

Online Appendix 1. List of included studies

1.	Brummel, A.R.; Soliman, A.M.; Carlson, A.M.; de Oliveira, D.R. Optimal diabetes care outcomes following face-to-face medication therapy management services. <i>Population health management</i> 2013 , <i>16</i> , 28-34, doi:10.1089/pop.2012.0023.
2.	Ferries, E.; Dye, J.T.; Hall, B.; Ndehi, L.; Schwab, P.; Vaccaro, J. Comparison of Medication Therapy Management Services and Their Effects on Health Care Utilization and Medication Adherence. <i>Journal of managed care & specialty pharmacy</i> 2019 , <i>25</i> , 688-695, doi:10.18553/jmcp.2019.25.6.688.
3.	Foppa, A.A.; Chemello, C.; Vargas-Pelaez, C.M.; Farias, M.R. Medication Therapy Management Service for Patients with Parkinson's Disease: A Before-and-After Study. <i>Neurology and therapy</i> 2016 , <i>5</i> , 85-99, doi:10.1007/s40120-016-0046-4.
4.	Geurts, M.M.; Stewart, R.E.; Brouwers, J.R.; de Graeff, P.A.; de Gier, J.J. Implications of a clinical medication review and a pharmaceutical care plan of polypharmacy patients with a cardiovascular disorder. <i>Int J Clin Pharm</i> 2016 , <i>38</i> , 808-815, doi:10.1007/s11096-016-0281-x.
5.	Henrichsmann, M.; Hempel, G. Impact of medication therapy management in patients with Parkinson's disease. <i>International journal of clinical pharmacy</i> 2016 , <i>38</i> , 54-60.
6.	Holland, R.; Lenaghan, E.; Harvey, I.; Smith, R.; Shepstone, L.; Lipp, A.; Christou, M.; Evans, D.; Hand, C. Does home based medication review keep older people out of hospital? The HOMER randomised controlled trial. <i>Bmj</i> 2005 , <i>330</i> , 293.
7.	Isetts, B.J.; Schondelmeyer, S.W.; Artz, M.B.; Lenarz, L.A.; Heaton, A.H.; Wadd, W.B.; Brown, L.M.; Cipolle, R.J. Clinical and economic outcomes of medication therapy management services: the Minnesota experience. <i>Journal of the American Pharmacists Association : JAPhA</i> 2008 , <i>48</i> , 203-211; 203 p following 211, doi:10.1331/JAPhA.2008.07108.
8.	Jodar-Sanchez, F.; Malet-Larrea, A.; Martin, J.J.; Garcia-Mochon, L.; Lopez Del Amo, M.P.; Martinez-Martinez, F.; Gastelurrutia-Garralda, M.A.; Garcia-Cardenas, V.; Sabater-Hernandez, D.; Saez-Benito, L., et al. Cost-utility analysis of a medication review with follow-up service for older adults with polypharmacy in community pharmacies in Spain: the conSIGUE program. <i>PharmacoEconomics</i> 2015 , <i>33</i> , 599-610, doi:10.1007/s40273-015-0270-2.
9.	Krass, I.; Taylor, S.J.; Smith, C.; Armour, C.L. Impact on medication use and adherence of Australian pharmacists' diabetes care services. <i>Journal of the American Pharmacists Association : JAPhA</i> 2005 , <i>45</i> , 33-40.
10.	Lapointe-Shaw, L.; Bell, C.; Austin, P.; Abrahamyan, L.; Ivers, N.M.; Li, P.; Pechlivanoglou, P.; Redelmeier, D.A.; Dolovich, L. Community pharmacy medication review, death and re-admission after hospital discharge: a propensity score-matched cohort study. <i>BMJ Qual Saf</i> 2019 , 10.1136/bmjqs-2019-009545, doi:10.1136/bmjqs-2019-009545.
11.	Leendertse, A.; De Koning, G.; Goudswaard, A.; Belitser, S.; Verhoef, M.; De Gier, H.; Egberts, A.; Van den Bemt, P. Preventing hospital admissions by reviewing medication (PHARM) in primary care: an open controlled study in an elderly population. <i>Journal of clinical pharmacy and therapeutics</i> 2013 , <i>38</i> , 379-387.
12.	Lenaghan, E.; Holland, R.; Brooks, A. Home-based medication review in a high risk elderly population in primary care--the POLYMED randomised controlled trial. <i>Age and ageing</i> 2007 , <i>36</i> , 292-297, doi:10.1093/ageing/afm036.
13.	Messerli, M.; Blozik, E.; Vriends, N.; Hersberger, K.E. Impact of a community pharmacist-led medication review on medicines use in patients on polypharmacy--a prospective randomised controlled trial. <i>BMC health services research</i> 2016 , <i>16</i> , 145, doi:10.1186/s12913-016-1384-8.
14.	Messerli, M.; Vriends, N.; Hersberger, K.E. Humanistic outcomes and patient acceptance of the pharmacist-led medication review "Polymedication Check" in primary care in Switzerland: a prospective randomized controlled trial. <i>Patient Prefer Adherence</i> 2018 , <i>12</i> , 1071-1078, doi:10.2147/ppa.s160789.
15.	Moore, J.M.; Shartle, D.; Faudskar, L.; Matlin, O.S.; Brennan, T.A. Impact of a patient-centered pharmacy program and intervention in a high-risk group. <i>Journal of managed care pharmacy : JMCP</i> 2013 , <i>19</i> , 228-236, doi:10.18553/jmcp.2013.19.3.228.
16.	Mott, D.A.; Martin, B.; Breslow, R.; Michaels, B.; Kirchner, J.; Mahoney, J.; Margolis, A. Impact of a medication therapy management intervention targeting medications associated with falling: Results of a pilot study. <i>Journal of the American Pharmacists Association : JAPhA</i> 2016 , <i>56</i> , 22-28, doi:10.1016/j.japh.2015.11.001.

17	Planas, L.G.; Crosby, K.M.; Mitchell, K.D.; Farmer, K.C. Evaluation of a hypertension medication therapy management program in patients with diabetes. <i>Journal of the American Pharmacists Association : JAPhA</i> 2009 , <i>49</i> , 164-170, doi:10.1331/JAPhA.2009.08164.
18	Roughead, E.E.; Barratt, J.D.; Ramsay, E.; Pratt, N.; Ryan, P.; Peck, R.; Killer, G.; Gilbert, A.L. The effectiveness of collaborative medicine reviews in delaying time to next hospitalization for patients with heart failure in the practice setting: results of a cohort study. <i>Circulation. Heart failure</i> 2009 , <i>2</i> , 424-428, doi:10.1161/circheartfailure.109.861013.
19	Roughead, E.E.; Barratt, J.D.; Ramsay, E.; Pratt, N.; Ryan, P.; Peck, R.; Killer, G.; Gilbert, A.L. Collaborative home medicines review delays time to next hospitalization for warfarin associated bleeding in Australian war veterans. <i>J Clin Pharm Ther</i> 2011 , <i>36</i> , 27-32, doi:10.1111/j.1365-2710.2009.01149.x.
20	Shaya, F.T.; Chirikov, V.V.; Rochester, C.; Zaghbab, R.W.; Kucharski, K.C. Impact of a comprehensive pharmacist medication-therapy management service. <i>Journal of medical economics</i> 2015 , <i>18</i> , 828-837, doi:10.3111/13696998.2015.1052463.
21	Skinner, J.S.; Poe, B.; Hopper, R.; Boyer, A.; Wilkins, C.H. Assessing the effectiveness of pharmacist-directed medication therapy management in improving diabetes outcomes in patients with poorly controlled diabetes. <i>The Diabetes educator</i> 2015 , <i>41</i> , 459-465, doi:10.1177/0145721715587563.
22	Sorensen, L.; Stokes, J.A.; Purdie, D.M.; Woodward, M.; Elliott, R.; Roberts, M.S. Medication reviews in the community: results of a randomized, controlled effectiveness trial. <i>British journal of clinical pharmacology</i> 2004 , <i>58</i> , 648-664, doi:10.1111/j.1365-2125.2004.02220.x.
23	Stafford, L.; Peterson, G.M.; Bereznicki, L.R.; Jackson, S.L.; van Tienen, E.C.; Angley, M.T.; Bajorek, B.V.; McLachlan, A.J.; Mullan, J.R.; Misan, G.M., et al. Clinical outcomes of a collaborative, home-based postdischarge warfarin management service. <i>Ann Pharmacother</i> 2011 , <i>45</i> , 325-334, doi:10.1345/aph.1P617.
24	Verdoorn, S.; Kwint, H.-F.; Blom, J.W.; Gussekloo, J.; Bouvy, M.L. Effects of a clinical medication review focused on personal goals, quality of life, and health problems in older persons with polypharmacy: A randomised controlled trial (DREAMeR-study). <i>PLoS medicine</i> 2019 , <i>16</i> , e1002798, doi:10.1371/journal.pmed.1002798.
25	Verrue, C.; Mehuys, E.; Boussery, K.; Adriaens, E.; Remon, J.P.; Petrovic, M. A pharmacist-conducted medication review in nursing home residents: impact on the appropriateness of prescribing. <i>Acta clinica Belgica</i> 2012 , <i>67</i> , 423-429, doi:10.2143/acb.67.6.2062707.
26	Wittayanukorn, S.; Westrick, S.C.; Hansen, R.A.; Billor, N.; Braxton-Lloyd, K.; Fox, B.I.; Garza, K.B. Evaluation of medication therapy management services for patients with cardiovascular disease in a self-insured employer health plan. <i>Journal of managed care pharmacy : JMCP</i> 2013 , <i>19</i> , 385-395, doi:10.18553/jmcp.2013.19.5.385.
27	Wouters, H.; Scheper, J.; Koning, H.; Brouwer, C.; Twisk, J.W.; van der Meer, H.; Boersma, F.; Zuidema, S.U.; Taxis, K. Discontinuing Inappropriate Medication Use in Nursing Home Residents: A Cluster Randomized Controlled Trial. <i>Ann Intern Med</i> 2017 , <i>167</i> , 609-617, doi:10.7326/m16-2729.
28	Zermansky, A.G.; Alldred, D.P.; Petty, D.R.; Raynor, D.K.; Freemantle, N.; Eastaugh, J.; Bowie, P. Clinical medication review by a pharmacist of elderly people living in care homes--randomised controlled trial. <i>Age and ageing</i> 2006 , <i>35</i> , 586-591, doi:10.1093/ageing/afl075.

Online Appendix 2. Characteristics of included studies

Author, year	Country	N (Control/ intervention)	Setting	Health professional	Age group, residency	Medication review model*	Type of study	Outcome measures	Conclusions
Risk medication									
<i>Medication increasing the risk of falls</i>									
Mott, 2016 [26]	USA	42/39	Community pharmacy	Pharmacist	Home-dwelling elderly with risk of falls	Medication Therapy Management with five follow-ups by phone (2a)	RCT	Clinical: Use of 'Fall Risk Increasing Drugs' (FRID) and number of falls	Clinical: Significant reduction in use of 'Fall Risk Increasing Drugs' (FRID) after six months (P<0.05). No difference in number of falls between groups.
Heart medication									
Geurts, 2016 [27]	The Netherlands	264/248	Community pharmacy	Pharmacist	Home-dwelling elderly using five or more medications and at least one for heart disorder	Medication review with interview and no follow-up (3)	RCT	Clinical: Number of drug-related problems (DRP) and improvement of clinical and laboratory parameters	Clinical: Decrease in number of DRP identified for intervention group. No difference in clinical or laboratory parameters.
Anticoagulant medication									
Roughead, 2011 [28]	Australia	16,320/816	Home	Pharmacist	Home-dwelling elderly using warfarin	Medication review with interview and follow-up with GP (2a)	Retrospective cohort study	Economic: Number of hospital admissions related to bleeding	Economic: A 79% reduction in likelihood of hospitalisation related to bleeding for the period of 2-6 months after receiving a medication review. No difference for the time before two months or 6-12 months.
Stafford, 2011 [29]	Australia	128/108	Home	Pharmacist	Adult users of warfarin	Medication review with 2-3 follow-ups (2a)	Prospective, non-randomised controlled cohort study	Clinical: Combined incidence of major and minor hemorrhagic events in the 90 days post discharge Economic: Warfarin-related hospital readmissions and death	Clinical: Significant reduction in the number of hemorrhagic events in the 90 days post discharge (5.3% vs. 14.7%, P=0.01). Economic: No difference in readmission or death.



Author, year	Country	N (Control/ intervention)	Setting	Health professional	Age group, residency	Medication review model*	Type of study	Outcome measures	Conclusions
Blood pressure lowering medication									
Wittayanukorn, 2013 [30]	USA	62/63	Health clinic	Pharmacist	Adult, home-dwelling with cardiovascular disease (CVD)	Medication Therapy Management (MTM) with interview and at least one follow-up (2a)	Two Pre- and post-retrospective designs: (1) a cohort study with comparison groups and (2) a cohort study with group comparison	Economic: Direct cost per patient Clinical: Blood pressure	Economic: Significantly lower costs for the MTM group (-\$359.3±219.2, P<0.0001). Clinical: Significant improvement of blood pressure.
Planas, 2007 [31]	USA	20/32	Community pharmacy	Pharmacist	Home-dwelling adults with diabetes and high blood pressure	MTM with interview and follow-up every month for 9 months (2a)	RCT	Clinical: Systolic blood pressure, percent blood pressure (>130/80 mmHg) and antihypertensive medication adherence	Clinical: Significantly improved systolic blood pressure and percentage >130/80 mmHg [95% CI 7.45-32.66, P=0.003]. A non-significant improvement of adherence
Antidiabetic medication									
Skinner, 2015 [32]	USA	50/50	Health clinic	Pharmacist	Home-dwelling adults with suboptimal control of diabetes	MTM with interview and no structured follow-up (2a)	Retrospective, case-control study	Clinical: HbA1c, blood pressure, lipids and creatinine Humanistic: Adherence	Clinical: Significant improvement of HbA1c and adherence (P<0.01). No difference for other parameters.
Brummel, 2013 [33]	USA	103/121	Health clinic	Pharmacist	Home-dwelling adults with diabetes	MTM with interview and follow-up (3)	Retrospective review	Clinical: Number of DRP and achievement of goals for treatment (HbA1c, LDL, blood pressure and others)	Clinical: Significant improvement of HbA1c [95 % CI 1.78-14.68, P<0.0025] and LDL [95% CI 1.67-33.18, P=0.0085]
Krass, 2005 [34]	Australia	82/106	Community pharmacy	Pharmacist	Home-dwelling adults with type 2 diabetes	Medication review with interview and follow-up every month for nine months (2a)	Cohort study	Clinical: Change in medication regime Humanistic: Adherence	Clinical: Significant improvement of adherence (BMQ-score, P<0.001). Significant reduction in prescribed medication (P=0.02).



Author, year	Country	N (Control/ intervention)	Setting	Health professional	Age group, residency	Medication review model*	Type of study	Outcome measures	Conclusions
<i>Medication against Parkinson's disease</i>									
Foppa, 2016 [35]	Brazil	55	Community pharmacy	Pharmacist	Home-dwelling Parkinson's patients	MTM with interview and five follow-ups (2a)	Quasi-experimental, uncontrolled before and after study	Clinical: Number of solved DRP, motor and non-motor symptoms Humanistic: HRQoL, adherence	Clinical: Significant reduction in DRP (P<0.001). No difference for motor symptoms and a significant reduction in non-motor symptoms. Humanistic: Improvement of HRQoL and significant improvement of adherence.
Henrichsmann, 2016[36]	Germany	90	Community pharmacy	Pharmacist	Home-dwelling Parkinson's patients	MTM with interview and one follow-up (2a)	Longitudinal intervention study	Clinical: number of DRP and changes to Unified Parkinson's disease rating scale (UPDRS) and Movement Disorder Society Unified Parkinson's disease ratings scale (MDS-URDS)	Clinical: 115 clinically relevant DRP identified. Significantly improvement of UPDRS and MDS-URDS
<i>Risk patients</i>									
<i>Frail patients</i>									
Morre, 2013 [38]	USA	2250/2250	PBM firm (pharmacy benefit managers company)	Pharmacist	Home-dwelling adults considered high-risk patients based on the number of insurance claims	MTM with interview and at least two follow-ups over the phone (3)	Retrospective cohort study using propensity score matching for control group	Economic: Total health care costs and contacts to health care Humanistic: Adherence	Economic: Significant reduction in health care costs for intervention group (P<0.048) and number of visits to GP and hospital (P<0.001). Humanistic: Adherence improved for some medication groups.
Zermansky, 2006 [41]	UK	330/331	Care home	Pharmacist	Frail care home residents	Medication review with patient and carer. No structured follow-up (3)	RCT	Clinical: Changes in number of medications, changes in medication, number of falls, deaths, hospital admissions and GP visits Economic: Cost of medication for 28 days	Clinical: Significant reduction in number of falls [0.95 % CI 0.49-0.70, P<0.00001] and significantly more changes to medication [0.95 % CI 1.21-1.48, P<0.0001]. Economic: No differences in costs, re-admission, or visits to GP.
Leendertse, 2013 [42]	The Netherlands	310/364	Unclear	Pharmacist	Home dwelling 65+ years using high risk medication	Medication review with interview and at least two follow-ups (2a)	Non-randomised controlled cohort study	Economic: Hospital admission, survival Clinical: Adverse drug events Humanistic: HRQoL	Economic: No significant differences in hospital admissions. Clinical: No significant differences Humanistic: No significant differences



Author, year	Country	N (Control/ intervention)	Setting	Health professional	Age group, residency	Medication review model*	Type of study	Outcome measures	Conclusions
Verdoorn, 2019[43]	The Netherlands	314/315	Community pharmacy	Community pharmacist	Home-dwelling 70+ years using 7+ medicines	Medication review with interview and at least two follow-ups (3)	RCT	Humanistic: HRQoL Clinical: Number of health problems	Humanistic: No significant differences Clinical: No significant differences
Wouters, 2017 [37]	The Netherlands	193/223	Care home	Pharmacist and physician	Frail elderly living in care homes	Medication review based on questionnaire from patient. No structured follow-up (2b)	Cluster RCT	Clinical: Deprescribing Economic: Visits and consultations with other health care professionals Humanistic: Cognitive impairment, neuropsychiatric symptoms, HRQoL	Clinical: A greater proportion of intervention group had at least one drug deprescribed. Economic: No difference Humanistic: No differences.
Lenaghan, 2007 [40]	UK	67/69	Home	Pharmacist	Elderly, home-dwelling at risk	Home medication review and one follow-up (2a)	RCT	Economic: Non-elective hospital admissions, admitted to care home, death Clinical: Number of prescribed medications Humanistic: HRQoL	Economic: no reduction in number of hospital admission Clinical: Significant reduction in prescribed medication [0.95% CI -1.66 - -0.08, P=0.03]
Verrue et al., 2012 [39]	Belgium	154/230	Care home	Clinical pharmacist	Care home residents	Medication review without interview and no structured follow-up (2b)	Non-randomised, controlled study	Clinical: Overuse, underuse and misuse of medication	Clinical: Non-significant improvement of prescribing
<i>Patients recently discharged from hospital</i>									
Lapointe-Shaw, 2019 [44]	Canada	67,163/ 67,163	Home or community pharmacy	Pharmacist	Home-dwelling elderly	MedsCheck with interview and no structured follow-up (2a)	Retrospective propensity score-matched cohort study	Economic: Time to death or readmission to hospital	Economic: Significant reduction in risk of 30 days to death or readmission [0.95% CI 0.95-1.00, P=0.02]
Shaya, 2015 [45]	USA	73/28	Endocrinology practice	Pharmacist	Home-dwelling diabetic adults recently discharged from hospital	MTM with interview and three follow-ups (3)	Non-randomised with historical control group	Economic: Hospital readmission at 30 days post discharge, use of health services and services related to DRP	Economic: No differences for economic outcomes



Author, year	Country	N (Control/ intervention)	Setting	Health professional	Age group, residency	Medication review model*	Type of study	Outcome measures	Conclusions
Holland, 2005[46]	United Kingdom	426/429	Home	Pharmacist	Hospitalized patients intended to be discharged	Medication review after discharge and one follow-up after 6-8 weeks	RCT	Economic: Hospital emergency readmission, death, admission to residential or nursing home Humanistic: HRQoL	Economic: Significant more readmissions in the intervention group [0.95% CI 1.07-1.58, P=0.009]. Fewer deaths in the intervention group and more patients were admitted to homes in the intervention group. Humanistic: No significant difference between intervention and control groups.
<i>Patients with multimorbidity</i>									
Sorensen, 2004 [49]	Australia	223/177	Home	Pharmacist/ GP	Adult, high-risk patients with comorbidity (3)	Medication review with interview followed by GP/pharmacist meeting and at least one follow-up with GP	Randomised, controlled effectiveness study	Clinical: Number of DRP Economic: Medication and health-related costs Humanistic: HRQoL	Clinical: No difference Economic: No differences Humanistic: No difference
Ferries, 2019 [47]	USA	64,801/5692	Humana, US (Company)	N/A	Home-dwelling, adult, comorbid patients with diabetes, CVD, high blood pressure, dyslipidaemia or osteoporosis (2a)	Comprehensive Medication Review (CMR) and Targeted Medication Review (TMR). No described follow-up.	Retrospective cohort study, propensity score-matched control group	Economic: Number of hospital admissions and visits to emergency department Humanistic: Adherence	Economic: Significant reduction in acute admissions to hospital and visits to emergency department. Humanistic: Improved adherence for medication for diabetes, dyslipidaemia and high blood pressure.
Roughead, 2009 [50]	Australia	5444/273	Home	Pharmacist	Elderly, comorbid heart patients (2a)	Medication review with interview and one follow-up with GP	Retrospective cohort study	Economic: Time until next admission to hospital Humanistic: Adherence (Medication Possession ratio and Daily Polypharmacy Possession Ratio)	Economic: A significant reduction of 45% of admissions to hospital due to reduction in heart attacks [0.95 % CI 0.39-0.77] Humanistic: No difference
Messerli, 2016[52]	Switzerland	232/218	Community pharmacy	Pharmacist	Home-dwelling, polypharmacy adults (2a)	Medication review with one follow-up	RCT		
Messerli, 2018 [51]	Switzerland	232/218	Community pharmacy	Pharmacist	Home-dwelling, polypharmacy adults (2a)	Medication review with interview and one follow-up	RCT	Humanistic: Patients' knowledge, patient satisfaction and patient acceptance	Humanistic: Increased knowledge and confidence using medication. Patients found the medication review helpful.



Author, year	Country	N (Control/ intervention)	Setting	Health professional	Age group, residency	Medication review model*	Type of study	Outcome measures	Conclusions
Isetts, 2007 [48]	USA	126/128	Health clinic	Pharmacist	Home-dwelling adults (2a)	MTM with interview and at least one follow-up	Prospective cohort study with retrospective control group	Clinical: Number of solved DRP, meeting measures for Health care Effectiveness Data and Information Set (HEDIS) Economic: Health-related costs	Clinical: 2.2 DRP were solved per patient in the intervention group. HEDIS measures improved. Economic: Health-related costs reduced by 31,5% for the intervention group.
Jodar-Sanchez, 2015 [1]	Spain	715/688	Community pharmacy	Pharmacist	Home-dwelling elderly using five or more medications (2a)	Medication review with interview and five follow-ups	Cluster RCT	Clinical: DRP, number of drugs Economic: Number of admissions to hospital and visits to the emergency department and health care costs Humanistic: HRQoL	Clinical: Significant reduction of admissions to hospital and visits to the emergency department. Economic: Significant reduction in health care costs Humanistic: Significant improvement of HRQoL.

*Medication review model according to PCNE definition

