Appendix A

Electronic database searches

Medline, IPA and PsychINFO

#	Searches	Results
1	((medic$ or drug$) adj2 discrepanc$).mp.	524
2	((medic$ or drug$) adj2 reconciliation$).mp.	1,193
3	((medic$ or drug$) adj2 histor$).mp.	75,175
4	((medic$ or drug$) adj2 list$).mp.	5, 023
5	(((medic$ adj2 chart$) or (medic$ adj2 record$)) adj2 assessment).mp.	125
6	((medic$ or drug$ or prescription$ or (medic$ adj2 chart$) or (medic$ adj2 record$)) adj2 review$).mp.	35,859
7	((medic$ or drug$) adj2 congruence$).mp.	20
8	((medic$ or drug$) adj2 management).mp.	37,424
9	1 or 2 or 3 or 4 or 5 or 6 or 7 or 8	151,309
10	patient admission.mp. or Patient Admission/	20,054
11	patient discharge.mp. or Patient Discharge/	21,100
12	patient transfer.mp. or Patient Transfer/	6,658
13	Hospitalization/ or hospital transfer.mp.	81,536
14	"Continuity of Patient Care"/ or care transition.mp.	15,531
15	inpatients.mp. or Inpatients/	58,575
16	seamless care.mp.	154
17	continuum of care.mp.	3,103
18	"Delivery of Health Care, Integrated"/ or integrated health care.mp.	10,066
19	10 or 11 or 12 or 13 or 14 or 15 or 16 or 17 or 18	199,032
20	pharmac*.mp.	905,186
21	9 and 19 and 20	1,144
22	limit 21 to (abstracts and english language and humans)	1009

CINHAL

#	Searches	Results
S18	S14 AND S15 AND S16 Limiters-Peer Reviewed; English Language; Abstract Available	267
S17	S14 AND S15 AND S16	396
S16	S7 OR S8 OR S9 OR S10 OR S11 OR S12 OR S13	306,305
S15	S1 OR S2 OR S3 OR S4 OR S5 OR S6	9,033
S14	"Pharmac*"	101,387
S13	(MH "Continuity of Patient Care+") OR "continu*"	187,044
S12	"seamless care"	104
S11	(MH "Inpatients")	55,914
S10	"emergency medic*"	29,880
S9	"transition of care"	143
S8	(MH "Transfer, Discharge")	3058
S7	(MH "Patient Admission") OR (MH "Hospitalization+") OR (MH "Patient Discharge+")	56,917
S6	"medication discrepancies"	45
S5	"medication discrepancy"	10
S4	"drug history"	122
S3	(MH "Medication Errors+")	8,626
S2	(MH "Medication History")	60
S1	(MH "Medication Reconciliation")	472

Embase

#	Searches	Results
24	#1.20 AND #1.21 AND #1.22 AND #1.23 [english]/lim AND [humans]/lim AND [abstracts]/lim	335
23	#1.15 OR #1.16 OR #1.17 OR #1.18 OR #1.19	375,805
22	#1.5 OR #1.6 OR #1.7 OR #1.8 OR #1.9 OR #1.10 OR #1.11 OR #1.12 OR #1.13 OR #1.14	454,467
21	#1.1 OR #1.2 OR #1.3 OR #1.4	4,019
20	pharmac*	3,875,936
19	'hospitalized patients'/exp OR 'hospitalized patients'	74,696
18	'inpatients'/exp OR 'inpatients'	108,750
17	'patient transfer'/exp OR 'patient transfer'	40,927
16	'patient discharge'/exp OR 'patient discharge'	96,003
15	'patient admission'/exp OR 'patient admission'	137,129

14	'medication'/exp OR medication AND record	179,120
13	'medication'/exp OR medication AND record AND systems	4,687
12	'medication'/exp OR medication AND record AND assessment	14,853
11	'medication'/exp OR medication AND record AND ('review'/exp OR review)	44,320
10	'medication'/exp OR medication AND chart AND ('review'/exp OR review)	9,372
9	medic* OR drug* AND list*	52,323
8	'medication'/exp OR medication AND ('history'/exp OR history)	91,985
7	'drug'/exp OR drug AND ('history'/exp OR history)	213,214
6	'drug'/exp OR drug AND ('history'/exp OR history) AND taking	9,182
5	'medication'/exp OR medication AND ('history'/exp OR history) AND taking	5389
4	'medication'/exp OR medication AND reconciliation AND errors	443
3	'medication'/exp OR medication AND ('history'/exp OR history) AND errors	570
2	'medication'/exp OR medication AND discrepancies	2464
1	'medication'/exp OR medication AND reconciliation	1453

PubMed

((((((medication reconciliation) OR medication discrepancies) OR medication history) OR ((medication AND (chart OR record) AND assessment)))) AND (((continuity of care) OR seamless care) OR ((hospital* OR inpatient* OR interface* OR discharge* OR admission*)))) AND pharmac***** [640]

Appendix B

List of excluded full text papers and of the reasons for their exclusion

No control group/ ineligible comparator

Boso ribelles et al (2011). "Evaluation of a plan for cardiology medication reconciliation on admission, and patient information at discharge, in a teaching hospital." EJHP Practice 17(1)

Anderegg, S. V., et al. (2013). "Acceptance of recommendations by inpatient pharmacy case managers: unintended consequences of hospitalist and specialist care." Pharmacotherapy:The Journal of Human Pharmacology & Drug Therapy **33**(1): 11-21.

Cornu, P., et al. (2012). "Effect of medication reconciliation at hospital admission on medication discrepancies during hospitalization and at discharge for geriatric patients." Annals of Pharmacotherapy **46**(4): 484-494.

Hellstrom, L. M., et al. (2012). "Errors in medication history at hospital admission: prevalence and predicting factors." BMC Clin Pharmacol **12**: 9.

Lessard, S., et al. (2006). "Medication discrepancies affecting senior patients at hospital admission." Am J Health Syst Pharm **63**(8): 740-743.

Mergenhagen, K. A., et al. (2012). "Pharmacist- versus physician-initiated admission medication reconciliation: impact on adverse drug events." American Journal of Geriatric Pharmacotherapy **10**(4): 242-250.

Midlov, P., et al. (2012). "The effect of medication reconciliation in elderly patients at hospital discharge." International Journal of Clinical Pharmacy **34**(1): 113-119.

Quennery, S., et al. (2011). "Added value of pharmacist-acquired drug histories in an orthopaedic ward." Acta Clinica Belgica **66**(3): 196-199.

Reeder, T. A. and A. Mutnick (2008). "Pharmacist- versus physician-obtained medication histories." American Journal of Health-System Pharmacy **65**(9): 857-860.

Not Pharmacist-led medication reconciliation

Lalonde, L., et al. (2008). "Effectiveness of a medication discharge plan for transitions of care from hospital to outpatient settings." American Journal of Health-System Pharmacy **65**(15): 1451-1457.

Midlov, P., et al. (2008). "Medication report reduces number of medication errors when elderly patients are discharged from hospital." Pharmacy World & Science **30**(1): 92-98.

Schnipper, J. L., et al. (2009). "Effect of an electronic Medication reconciliation application and process redesign on potential adverse drug events a cluster-randomized trial." Archives of Internal Medicine **169**(8): 771-780.

Showalter, J. W., et al. (2011). "Effect of standardized electronic discharge instructions on post-discharge hospital utilization." J Gen Intern Med **26**(7): 718-723.

Zoni, A. C., et al. (2012). "The impact of medication reconciliation program at admission in an internal medicine department." European Journal of Internal Medicine **23**(8): 696-700.

Study Protocol

Salanitro, A. H., et al. (2013). "Rationale and design of the Multicenter Medication Reconciliation Quality Improvement Study (MARQUIS)." BMC Health Serv Res **13**: 230.

Not English

Sanchez Ulayar, A., et al. (2012). "Pharmaceutical intervention upon hospital discharge to strengthen understanding and adherence to pharmacological treatment." Farm Hosp **36**(3): 118-123.

Medication reconciliation is not the primary intervention

Nester TM et al (2002).” Effectiveness of a pharmacist acquired medication history in promoting patient safety”. Am J Health-Syst Pharm 59:2221-25.

Lisby M et al (2010). “The effect of systematic medication review in elderly patients admitted to an acute ward of Internal Medicine”. Basic & Clinical Pharmacology & Toxicology 106: 422–427.

Edwards, S. J., et al. (2014). "Outcomes assessment of a pharmacist-directed seamless care program in an ambulatory oncology clinic." Journal of Pharmacy Practice **27**(1): 46-52.

Fera T, Anderson C, Kanel KT, Ramusivich DL. Role of a care transition pharmacist in a primary care resource center. Am J Health Syst Pharm. 2014;71(18):1585-90.

Hutchison LJ, Mayzell GG, Bailey SC, Broyles JE. Impact of a discharge medication therapy management program in an extended care hospital. Consult Pharm 2014;29(1):33-8.

Marotti, S. B., et al. (2011). "A randomised controlled trial of pharmacist medication histories and supplementary prescribing on medication errors in postoperative medications." Anaesthesia and Intensive Care **39**(6): 1064-1070.

Nazareth, I., et al. (2001). "A pharmacy discharge plan for hospitalized elderly patients--a randomized controlled trial." Age & Ageing **30**(1): 33-40.

Sarangarm, P., et al. (2013). "Impact of pharmacist discharge medication therapy counselling and disease state education: Pharmacist Assisting at Routine Medical Discharge (project PhARMD)." American Journal of Medical Quality **28**(4): 292-300.

Spinewine, A., et al. (2007). "Effect of a collaborative approach on the quality of prescribing for geriatric inpatients: a randomized, controlled trial." J Am Geriatr Soc **55**(5): 658-665.

Szkiladz, A., et al. (2013). "Impact of pharmacy student and resident-led discharge counselling on heart failure patients." Journal of Pharmacy Practice **26**(6): 574-579.

Taber, D. J., et al. (2013). "Improved patient safety and outcomes with a comprehensive interdisciplinary improvement initiative in kidney transplant recipients." Am J Med Qual **28**(2): 103-112.

Not hospital based

Stewart S et al (1998). "Effects of a home-based intervention among patients with congestive heart failure discharged from acute hospital care". Arch Intern Med 158:1067-1072.

Boockvar, K. S., et al. (2006). "Medication reconciliation for reducing drug-discrepancy adverse events." American Journal of Geriatric Pharmacotherapy **4**(3): 236-243.

Kilcup, M., et al. (2013). "Postdischarge pharmacist medication reconciliation: impact on readmission rates and financial savings." J Am Pharm Assoc (2003) **53**(1): 78-84.

Stewart, A. L. and K. J. Lynch (2014). "Medication discrepancies despite pharmacist led medication reconciliation: the challenges of maintaining an accurate medication list in primary care." Pharm Pract (Granada) **12**(1): 360.

Ineligible study design/procedure

Carter, M. K., et al. (2006). "Pharmacist-acquired medication histories in a university hospital emergency department." American Journal of Health-System Pharmacy **63**(24): 2500-2503.

Karapinar-Carkit, F., et al. (2009). "Effect of medication reconciliation with and without patient counselling on the number of pharmaceutical interventions among patients discharged from the hospital." Annals of Pharmacotherapy **43**(6): 1001-1010.

Musgrave, C. R., et al. (2013). "Improving transplant patient safety through pharmacist discharge medication reconciliation." American Journal of Transplantation **13**(3): 796-801.

Mudge AM, Shakhovskoy R, Karrasch A. Quality of transitions in older medical patients with frequent readmissions: opportunities for improvement. Eur J Intern Med. 2013;24(8):779-83.

Sen S, Siemianowski L, Murphy M, McAllister SC. Implementation of a pharmacy technician-centered medication reconciliation program at an urban teaching medical center. Am J Health Syst Pharm. 2014;71(1):51-6.

Stitt, D. M., et al. (2011). "Medication discrepancies identified at time of hospital discharge in a geriatric population." American Journal of Geriatric Pharmacotherapy **9**(4): 234-240.

Unroe, K. T., et al. (2010). "Inpatient medication reconciliation at admission and discharge: A retrospective cohort study of age and other risk factors for medication discrepancies." American Journal of Geriatric Pharmacotherapy **8**(2): 115-126.

Not medication reconciliation intervention

Eijsbroek, H., et al. (2013). "Medication issues experienced by patients and carers after discharge from the intensive care unit." J Crit Care **28**(1): 46-50.

Hohmann, C., et al. (2013). "Adherence to hospital discharge medication in patients with ischemic stroke: a prospective, interventional 2-phase study." Stroke **44**(2): 522-524.

Hohmann, C., et al. (2014). "Providing systematic detailed information on medication upon hospital discharge as an important step towards improved transitional care." Journal of Clinical Pharmacy & Therapeutics **39**(3): 286-291.

Romero, C. M., et al. (2013). "Effects of the implementation of a preventive interventions program on the reduction of medication errors in critically ill adult patients." Journal of Critical Care **28**(4): 451-460.

Not relevant clinical outcome

Smith L et al (1997). "An investigation of hospital generated pharmaceutical care when patients are discharged home from hospital". Br J Clin Pharmacol 1997; 44: 163–165.

Michels R et al (2003). "Programme using pharmacy technicians to obtain medication histories." American Journal of Health-System Pharmacy 60: 1982-86.

Alassaad, A., et al. (2013). "Prescription and transcription errors in multidose-dispensed medications on discharge from hospital: an observational and interventional study." J Eval Clin Pract **19**(1): 185-191.

Basey AJ, Krska J, Kennedy TD, Mackridge AJ. Prescribing errors on admission to hospital and their potential impact: A mixed-methods study. BMJ Quality and Safety. 2014;23(1):17-25.

Becerra-Camargo, J., et al. (2013). "A multicentre, double-blind, randomised, controlled, parallel-group study of the effectiveness of a pharmacist-acquired medication history in an emergency department." BMC Health Services Research 13: 337.

Beckett, R. D., et al. (2012). "Effectiveness and feasibility of pharmacist-led admission medication reconciliation for geriatric patients." Journal of Pharmacy Practice 25(2): 136-141.

Benson, J. M. and G. Snow (2012). "Impact of medication reconciliation on medication error rates in community hospital cardiac care units." Hospital Pharmacy **47**(12): 927-932.

Bergkvist, A., et al. (2009). "Improved quality in the hospital discharge summary reduces medication errors--LIMM: Landskrona Integrated Medicines Management." European Journal of Clinical Pharmacology **65**(10): 1037-1046.

Brownlie K, Schneider C, Culliford R, Fox C, Boukouvalas A, Willan C, Maidment ID. Medication reconciliation by a pharmacy technician in a mental health assessment unit. Int J Clin Pharm 2014;36(2):303-9.

Buckley MS, Harinstein LM, Clark KB, Smithburger PL, Eckhardt DJ, Alexander E, et al. Impact of a clinical pharmacy admission medication reconciliation program on medication errors in "high-risk" patients. The Annals of pharmacotherapy. 2013;47(12):1599-610.

Chan, E. W., et al. (2010). "An intervention to encourage ambulance paramedics to bring patients' own medications to the ED: impact on medications brought in and prescribing errors." Emerg Med Australas **22**(2): 151-158.

Conklin, J. R., et al. (2014). "Care Transitions Service: A pharmacy-driven program for medication reconciliation through the continuum of care." American Journal of Health-System Pharmacy: 802-810.

Eggink, R. N., et al. (2010). "The effect of a clinical pharmacist discharge service on medication discrepancies in patients with heart failure." Pharmacy World & Science 32(6): 759-766.

Farley, T. M., et al. (2014). "Effect of clinical pharmacist intervention on medication discrepancies following hospital discharge." International Journal of Clinical Pharmacy 36(2): 430-437.

Fertleman, M., et al. (2005). "Improving medication management for patients: The effect of a pharmacist on post-admission ward rounds." Quality and Safety in Health Care 14(3): 207-211.

Grant, R. W., et al. (2003). "Improving Adherence and Reducing Medication Discrepancies in Patients with Diabetes." Ann Pharmacother **37**(7): 962-969.

Grimes, T. C., et al. (2014). "Collaborative pharmaceutical care in an Irish hospital: Uncontrolled before-after study." BMJ Quality and Safety 23(7): 574-583.

Hale, A. R., et al. (2013). "Perioperative medication management: expanding the role of the preadmission clinic pharmacist in a single centre, randomised controlled trial of collaborative prescribing." BMJ Open **3**(7).

Hayes, B. D., et al. (2007). "Pharmacist-conducted medication reconciliation in an emergency department." American Journal of Health-System Pharmacy **64**(16): 1720-1723.

Hick, H. L., et al. (2001). "The impact of the pharmacist on an elective general surgery pre-admission clinic." Pharmacy World & Science **23**(2): 65-69.

Ho, P. M., et al. (2014). "Multifaceted intervention to improve medication adherence and secondary prevention measures after acute coronary syndrome hospital discharge: a randomized clinical trial." JAMA Intern Med **174**(2): 186-193.

Kripalani, S., et al. (2012). "Effect of a pharmacist intervention on clinically important medication errors after hospital discharge: a randomized trial." Annals of Internal Medicine 157(1): 1-10.

Kwan, Y., et al. (2007). "Pharmacist medication assessments in a surgical preadmission clinic." Archives of Internal Medicine 167(10): 1034-1040.

Nickerson, A., et al. (2005). "Drug-therapy problems, inconsistencies and omissions identified during a medication reconciliation and seamless care service." Healthcare Quarterly 8 Spec No: 65-72.

Nielsen TR, Andersen SE, Rasmussen M, Honore PH. Clinical pharmacist service in the acute ward. Int J Clin Pharm. 2013;35(6):1137-51.

Magalhães GF, Santos GB, Rosa MB, Noblat Ld A. Medication Reconciliation in Patients Hospitalized in a Cardiology Unit. PLoS ONE 2014; 9(12): e115491. doi: 10.1371/journal.pone.0115491.

Mortimer, C., et al. (2011). "The impact of an aged care pharmacist in a department of emergency medicine." J Eval Clin Pract **17**(3): 478-485.

Peyton, L., et al. (2010). "Evaluation of medication reconciliation in an ambulatory setting before and after pharmacist intervention." J Am Pharm Assoc (2003) **50**(4): 490-495.

Rahman, M. H., et al. (2005). "An evaluation of pharmacist-written hospital discharge prescriptions on general surgical wards." International Journal of Pharmacy Practice **13**(3): 179-185.

Tompson, A. J., et al. (2012). "Utilizing community pharmacy dispensing records to disclose errors in hospital admission drug charts." International Journal of Clinical Pharmacology & Therapeutics **50**(9): 639-646.

Van den Bemt, P. M., et al. (2009). "Medication reconciliation performed by pharmacy technicians at the time of preoperative screening." Ann Pharmacother 43(5): 868-874.

Van den Bemt, P. M., et al. (2013). "Effect of medication reconciliation on unintentional medication discrepancies in acute hospital admissions of elderly adults: a multicenter study." J Am Geriatr Soc 61(8): 1262-1268.

Vasileff, H. M., et al. (2009). "The effect on medication errors of pharmacists charting medication in an emergency department." Pharmacy World & Science 31(3): 373-379.

Leguelinel-Blache G, Arnaud F, Bouvet S, Dubois F, Castelli C,Roux-Marson C, Ray V, Sottoe A, Kinowski J. Impact of admission medication reconciliation performed by clinical pharmacists on medication safety. Eur J Intern Med 2014; 25(9):808-14.

Pharmacist is not the sole provider

Poole DL et al (2006). "Medication reconciliation: a necessity in promoting a safe hospital discharge." Journal for Healthcare Quality **28**(3):12-19.

Coffey M et al (2009). "Implementation of admission medication reconciliation at two academic Health Sciences Centres: challenges and success factors." Healthcare Quarterly 12 Special Issue 2009

Dedhia, P., et al. (2009). "A quality improvement intervention to facilitate the transition of older adults from three hospitals back to their homes." Journal of the American Geriatrics Society **57**(9): 1540-1546.

Duggan, C., et al. (1998). "Reducing adverse prescribing discrepancies following hospital discharge." International Journal of Pharmacy Practice **6**(Jun): 77-82.

Henneman, E. A., et al. (2014). "An evaluation of a collaborative, safety focused, nurse-pharmacist intervention for improving the accuracy of the medication history." J Patient Saf **10**(2): 88-94.

Jack, B. W., et al. (2009). "A reengineered hospital discharge program to decrease rehospitalisation: a randomized trial." Annals of Internal Medicine **150**(3): 178-187.

Nassaralla, C. L., et al. (2007). "Implementation of a medication reconciliation process in an ambulatory internal medicine clinic." Qual Saf Health Care **16**(2): 90-94.

Setter, S. M., et al. (2009). "Effectiveness of a pharmacist-nurse intervention on resolving medication discrepancies for patients transitioning from hospital to home health care." American Journal of Health-System Pharmacy **66**(22): 2027-2031.

Appendix C

Summary of risk of bias assessment*

Study reference	Randomization	Allocation concealment	Similarity of baseline characteristics	Similarity of baseline outcomes	Incomplete outcome data	Assessors blind to outcome	Absence of contamination	Selective outcome reporting	Free of other biases	Total†
Anderegg 2014	-	+	+	?	?	+	-	-	+	4
Bolas 2004	+	+	+	?	-	-	?	-	+	4
Eisenhower 2014	-	-	?	?	-	+	+	-	-	2
Farris 2014	+	+	+	?	+	+	-	+	+	7
Gardella 2012	-	-	?	?	?	+	+	+	-	3
Gillespie 2009	+	+	?	?	?	+	+	+	+	6
Hawes 2014	+	+	?	?	?	+	+	+	+	6
Hellstrom 2011	-	-	+	?	+	+	-	+	-	4
Hellstrom 2012	-	-	+	?	+	+	+	+	-	5
Koehler 2009	+	+	+	?	?	+	+	+	-	6
Pal 2013	-	-	+	?	+	+	-	+	-	4
Schnipper 2006	+	+	+	?	?	+	+	+	+	7
Scullin 2007	+	+	+	?	?	+	?	+	+	6
Stowasser 2002	+	?	+	+	+	+	+	-	+	8
Walker 2009	-	-	+	?	-	?	+	+	+	4
Warden 2014	-	-	+	?	?	+	+	+	+	5
Wilkinson 2011	-	-	?	?	?	-	?	+	-	1

Key: +, clear; -, not done; ?, unclear.

*EPOC risk of bias assessment; modified for non-controlled studies.

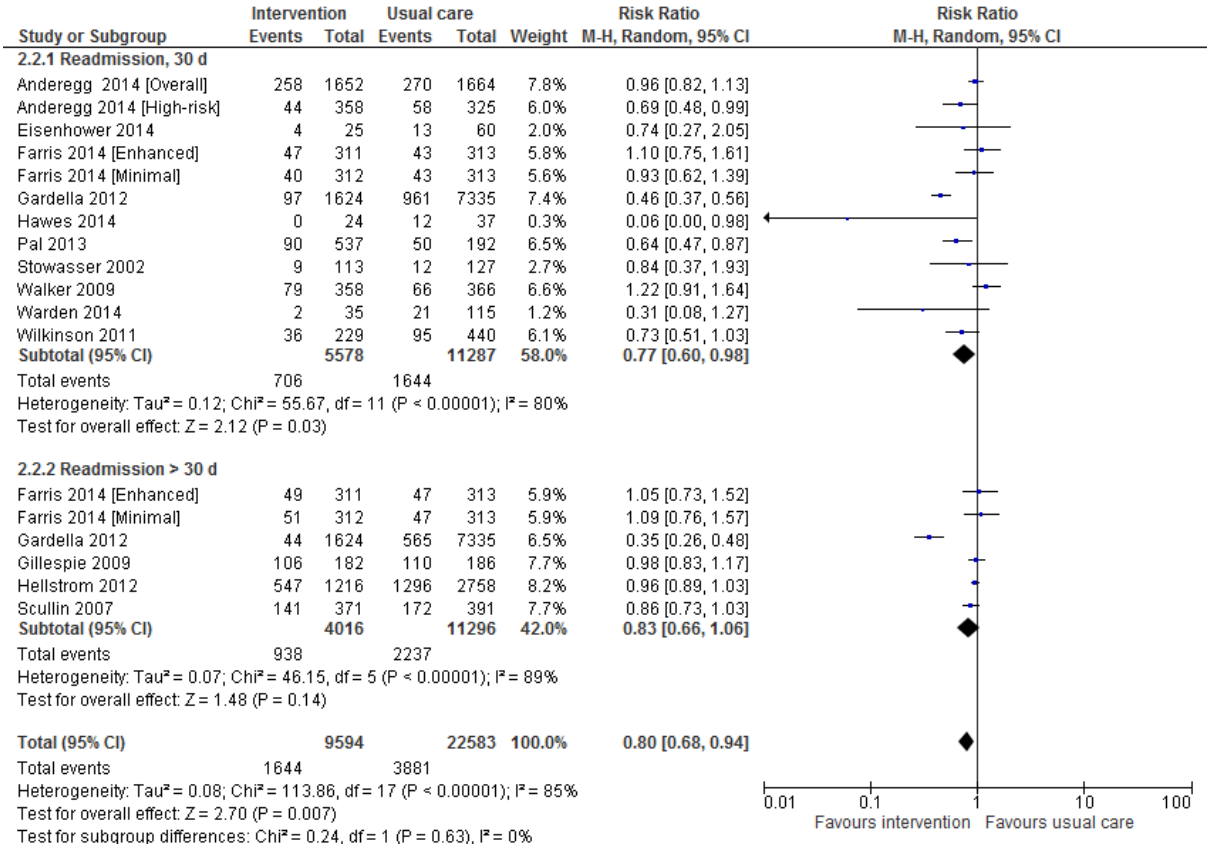
†Studies with a 'clear data' on each of the domains were given a score of 1.

Appendix D

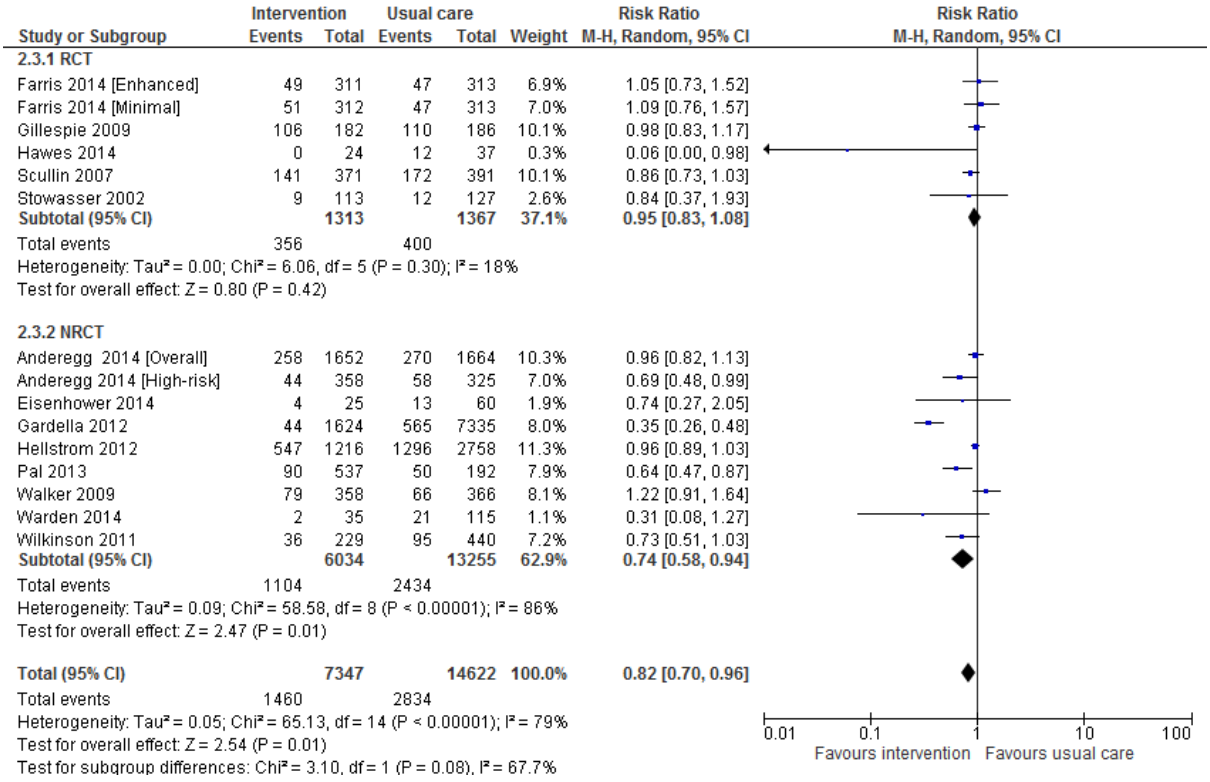
Subgroup analysis

4.1 **All-cause Readmission**

4.1.1 Subgroup analysis based on outcome timing

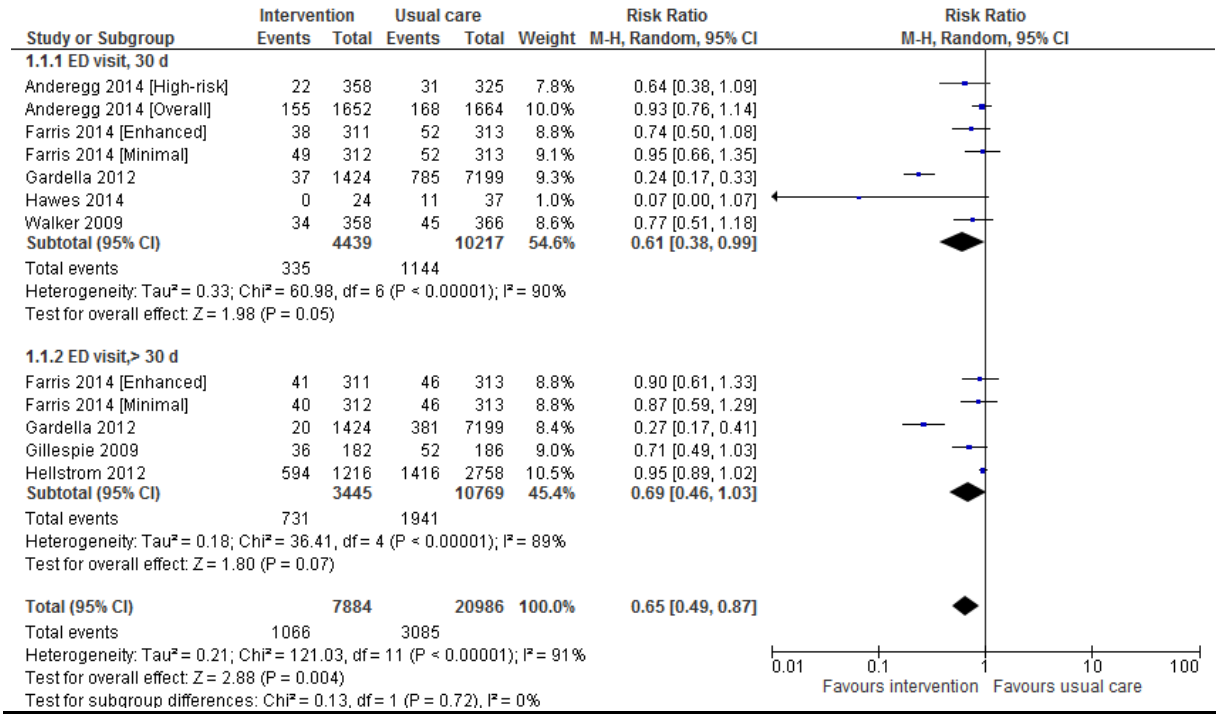


4.1.2 Subgroup analysis based on study design

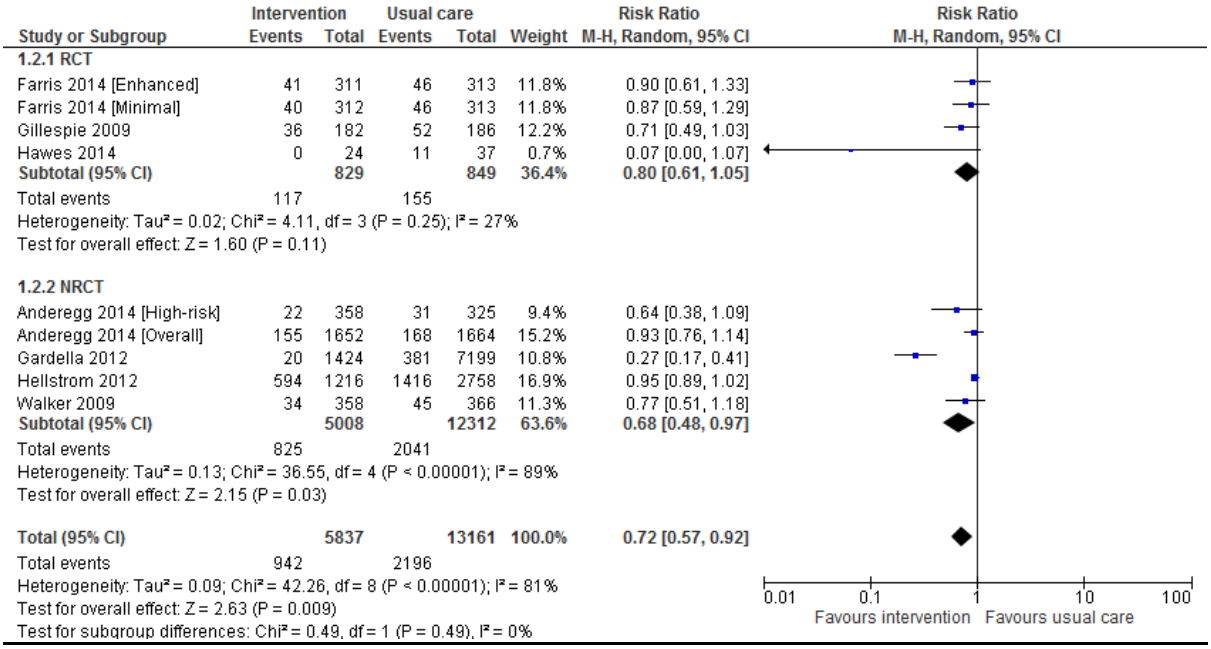


4.2 **All-cause ED visits**

4.2.1 Subgroup analysis based on outcome timing

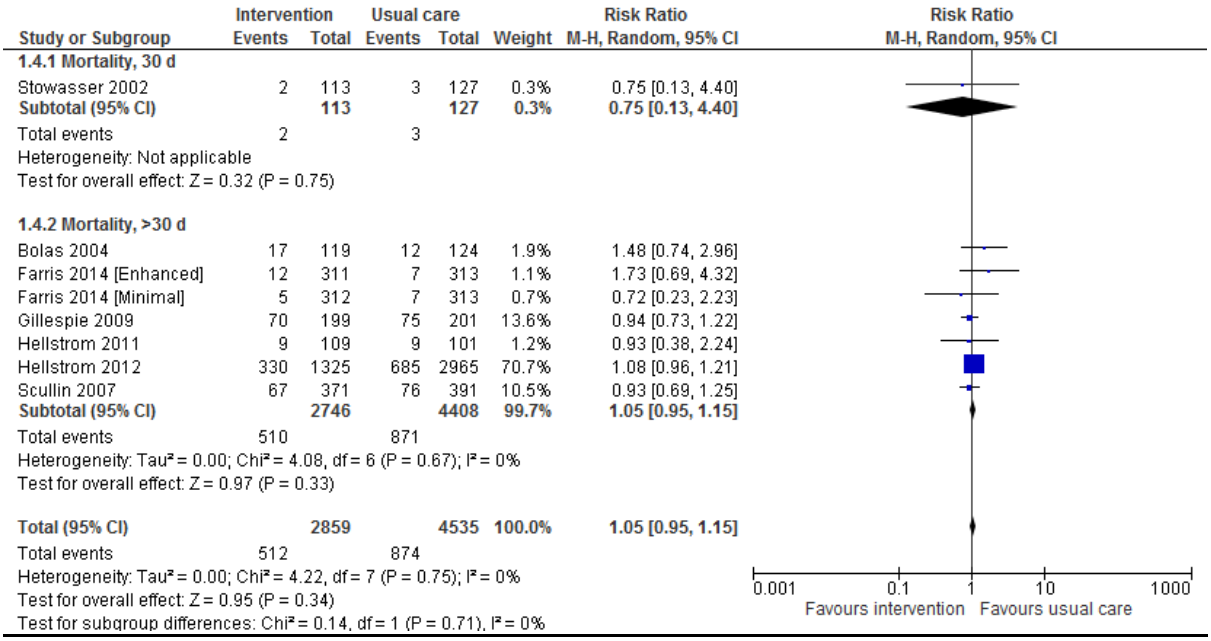


4.2.2 Subgroup analysis based on study design

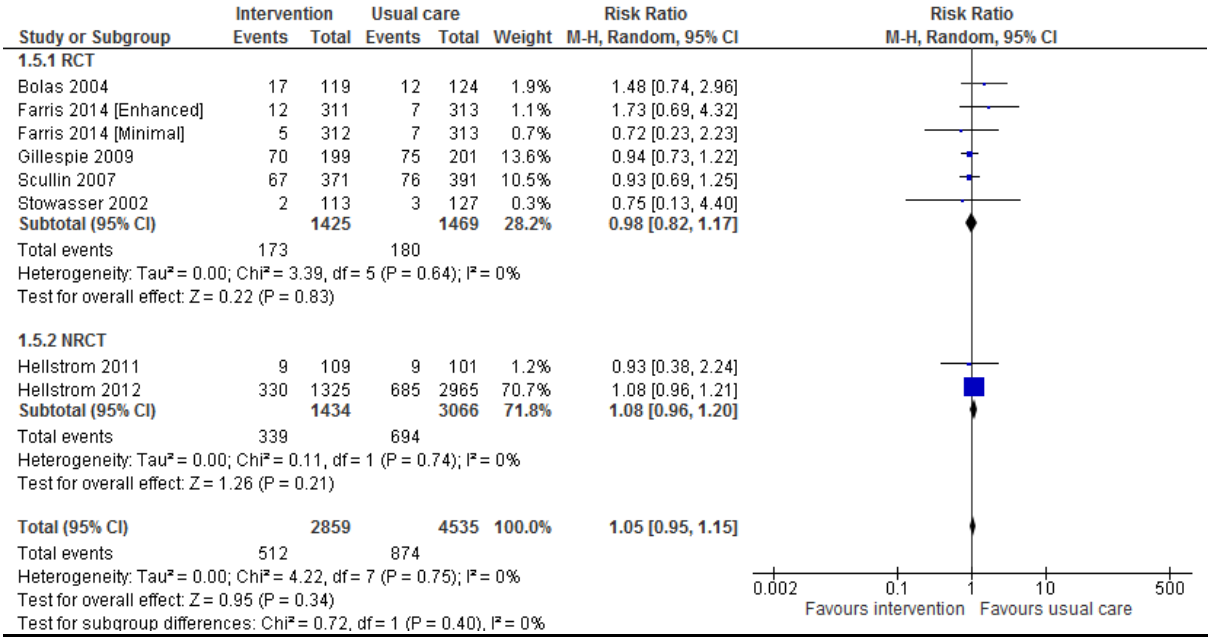


4.3 **All-cause mortality**

4.3.1 Subgroup analysis based on outcome timing

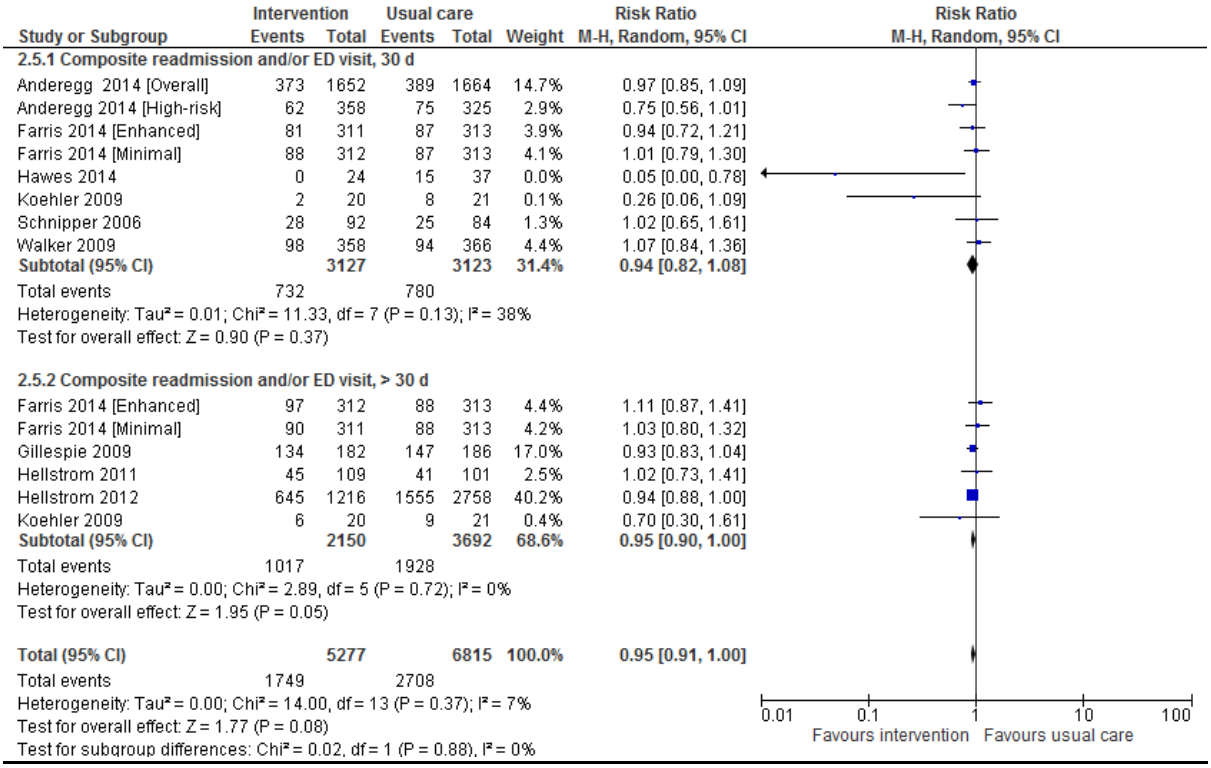


4.3.1 Subgroup analysis based on study design

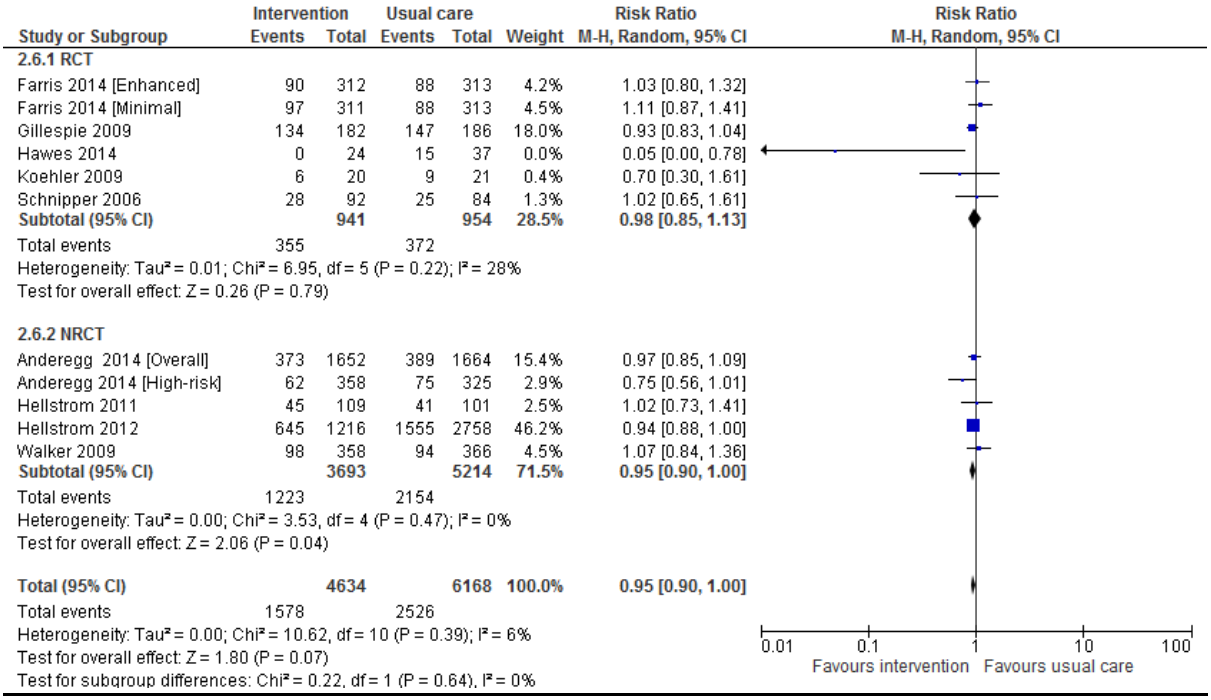


4.4 **Composite readmission and/or ED visit**

4.4.1 Subgroup analysis based on outcome timing



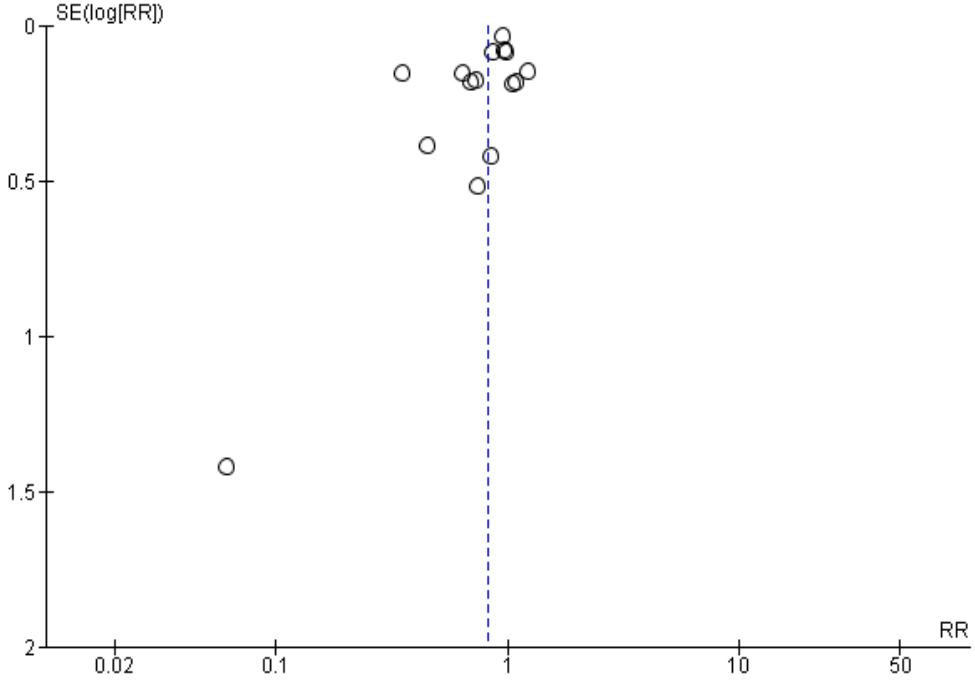
4.4.2 Subgroup analysis based on study design



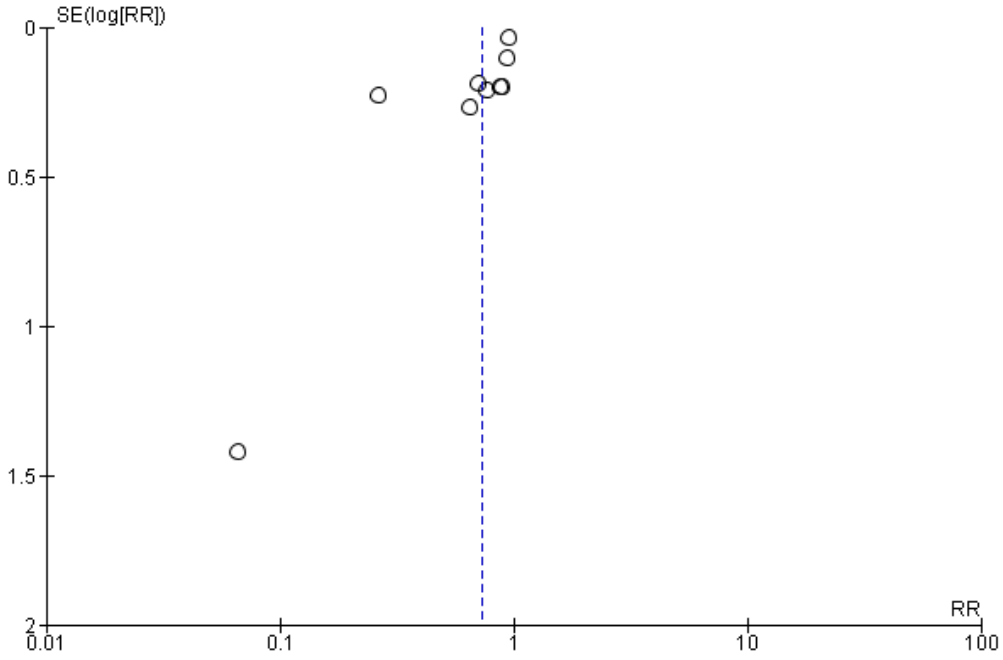
Appendix E

Funnel Plots

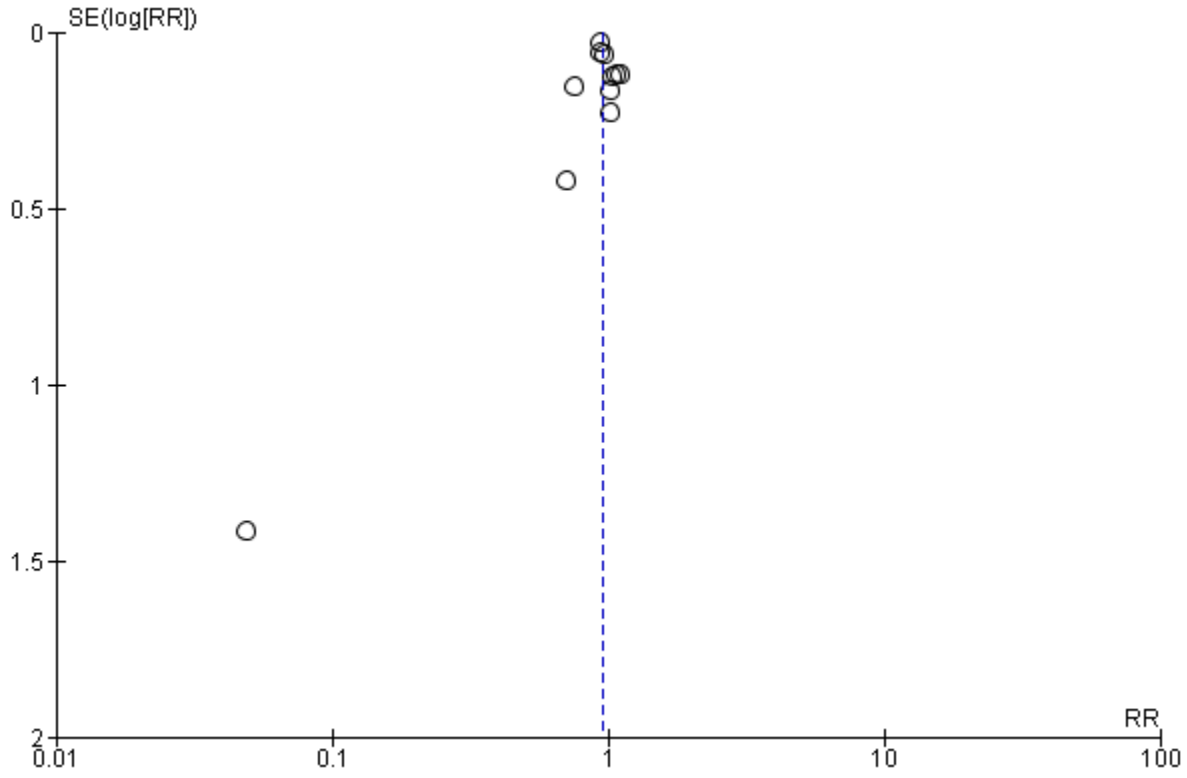
A. All-cause readmission Egger's test, p= 0.08; Begg's test, p=0.13



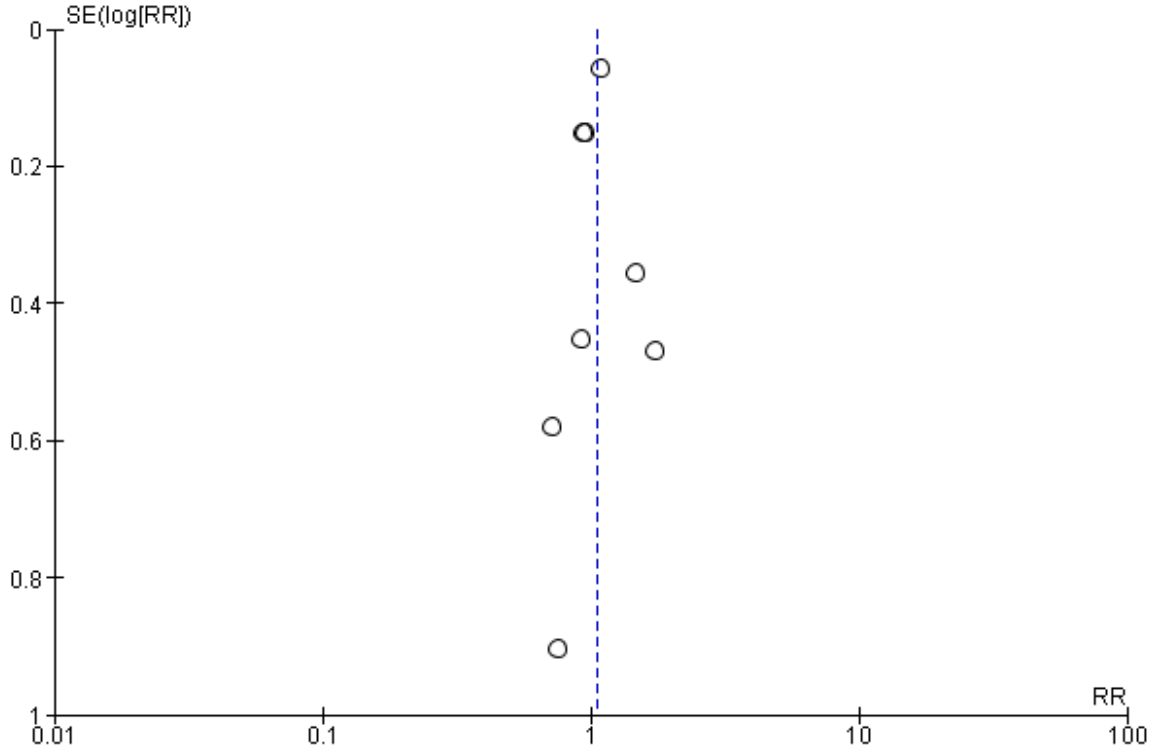
B. All-cause ED visit Egger's test, p= 0.04; Begg's test, p=0.01



C. **Composite readmission and/or ED visit** Egger's test, p= 0.57; Begg's test, p=0.35



D. **All-cause mortality** Egger's test p=0.83; Begg's test p=0.71



Funnel plots for the four outcomes for patients at hospital transitions. A) all-cause readmission B) all-cause ED visit C) composite readmission and/or ED visit D) all-cause mortality. The vertical line in the graphs corresponds to the pooled relative risk across studies.