treatment interval Total interval Other: First GP visit to first LCS visit LCS to Dx	N 138 96% male Mean age 58 yrs 2.1% St IV 100% NSCLC							Median 19 days	Median 56 days	Median LCS to Dx = 11 days Median First GP visit to first LCS visit = 20.5 days	2.7 3.3 (a) 4.1 3.7	BTS, Canadian All < 14 weeks according to study investigators 40% had GP-LCS < 14 d <u>but no median interval given</u> 64% had LCS-Dx < 14 d 30% had Treatment int <14d 26% Total interval < 6 weeks	
106.	Perez et al., 2008(130)	Cross sectional study	Medical records	To analyse factors impacting length of	Treatment interval	N 198 84% male							Median 39 days (IQR 17 – 66)			1.13 3.5	42% < 30 days	

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							GP-LCS interval	Doctor Interval	System Interval	PCI	SCI	Diagnostic Interval	Treatment Interval	Total interval	Other relevant intervals / findings			
		Catalonia Spain 2001 - 2002		treatment interval in six commonest cancers in Catalonia, Spain		50% St IV										3.7 3.12		

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							GP-LCS interval	Doctor Interval	System Interval	PCI	SCI	Diagnostic Interval	Treatment Interval	Total interval	Other relevant intervals / findings		
107.	Burmeister et al., 2010(131)	Retrospective analysis Queensland Australia, 2000 - 2004	Queensland Cancer Registry, clinical records, Clinical Pharmacy Oncology Management System, radiation therapy database, Data linkage	To determine whether lung cancer radiation therapy waiting times in Queensland public hospitals are associated with distance of residence from the nearest treatment facility	Treatment interval	N 1535 Age 69 yrs 71% male 91% NSCLC 6% SCLC							Median 33 days			1.13 1.17 (a) 3.3 (c)	Royal Australian and NewZealand College of Radiologists (RANZCR) guidelines for therapy and NHS: <50% met targets	
108.	Berthelet et al., 2006(132)	Retrospective review Quebec, Canada 1991 - 1999	Medical records at Vancouver Island Centre of the British Columbia Cancer Agency (BCCA).	To examine time intervals between diagnosis and treatment of limited stage small cell lung cancer (L-SCLC) and to evaluate its effect on clinical outcomes.	Other: Scan to Dx Dx to LCS LCS to Rx (CCXRT)	N 166 Med age 68 years 44% male 100% SCLC									Median LCS to Rx (CCXRT) 63.5 (range 2 – 272 Median Scan to Dx = 20 (0 – 160) Median Dx to LCS = 12 (-9 – 66)	1.13		
109.	Leprieur et al., 2012(133)	Retrospective review 2006 – 2008 France	Medical records	To describe delays In elderly patients with lung cancer	Total interval	N 193 Age 68.5 yrs 70% males Stage IV 60% SCLC 13% NSCLC 87% Gp 1: >70 yrs: N 92 66%male Median age 78yrs 13% SCLC 79% NSCLC Gp2 <70 yrs N 101 73%male Age 60 yrs 14% SCLC 82% NSCLC								Gp1: Median 34 days / 1.1 months (IQR 18 – 56) Gp 2:Median 34d/1.1mo (IQR 14 – 62)		1.10 4.1 4.8		
110.	Bilimoria et al., 2011(134)	Retrospective review USA 2003 - 2005	National Cancer database (NCDB)	(1) to determine whether treatment interval has increased over time; (2) to examine treatment intervals at National Cancer Institute (NCI) designated cancer centers, academic hospitals, Veterans' Affairs (VA) facilities, and community hospitals; and (3) to assess factors associated with longer times	Treatment interval	N 54,338 54% male Stage I 62% Med age 69 yrs							Median 35 days			3.5 1.2 (a) 1.13 1.4 (a)	43% treated within 30 days	
111.	Booth et al., 2013(135)	Population-based, retrospective cohort study Ontario, Canada 2004 - 2006	Ontario Cancer Registry (OCR)	Describe the association between time to adjuvant chemotherapy (TTAC) and survival in non–small cell lung cancer (NSCLC).	Treatment interval	N 1032 Mean age 62 50% male 5% St IV 20% St I							Median 35 days (range 0 – 161)					
112.	Cheung et al., 2011(136)	Populatio n based cohort study 1996 – 2000 Manitoba Canada	Manitoba cancer registry	To determine the wait times and healthcare costs around the time of non-small cell lung cancer (NSCLC) diagnosis for a large, population-based cohort of patients.	Diagnostic interval LCS to Dx	N 2852 57% male Mean age 72 yrs 40% St IV						Median 145 d (IQR 90 – 170)			Median LCS to Dx = 6 (1 – 20)	3.12 4.1 1.13 1.15		
113.	Collins et al., 2009(137)	Retrospective review Dublin 2006	Medical records St. James hospital	To evaluate trends in waiting times	GPLCS interval LCS to Dx Treatment interval	N 331	Median 5 (IQR 3 – 10)						Median 25 (IQR 5 – 22)		Median LCS to Dx = 5 (IQR 7 – 25)	3.3 (a) 4.8 3.12	NHS for GPLCS (TWW), SCI and Rx Int	
114.	Faris et al., 2015(99)	Retrospective review	Medical records	To examine presurgical	System interval	N 614 Age 66 yrs			Median 84 (IQR 43 –				Median 40 (IQR 26 – 69)			4.1 3.3 (a)		

#	BIBLIOMETRICS	STUDY DESIGN Region, Year	DATA SOURCE	AIMS	OUTCOME MEASURES OF INTEREST / DEFINITIONS	RESULTS: Patient Demographics	Time Intervals in lung cancer pathway by Olesen's definitions [1] or equivalent									SUGGESTED FACTORS RESPONSIBLE FOR DELAY	Guidelines applied on target times?	Involvement of Fast Track System?
							GP-LCS interval	Doctor Interval	System Interval	PCI	SCI	Diagnostic Interval	Treatment Interval	Total interval	Other relevant intervals / findings			
		2009 – 2013, USA		evaluation of lung cancer patients receiving surgery	Treatment interval	52% male St IV 7% St I 56%			189)									

#	BIBLIOMETRICS	STUDY DESIGN Region, Year	DATA SOURCE	AIMS	OUTCOME MEASURES OF INTEREST / DEFINITIONS	RESULTS: Patient Demographics	Time Intervals in lung cancer pathway by Olesen's definitions [1] or equivalent								SUGGESTED FACTORS RESPONSIBLE FOR DELAY	Guidelines applied on target times?	Involvement of Fast Track System?
							GP-LCS interval	Doctor Interval	System Interval	PCI	SCI	Diagnostic Interval	Treatment Interval	Total interval	Other relevant intervals / findings		
115.	Grunfeld et al., 2009 (138)	Prospective study Ottawa 2004 - 2005	Medical records, Chart abstraction and patient-completed questionnaires	To prospectively measure peri-diagnostic and surgical time intervals for patients with suspected colorectal, lung, or prostate cancer.	Treatment interval (Interval 5) Secondary Care interval (9) GPLCS (3)	N 81 Mean age 66 yrs 59% male	Median 11 (IQR 6 – 18)				Median 45 (35 – 64)		Median 16 (10 – 28)			1.15 1.10		
116.	Sood et al., 2009(139)	Retrospective review South Auckland, New Zealand, 2004	Hospital records	To determine the patient characteristics, referral patterns and delays in assessment and treatment of patients with primary lung cancer in South Auckland, New Zealand and compare with international standards.	GP LCS interval Other: LCS to Dx LCS to Rx (surgery)	N 80 60% Male 69%NSCLC 18% SCLC Median age 69 yrs	Median 18 days (IQR 13.5 – 21.5)								Median LCS to Dx = 11 (4 – 25) Median LCS to RX (surg) = 64d (no IQR)	3.12 1.13 1.15 4.5 3.2 4.10 5.6 3.3 (a) 3.3 (b) 3.3 (c)	BTS: 9% met GPLCS 16% met LCS to Rx (surg)	
117.	Stevens et al., 2008(140)	Retrospective review Auckland, Northland 2004	Medical records	To determine Secondary Care transit times for lung cancer patients, whether these times conformed to international guidelines and the major factors which influenced these times.	Secondary Care Treatment interval GPLCS Other: First ref to SC to Dx	N 565	Median 12				Median 64 (IQR 38 – 93)		Median 31 (IQR 15 - 33)		Median First ref to SC to Dx = 22 (IQR 11 – 42)	1.13 1.15 4.1 5.6 1.0 3.1 1.2 (a) 1.10 1.4 (a) 1.17 (a) 3.7 5.11 1.9 1.6 3.11 2.11 3.4	BTS: 38% within GPLCS 36% LCS -RadRT 56% LCS – PallXRT 40% LCS – chemo 60% LCS-Sx	
118.	Li et al., 2013(141)	Retrospective population level study Alberta Canada 2005	Alberta Cancer Registr	to assess time intervals in 3 common cancers across cancer sites to identify potentially important variation in the timeliness of cancer care	Treatment interval	N 785							Overall median 41 (Sx = 49, XRT = 35, Chemo = 52)			1.18 1.13 3.3 (b) 3.3 (c)		
119.	Allgar et al., 2005(142)	Retrospective archive study UK 1999 - 2000	Secondary Patient-reported data from the *National Survey of NHS Patients: Cancer*	Describe and compare the components of diagnostic delay (patient, Primary Care, referral, Secondary Care) for six types of cancer incl lung	GPLCS interval: "Q D3" from Box 1; but note patients who had a delay of more than 1 year not incl in analysis Other: LCS-Dx "Secondary Care" delay	N total 4011 1061 for GPLCS N for LCS to Dx = 812	Median 11 (5 – 56) Mean 34.8 (SD 51.4)								LCS to Dx = median 0 (IQR 0 – 7)	2.0		
120.	Rubin et al., 2015(143)	Retrospective study UK 2009 - 2010	English National Audit of Cancer Diagnosis in Primary Care,	To assess whether, in patients with symptoms suggestive of cancer, primary-care investigations are associated with less prompt referral	Primary Care interval	N 1494				Median 13 (IQR 3 – 39)						2.0 2.9 2.7 4.1 5.7 (a) 4.4 4.5 5.3		
121.	Gotfrit et al., 2016(144)	Retrospective study 2007 - 2012 Ottawa Canada	Single centre medical chart review	To study referral patterns of patients with advanced NSCLC who are admitted and referred to Medical Oncology	Treatment interval Secondary Care Other: LCS to Rx Referral to SC until Med Onc Dx to Med Onc	N 223 Median age 65 48% male90% St IV 100% NSCLC					Median 40 (range 7 – 272)		Median 43 (range 7 – 263)		LCS to Rx (chemo) = 31 (0 – 251) Median Referral to SC until Med Onc = 8 (range 0 -55) Dx to Med Onc = 10 (-10 – 126)	1.16 2.3 4.5 3.12 4.4 1.14 2.7 4.10		
122.	Ichinoche et al., 2006(145)	Retrospective review Shizuoka, Japan 1999 -2004	Clinician interviews and medical records	To study delays in treatment of Pancoast tumours	Total interval	N 48 88%male Median age 65.5 yrs								Mean 108.2 (range 14 – 349)		4.4 4.1 4.2 4.6 4.7 1.9 4.5 4.11 3.7		

#	BIBLIOMETRICS	STUDY DESIGN Region, Year	DATA SOURCE	AIMS	OUTCOME MEASURES OF INTEREST / DEFINITIONS	RESULTS: Patient Demographics	Time Intervals in lung cancer pathway by Olesen's definitions [1] or equivalent								SUGGESTED FACTORS RESPONSIBLE FOR DELAY	Guidelines applied on target times?	Involvement of Fast Track System?
							GP-LCS interval	Doctor Interval	System Interval	PCI	SCI	Diagnostic Interval	Treatment Interval	Total interval	Other relevant intervals / findings		
123.	Mackillop et., 1994(146)	Retrospective study Canada 1990	OCTRF database	To describe the waiting times to radiotherapy in Ontario	GPLCS interval Treatment interval Other: LCS to Rx (XRT)	N1 (high dose > 40Gy) = 2028 N2 (Low dose <40Gy) = 3245	Median for high dose group LCS to Rx (XRT) = ?7 Median for low dose group LCS to Rx (XRT) = ??7						Median high = 27.3 days Median low = 28.5		Median for high dose group LCS to Rx (XRT) = 20 Median for low dose group LCS to Rx (XRT) = 12?	2.7 3.3 (c)	Canadian Association of Radiation Oncologists: 2 weeks for GPLCS and LCS to Rx (XRT) (103) 80% met GPLCS 38% met LCS to Rx	
124.	Mackillop et al., 1995(147)	Survey study Canada and USA	Clinician interviews	To compared how long patients wait for radiotherapy in Canada and USA	GPLCS LCS to XRT SCI	N/A – results of clinician questionnaires	Canada: Median 11d USA: Median 3d				Canada: Median 34d USA: Median 9d				LCS to XRT: Canada: Median 21d USA: Median 6d	3.2 3.3 (c)		
125.	Kim et al., 2016(148)	Cancer registry study Alberta, Canada 2004 - 2011	Alberta cancer registry, billings and EMR	To quantify diagnostic and treatment delays in St I III (potentiallu curable) NSCLC in Alberta and factors associated with delays	Treatment interval System interval	N 3009 Age 69yrs 54% male St I 29% St III 69% 100% NSCLC			Median 78 d				Median 51d (to all forms)			3.3 (a) 1.25 1.15 3.6 4.7 5.5 5.1 5.9 1.18 (a) 4.5 4.1	BTS(2), Danish Lung Cancer Group(11), Alberta Thoracic Oncology Program Author identified delays as those exceeding medians but did not report % exceeding delays as a group.	
126.	Hunnibell et al., 2012(149)	Prospective tracking study DVA, USA 2007 - 2010	Medical records	To improve the timeliness of lung cancer care by filling the new position in 2007 of cancer care coordinator with an advanced practice nurse (APN) functioning as a nurse navigator	System interval Other: Scan to LCS	N for 2007 = 57 N for 2010 = 66 No other demogs given			Median 40 in 2007 Median 45 in 2010						Scan to Dx: Median 13 (n 37) in 2007 Median 10 (N 36) in 2010	5.5 4.5	No	Yes; nurse navigator
127.	Lal et al., 2011(150)	Retrospective comparative cohort study of patients referred to lung cancer clinics for investigation of suspicious imaging from 2006 2007. UK	Medical records	To assess the impact of a fast track CT pathway to select patients for lung cancer clinics on clinic efficiency, diagnostic and treatment delays, and patient satisfaction.	SCI Other: Referral to Decision to treat	Samples: N 2006 = 124 Mean age 66 yrs, 57% male N 2007 = 86 Mean age 68 yrs, 60% male					For 2006: median (IQR) = 55 (36) For 2007: 49 (36)				Other (Referral to decision to treat) For 2006: median (IQR) = 42 (30) For 2007: 35 (23)	5.6 4.2 (a) 4.5		
128.	Aasebo et al., 2011(151)	Retrospective study University Hospital of North Norway 2006 - 2009	Medical Records	To improve quality and shorten the workup time for patients with lung cancer using the Lean quality improvement process to improve patient flow	Treatment interval to surgery Other: scan to diagnosis CXR to CT	N before Lean in 2006 – 2008 = 40 N after Lean (2009) = 33							Median before lean for surgery/chemo/XRT = 26.5/6/5.5 Median to surgery in 14 eligible patients = 15 days		Median scan to diagnosis before lean = 64 Median after = 16 days Median CXR to CT before = 10 And after = 5.5	4.8 4.11 4.1	Study goal was that 85% of patients should have scan to Dx < 28 days…final result was that 82% had < 28d	

APPENDIX 3: Comparison of median time intervals (days) by region and local guidelines

Time Interval	Total number of studies reporting median (*N* / 128)	Median of median (days) [range of medians]	Median time intervals (days) by region Minimum – Maximum ¥ *[Number of studies]*							
			UK	Europe (excluding UK)	USA	Canada	Australia and New Zealand	Asia	South America	Africa
GP – LCS [1]	*28*	7 [0 - 33]	1 – 12 *[n=12]*	1 - 33 *[n=5]*	1– 5 *[n=3]*	4 – 17 *[n=4]*	0 – 18 *[n=4]*	-	-	-
Local maximum guideline timeframe (days)			7(2) - 14(6)	7(2) - 14(6)	1 (if 'urgent')(152)	n/a	14(153)	n/a		
Doctor [2]	*5*	15 [0 – 71]	-	0 – 24 *[n=2]*	15 - 71 *[n=2]*	-	-	13 *[n=1]*	-	-
Local guideline timeframe target (days)			n/a	28(154)	n/a					
Primary Care [3]	*17*	16 [7 – 52]	11 – 52 *[n=4]*	7 – 33 *[n=7]*	9.5 – 14 *[n=2]*	27 *[n=1]*	8.4 - 9 *[n=2]*	50 *[n=1]*	-	-
Local maximum guideline timeframe (days)			n/a							

Time Interval	Total number of studies reporting median (*N* / 128)	Median of median (days) [range of medians]	Median time intervals (days) by region Minimum – Maximum [¥] *[Number of studies]*							
			UK	Europe (excluding UK)	USA	Canada	Australia and New Zealand	Asia	South America	Africa
Secondary Care[4]	*22*	41 [9 – 75]	34 – 75 [*n=10*]	29 – 58 *[n=4]*	9 – 59 *[n=3]*	34 – 45 *[n=3]*	53 – 64 *[n=2]*	-	-	-
Local maximum guideline timeframe (days)			49(155) - 62(6, 86)	42 in 85% patients(11)	n/a		42(153)	n/a		
Diagnostic[5]	*21*	47 [8 – 187]	35 – 121 *[n=6]*	8 – 62 *[n=7]*	19 – 187 *[n=5]*	145 *[n=1]*	19 - 20 *[n=1]*	-	18 *[n=1]*	-
Local maximum guideline timeframe (days)			n/a			28(36)	n/a			
Treatment[6]	*46*	27 [6 – 80]	8 – 35 *[n=4]*	6 – 39 *[n=12]*	15 – 57 *[n=13]*	16 – 80 *[n=10]*	30 – 33 *[n=3]*	20 – 25 *[n=3]*	20 *[n=1]*	-
Local maximum guideline timeframe (days)			14(6)- 42(6, 26, 155)	14(11, 35, 112) - 42(101, 154)	n/a	14 until surgery(36)	14(10)	n/a		
System[7]	*9*	66 [36.5 – 107]	-	62 – 69 *[n=2]*	36.5 – 84 *[n=5]*	65.5 – 107 *[n=2]*	-	-	-	-
Local maximum guideline timeframe (days)			98(26)	14(154) - 42(35, 112)	n/a					

Time Interval	Total number of studies reporting median (*N* / 128)	Median of median (days) [range of medians]	Median time intervals (days) by region Minimum – Maximum ¥ *[Number of studies]*							
			UK	Europe (excluding UK)	USA	Canada	Australia and New Zealand	Asia	South America	Africa
Total [8]	*14*	54 [21 – 109]	21 – 70 *[n=2]*	30 – 108 *[n=7]*	50 – 52 *[n=2]*	51 – 109 *[n=2]*	-	74 *[n=1]*	-	-
Local maximum guideline timeframe (days)			56 days to surgery(56)							
Other: LCS to Diagnosis [9]	*27*	15 [0 – 70]	0 – 57 *[n=9]*	2 – 21 *[n=8]*	8 – 70 *[n=4]*	6 – 21 *[n=2]*	7 – 20 *[n=3]*	-	18 *[n=1]*	-
Local maximum guideline timeframe (days)			17(6, 156)	21(101) – 28 days for 80% patients(35, 112)	n/a					
Other: LCS to Treatment [10]	*30*	34 [6 – 104]	13 – 94 *[n=7]*	25 – 94 *[n=4]*	6 – 104 *[n=4]*	7 – 82 *[n=13]*	64 *[n=1]*	34 *[n=1]*	-	-
Local maximum guideline timeframe (days)			2/14/28 and 56 days to urgent/ palliative / definitive radiation therapy and	35(101)						

Time Interval	Total number of studies reporting median (*N* / 128)	Median of median (days) [range of medians]	Median time intervals (days) by region Minimum – Maximum ¥ *[Number of studies]*							
			UK	Europe (excluding UK)	USA	Canada	Australia and New Zealand	Asia	South America	Africa
			thoracotomy, respectively (2, 48)							

¥Or median time interval reported when only one available study. [1] GP-LCS interval: GP referral to Secondary Care to first LCS appointment; [2] Doctor interval: First presentation to first suspicious investigation result; [3] Primary Care interval: First presentation to first GP referral to Secondary Care; [4] Secondary Care interval: First GP referral to Secondary Care to treatment commencement; [5] Diagnostic interval: First presentation to confirmed diagnosis; [6] Treatment interval: Confirmed diagnosis to treatment start; [7] System interval: First suspicious investigation result to treatment commencement; [8] Total interval: First presentation to treatment commencement; [9] LCS to Diagnosis interval: first LCS appointment to confirmed diagnosis;[10] LCS to Treatment interval: first LCS appointment to treatment commencement.
ABBREVIATIONS: GP: General Practitioner; LCS: Lung Cancer Specialist; UK: United Kingdom, USA: United States of America; n/a: not available

APPENDIX 4: General Practitioner to Lung Cancer Specialist intervals and adherence with timeframes

Study	Sample size for interval	Year(s) conducted	Region	Median GP-LCS interval (days)*	IQR	% Patients within recommended timeframe	Origin of timeframe; maximum wait (days)
Sood et al.(139)	33	2004	New Zealand	18	13.5 – 21.5	9	BTS(2); ≤ 7
Lovgren et al.(111)	308	2003	Sweden	16	-	27	SLCG(112); ≤ 7 days
Stevens et al.(157)	160	2004	New Zealand	12	0 - 30	38	BTS(2); ≤ 7
Neal et al.(52)	313	2000 - 2001	United Kingdom	10	4 - 17	57	NHS(6); ≤ 14
Forrest et al.(156)	14507	2006 - 2010	United Kingdom	10	6 - 17	70	NHS(6); ≤ 14
Rolke et al.(158)	463	2005 - 2007	Norway	1	0 - 7	71	BTS(2), SLCG(35); ≤ 7
Mackillop et al. (146)	2028	1990	Canada	7	-	80	CARO(103); ≤ 14
Neal et al.(52)	96	2000 - 2001	United Kingdom	10	6 - 13	89	NHS(6); ≤ 14

ABBREVIATIONS: GP: General Practitioner; LCS: Lung Cancer Specialist; IQR: Interquartile Range; BTS: British Thoracic Society; SLCG: Swedish Lung Cancer Group; NHS: National Health Service; CARO: Canadian Association of Radiation Oncologists.
*unless stated otherwise

APPENDIX 5: Treatment intervals and adherence with timeframes

Study		Sample size for interval	Year(s) conducted	Region	Median Treatment interval (days)*	IQR*	Treatment modality	% Patients within recommended timeframe	Origin of timeframe; maximum wait (days)
Melling et al.(57)		148	1993	United Kingdom	28	-	All	23	SIGN(49), SMAC(56); ≤ 56
Shin et al.(119)		398	2006 – 2011	Korea	20	Range 1 – 302	Surgery	29	Fradet et al.(159); between 14 – 28
Knorst et al.(106)		69	1990 – 1998	Brazil	20	0 – 36	Surgery	30	N/S; ≤ 30
Yilmaz et al.(129)		138	2005 – 2006	Turkey	19	-	Surgery	30	BTS(2), Canadian(36); ≤ 14
Perez et al.(160)		198	2001 – 2002	Spain	39	17 – 66	All	42	N/S; ≤ 30
Bilimoria et al.(134)		54,338	2003 – 2005	USA	35	• -	Surgery	43	N/S; ≤ 30
Forrest et al.(156)		14962	2006 - 2010	United Kingdom	35	21 - 55	All	43	NHS(6); ≤ 31
Largey et al.(9)		75	2013	Australia	Mean 30	-	All	45	VLCR(10), DLCG(11); ≤ 14
Sulu et al.(34)		101	2009	Turkey	21	-	All	43.6	SLCG(112), Canadian(36); ≤ 14
Salomaa et al.(39)		111	2005	Finland	15	-	All	49	SLCG(112); ≤ 14
Brocken		215	1999 -	Netherlands	19	6.5 –	All	52.5	BTS(2),Dutch(161);

et al.(100)			2009			27			≤ 14
Yerdakul et al.(127)		750	2010 – 2011	Turkey	Mean 24		All	57	BTS(2), Canadian(36); ≤ 14
Gomez et al.(70)		10,554	2004 - 2007	USA	27	-	All	63	USA(71); ≤ 35
Schultz et al.(116)		1910	2002 – 2006	USA	27	10 – 48	All	63	RAND(26); ≤ 42
Akash et al.(94)		139	2012 - 2014	Singapore	35	Range 1 - 150	All	(1)25 (2) 51 (3)71	(1) SLCG(112); ≤ 14 (2) NHS(6); ≤ 31 (3) RAND(26); ≤ 42
Vidaver et al.(30)		227	2012 - 2014	USA	15	0 - 180	All	79	BTS(2)≤ 56 for surgical patients , RAND(26); ≤ 42

*unless specified otherwise

ABBREVIATIONS: IQR: Interquartile Range; SIGN: Scottish Intercollegiate Guidelines Network; SMAC: Standing Medical Advisory Committee; BTS: British Thoracic Society; NHS: National Health Service; VLCR: Victorian Lung Cancer Registry; DLCR: Danish Lung Cancer Registry; SLCG: Swedish Lung Cancer Group; USA: United States of America; RAND: Research and Development; N/S: Not Specified.

APPENDIX 6: Coding System of factors implicated in inappropriate delays

	1. Patient factors	2. Primary Care	3. Secondary Care	4. Diagnostic tests	5. Other
1	1.1 Lower educational level a. Elementary school	2.1 Lack of follow up appointments made	3.1 Delays in Secondary Care as a whole / resources	4.1 Waiting times	5.1 Lack of centralised secondary / tertiary care facilities
2	1.2 Age a. Older b. Younger	2.2 A defeatist attitude preventing referral	3.2 Limited access to specialists	4.2 High false negative rates with investigation	5.2 Lack of communication between ED and Primary Care provider
3	1.3 Insurance type a. No health insurance b. Private health insurance c. National Medicare or local equivalent d. Regional/county insurance	2.3 Index of suspicion not high enough to meet threshold for referral for diagnostic testing / Secondary Care	3.3 Delays in treatment appointment a. Surgery b. Chemotherapy c. Radiotherapy d. Chemoradiation e. Palliative service	4.3 Delay in return of results	5.3 No regulated referral system between primary and secondary/tertiary care
4	1.4 Race a. Non-white	2.4 Poor awareness of symptoms of high PPV	3.4 Hospital type a. Public b. Private c. Teaching d. Non-academic hospital	4.4 Access to investigations of high diagnostic yield	5.4 Introduction of regulated referral system between primary and secondary/tertiary care
5	1.5 Household income / socioeconomic position (SEP) a. Low b. Middle c. High	2.5 Lack of communication/information with Secondary Care providers	3.5 Referral to surgeon for opinion on operability	4.5 Multiple attempts (at invasive procedures) to establish diagnosis or operability of patient	5.5 Lack of a cancer care co-ordinator
6	1.6 Missing / declining / delaying follow up appointments	2.6 Delay in referral to Secondary Care	3.6 Need for multiple specialists' consultations	4.6 Delay to staging	5.6 Lack of rapid / multidisciplinary assessment clinic
7	1.7 Gender a. female b. male	2.7 Absence of Primary Care physician	3.7 Index of suspicion not high enough for further investigation	4.7 Delays in obtaining results of molecular studies	5.7 Higher number of visits prior to diagnosis

8	1.8 Medical comorbidities a. Chronic respiratory condition (asthma, COPD) b. Condition other than chronic respiratory	2.8 Lack of knowledge of efficiency of diagnostic tests	3.8 Lack of communication with Primary Care provider regarding results		5.8 Information overload on referral guidelines
9	1.9 Born overseas	2.9 Passive and/or unstructured history taking of potentially high risk patient	3.9 No protocol to follow up with patients regarding:		5.9 Referral guidelines not accessible
10	1.10 Early Stage	2.10 Delay due to PCP giving symptomatic treatment	3.10 Waiting time for hospital bed / longer time for outpatients		5.10 MDT involvement (i.e. opposite to 5.6)
11	1.11 Lack of symptoms (pt reported or clinically recognised) / "sicker quicker" / lack of high acuity presentation		3.11 Nihilism about treatment options		
12	1.12 Tumour type a. NSCLC				
13	1.13 Patient proximity to hospital a. Rural b. Non-rural				
14	1.14 Plausible alternative diagnosis				
15	1.15 Marital status a. Divorced / separated				
16	1.16 Area of profession a. Education				
17	1.17 "Physician shopping" delaying progress in diagnostic				

	workup / delayed treatment decision				
18	1.18 Advanced stage				

APPENDIX 7: Coding tally

	Frequency	Updated Valid Percent
1	8	1.1
1.1	24	3.3
1.10a	1	0.1
1.10b	1	0.1
1.10c	3	0.4
1.10d	1	0.1
1.11	8	1.1
1.11a	1	0.1
1.12	2	0.3
1.13	35	4.8
1.14	7	1.0
1.15	41	5.6
1.16	5	0.7
1.17a	8	1.1
1.18	4	0.5
1.18a	7	1.0
1.18b	5	0.7
1.19	1	0.1
1.19a	1	0.1
1.19b	4	0.5
1.1a	1	0.1
1.2	4	0.5
1.21	1	0.1
1.22a	1	0.1
1.23a	1	0.1
1.24	2	0.3
1.25	1	0.1
1.2a	15	2.0

	top 5	Freq	%
Lack of symptoms	1.15	41	5.6
Early stage	1.13	35	4.8
Lower educational level	1.1	24	3.3
Older age	1.2a	15	2.0
Deferring medical appointments	1.9	10	1.4
Low index of suspicion	2.3	27	3.7
Delay in referral to Secondary Care	2.7	17	2.3
Poor awareness of alarm symptoms	2.4	15	2.0
Delays in Primary Care as a whole	2	7	1.0
No follow up arranged by clinician	2.1	6	0.8
Delay to surgical treatment	3.3a	27	3.7
Multiple specialists consulted	3.7	23	3.1
Delays in Secondary Care as a whole	3.1	22	3.0
Delays to radiation therapy	3.3c	14	1.9
Waiting time to see LCS	3.4	13	1.8
Waiting time to diagnostics	4.1	41	5.6
Access to investigations of high diagnostic yield	4.5	24	3.3
Multiple attempts to establish diagnosis / operability	4.7	19	2.6
Delay in staging procedures	4.8	15	2.0
Delay in return of results	4.4	12	1.6
Lack of rapid / multidisciplinary assessment clinic	5.6	26	3.6
No regulated referral system	5.3	16	2.2
Lack of centralised care	5.1	12	1.6
Lack of a cancer care co-ordinator	5.5	6	0.8
Referral guidelines not accessible	5.9	5	0.7

1.2b	2	0.3
1.3	2	0.3
1.3c	1	0.1
1.3d	1	0.1
1.4	1	0.1
1.4a	5	0.7
1.5a	5	0.7
1.5b	2	0.3
1.5c	1	0.1
1.6	8	1.1
1.6a	4	0.5
1.6b	2	0.3
1.7a	5	0.7
1.7b	3	0.4
1.8	5	0.7
1.9	10	1.4
2	7	1.0
2.1	6	0.8
2.11	5	0.7
2.12	4	0.5
2.2	5	0.7
2.3	27	3.7
2.4	15	2.0
2.5	4	0.5
2.5a	5	0.7
2.5b	1	0.1
2.6	1	0.1
2.7	17	2.3
2.8	4	0.5
2.9	3	0.4
3.1	22	3.0
3.10a	1	0.1

3.10b	1	0.1
3.11	1	0.1
3.11a	4	0.5
3.11b	1	0.1
3.12	11	1.5
3.13	1	0.1
3.2	12	1.6
3.2a	1	0.1
3.3	2	0.3
3.3a	27	3.7
3.3b	4	0.5
3.3c	14	1.9
3.3d	5	0.7
3.3e	1	0.1
3.4	13	1.8
3.5	6	0.8
3.5a	4	0.5
3.5c	1	0.1
3.5d	1	0.1
3.6	7	1.0
3.7	23	3.1
3.8	7	1.0
3.9	1	0.1
4.1	41	5.6
4.11	2	0.3
4.2	5	0.7
4.2a	4	0.5
4.3	1	0.1
4.4	12	1.6
4.5	24	3.3
4.6	9	1.2
4.7	19	2.6

4.8	15	2.0
4.9	1	0.1
5.1	12	1.6
5.11	1	0.1
5.2	1	0.1
5.3	16	2.2
5.4	2	0.3
5.5	6	0.8
5.6	26	3.5
5.7a	5	0.7
5.7b	1	0.1
5.9	5	0.7

Updated Total	733
Updated Cumulative Percent	100.0

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