

Supplement

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Table S1 Data sources for each cost component

Cost domain	Data source
Direct costs	
Prescription	PIS dataset PHS: Scottish Drug Tariff, NHSBSA: BNF SNOMED Mapping dataset
Hospitalisation	SMR01 dataset PHS: Specialty Costs R040X, R042X
Examinations	SERA: “BloodAndXray” dataset PHS: Specialty Costs R120, R130
Indirect costs	
Productivity loss, including paid and unpaid work	SERA: “Employ” dataset SMR01 dataset ONS: Weekly pay rate, gross (£) for all employee jobs in the United Kingdom at 2020 prices

Abbreviations: BNF = British National Formulary, NHSBSA = National Health Service Business Service Authority, ONS = Office for National Statistics, PHS = Public Health Scotland, PIS = Prescription Information System, SERA = Scottish Early Rheumatoid Arthritis cohort, SMR01 = Scottish Morbidity Records-general/acute inpatient daycase, SNOMED = Systematised Nomenclature Of Medicine.

Table S2 Inclusion criteria for EULAR list of comorbidities

Disease of interest	Diagnostic and drug codes
Cardiovascular diseases	ICD-10: I00 – I99 BNF: 0202, 0205, 0206, 0209, 0210, 0212
Gastrointestinal diseases	ICD-10: K20 – K95 BNF: 01
Infections	ICD-10: A00 – A99, B00 – B99 BNF: 05
Depression	ICD-10: F30 – F39 BNF: 0403
Malignancy	ICD-10: C00 – C99, D00 – D49 BNF: 08 SMR06: any type of cancer
Osteoporosis	ICD-10: M80 – M85 BNF: 0606, 090604, 090501

Abbreviations: BNF = British National Formulary, ICD: International Classification of Diseases.

Table S3 Regression results for the CCI grouping: coefficients of the GLM model estimating direct costs

Covariates	Coefficient (95% CI)	Std. Err	p Value
Sex			
Male	Reference		
Female	-0.012 (-0.191, 0.158)	0.094	0.898
Age group			
< 45	Reference		
45 – 54	0.221 (-0.087, 0.528)	0.157	0.159
55 – 64	0.406 (0.113, 0.698)	0.149	<0.01
65 – 75	0.485 (0.186, 0.785)	0.153	<0.01
> 75	0.688 (0.345, 1.030)	0.175	<0.001
SIMD			
1 (most deprived)	Reference		
2	-0.644 (-0.908, -0.381)	0.134	<0.001
3	-0.627 (-0.904, -0.350)	0.141	<0.001
4	-0.572 (-0.837, -0.308)	0.135	<0.001
5 (least deprived)	-0.379 (-0.669, -0.088)	0.148	<0.05
Clinical outcomes			
HAQ-DI score	0.178 (0.030, 0.327)	0.076	<0.05
EQ5D score	-0.107 (-0.622, 0.408)	0.263	0.684
Follow-up period			
Index year	Reference		
2	0.415 (0.127, 0.703)	0.147	<0.01
3	0.552 (0.262, 0.843)	0.148	<0.001
4	0.706 (0.414, 0.999)	0.149	<0.001
5	0.344 (0.049, 0.640)	0.151	<0.01
6	0.517 (0.218, 0.816)	0.153	<0.001
LTC group (using the CCI grouping)			
RA alone	Reference		
RA + Single LTC	0.867 (0.633, 1.110)	0.119	<0.001
RA + MLTCs	1.576 (1.300, 1.851)	0.141	<0.001

Abbreviations: CCI = Charlson Comorbidity Index, EQ5D= EuroQol- 5 Dimension , GLM= generalised linear model, HAQ-DI= Health Assessment Questionnaire-Disability Index, LTC= long-term conditions, MLTCs= multiple long-term conditions, RA= rheumatoid arthritis, SIMD: Scottish Index of Multiple Deprivation

Table S4 Regression results for the CCI grouping: coefficients of the two-part model estimating indirect costs

Covariates	1st modelling part (probability of incurring costs)			2nd modelling part (conditional on incurring costs)		
	Coefficient (95% CI)	Std. Err	p value	Coefficient (95% CI)	Std. Err	p value
Age group						
< 45	Reference			Reference		
45 – 55	-0.040 (-0.325, 0.255)	0.148	0.812	0.073 (-0.133, 0.279)	0.105	0.487
55 – 65	-0.095 (-0.371, 0.181)	0.140	0.501	0.162 (-0.033, 0.357)	0.100	0.104
Sex						
Male	Reference			Reference		
Female	0.215 (-0.020, 0.450)	0.120	0.073	-0.394 (-0.559, -0.229)	0.084	<0.001
SIMD						
1 (most deprived)	Reference			Reference		
2	0.050 (-0.266, 0.366)	0.161	0.755	-0.052 (-0.250, 0.146)	0.101	0.606
3	-0.351 (-0.684, -0.019)	0.170	<0.05	0.004 (-0.241, 0.233)	0.121	0.975
4	-0.457 (-0.773, -0.142)	0.161	<0.01	-0.168 (-0.382, 0.046)	0.109	0.125
5 (least deprived)	-0.330 (-0.693, 0.022)	0.180	0.066	-0.150 (-0.395, 0.095)	0.125	0.230
Clinical outcomes						
HAQ-DI score	0.640 (0.258, 0.627)	0.094	<0.001	0.156 (0.033, 0.279)	0.063	<0.05
EQ5D score	-2.094 (-2.051, -0.795)	0.320	<0.001	-0.171 (-0.589, 0.248)	0.214	0.425
LTC group						
RA alone	Reference			Reference		
RA + Single LTC	0.800 (0.482, 1.118)	0.162	<0.001	0.326 (0.140, 0.512)	0.095	<0.001
RA + MLTCs	0.856 (0.427, 1.285)	0.219	<0.001	0.617 (0.379, 0.854)	0.121	<0.001

Abbreviations: CCI = Charlson Comorbidity Index, EQ5D= EuroQol- 5 Dimension, HAQ-DI= Health Assessment Questionnaire-Disability Index, LTC= long-term conditions, MLTCs= multiple long-term conditions, RA= rheumatoid arthritis, SIMD: Scottish Index of Multiple Deprivation

Table S5 Regression results for the EULAR grouping in the sensitivity analysis: coefficients of the GLM model estimating direct costs

Covariates	Coefficient (95% CI)	Std. Err	p Value
Sex			
Male	Reference		
Female	-0.133 (-0.317, 0.052)	0.094	<0.05
Age group			
< 45	Reference		
45 – 54	0.236 (-0.073, 0.546)	0.158	0.135
55 – 64	0.270 (-0.030, 0.569)	0.153	0.007
65 – 75	0.415 (0.107, 0.723)	0.157	<0.01
> 75	0.855 (0.505, 1.206)	0.179	<0.001
SIMD			
1 (most deprived)	Reference		
2	-0.485 (-0.750, -0.220)	0.135	<0.001
3	-0.608 (-0.886, -0.301)	0.142	<0.001
4	-0.389 (-0.656, -0.123)	0.136	<0.01
5 (least deprived)	-0.308 (-0.599, -0.016)	0.149	<0.05
Clinical outcomes			
HAQ-DI score	0.201 (0.051, 0.350)	0.076	<0.01
EQ5D score	-0.080 (-0.599, 0.439)	0.265	0.763
Follow-up period			
Index year	Reference		
2	0.363 (0.074, 0.654)	0.148	<0.05
3	0.538 (0.246, 0.830)	0.149	<0.001
4	0.568 (0.274, 0.861)	0.150	<0.001
5	0.316 (0.019, 0.612)	0.151	<0.05
6	0.471 (0.171, 0.772)	0.153	<0.01
LTC group			
RA alone	Reference		
RA + Single LTC	0.644 (0.402, 0.887)	0.141	<0.001
RA + MLTCs	1.530 (1.307, 1.754)	0.134	<0.001

Abbreviations: EQ5D= EuroQol- 5 Dimension, EULAR: European Alliance of Associations for Rheumatology, GLM= generalised linear model, HAQ-DI= Health Assessment Questionnaire-Disability Index, LTC= long-term conditions, MLTCs= multiple long-term conditions, RA= rheumatoid arthritis, SIMD: Scottish Index of Multiple Deprivation

Table S6 Regression results for the EULAR grouping in the sensitivity analysis: coefficients of the two-part model estimating indirect costs

Covariates	1st modelling part (probability of incurring costs)			2nd modelling part (conditional on incurring costs)		
	Coefficient (95% CI)	Std. Err	p value	Coefficient (95% CI)	Std. Err	p value
Age group						
18 – 34	Reference			Reference		
35 – 44	-0.142 (-0.441, 0.156)	0.152	0.350	0.100 (-0.112, 0.312)	0.108	0.356
45 – 54	-0.264 (-0.551, 0.024)	0.147	0.072	0.185 (-0.017, 0.386)	0.103	0.073
Sex						
Male	Reference			Reference		
Female	0.137 (-0.097, 0.372)	0.120	0.251	-0.427 (-0.595, -0.258)	0.086	<0.001
SIMD						
1 (most deprived)	Reference			Reference		
2	0.101 (-0.216, 0.420)	0.162	0.531	0.003 (-0.200, 0.205)	0.103	0.978
3	-0.407 (-0.742, -0.071)	0.171	<0.05	-0.016 (-0.258, 0.226)	0.123	0.895
4	-0.443 (-0.762, -0.123)	0.163	<0.01	-0.170 (-0.390, -0.050)	0.112	0.130
5 (least deprived)	-0.317 (-0.673, 0.039)	0.182	0.081	-0.121 (-0.373, 0.130)	0.128	0.344
Clinical outcomes						
HAQ-DI score	0.409 (0.223, 0.596)	0.095	<0.001	0.179 (0.054, 0.305)	0.064	<0.01
EQ5D score	-1.230 (-1.865, -0.596)	0.323	<0.001	-0.024 (-0.452, 0.403)	0.218	0.910
LTC group (using EULAR comorbidity list)						
RA alone	Reference			Reference		
RA + Single LTC	0.752 (0.479, 1.025)	0.139	<0.001	0.167 (-0.041, 0.376)	0.106	0.116
RA + MLTCs	1.064 (0.801, 1.327)	0.134	<0.001	0.495 (0.302, 0.688)	0.098	<0.001

Abbreviations: EQ5D= EuroQol- 5 Dimension, EULAR: European Alliance of Associations for Rheumatology, HAQ-DI= Health Assessment Questionnaire-Disability Index, LTC= long-term conditions, MLTCs= multiple long-term conditions, RA= rheumatoid arthritis, SIMD: Scottish Index of Multiple Deprivation

Table S7 Number of participants with EULAR list of comorbidities from multiple data sources

Data source	CVD	GI	Infection	Depression	Cancer	Osteoporosis
Prescription [#]	304	269	13	126	12	91
Hospitalisation	321	349	127	17	150	39
Cancer registry					184	
Overall*	367	393	106	109	159	104

Abbreviations: CVD = cardiovascular diseases, GI = Gastrointestinal diseases

[#] Prescriptions were assigned by therapeutic uses for the six comorbidities within relevant British National Formulary chapters (Table S2). Subsequently, the Proportion of Days Covered (PDC) approach was adopted to identify medications with a PDC over 0.8 in the last year of follow-up (1/12/2018-30/11/2019).

* Prescribing, hospital and cancer records were combined to count the number of long-term conditions.

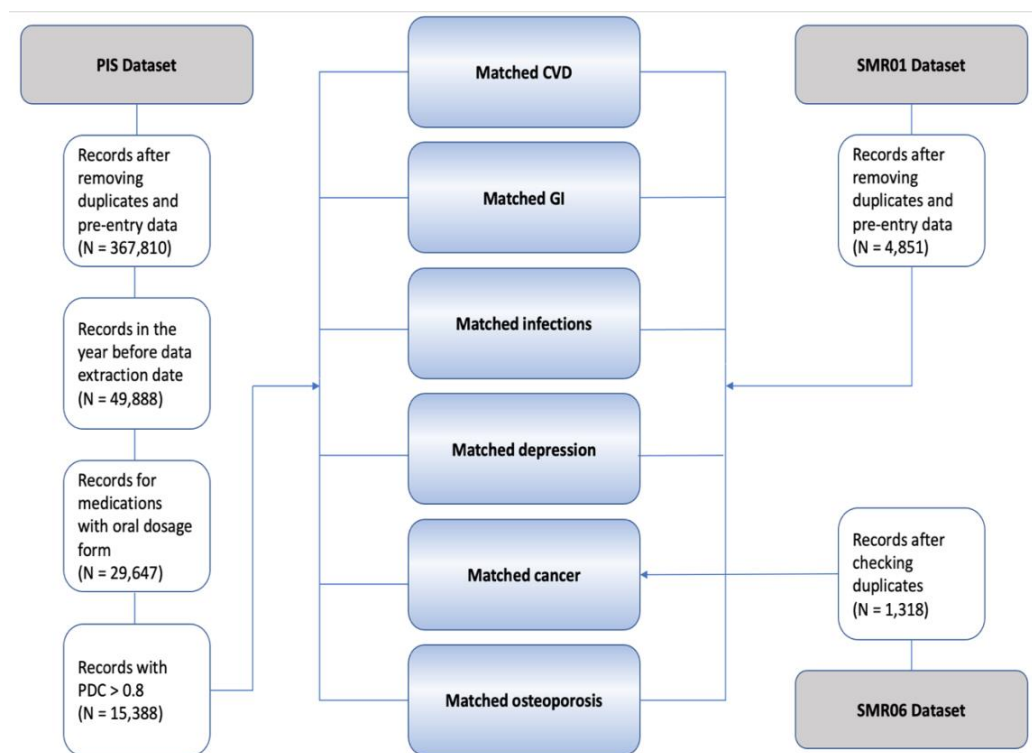
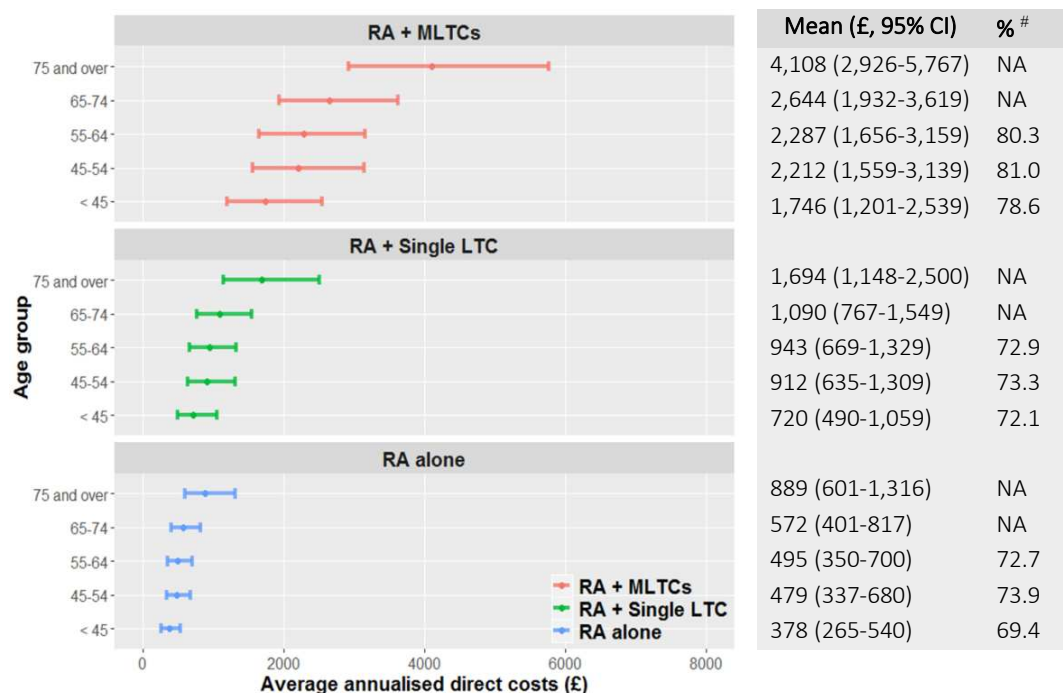


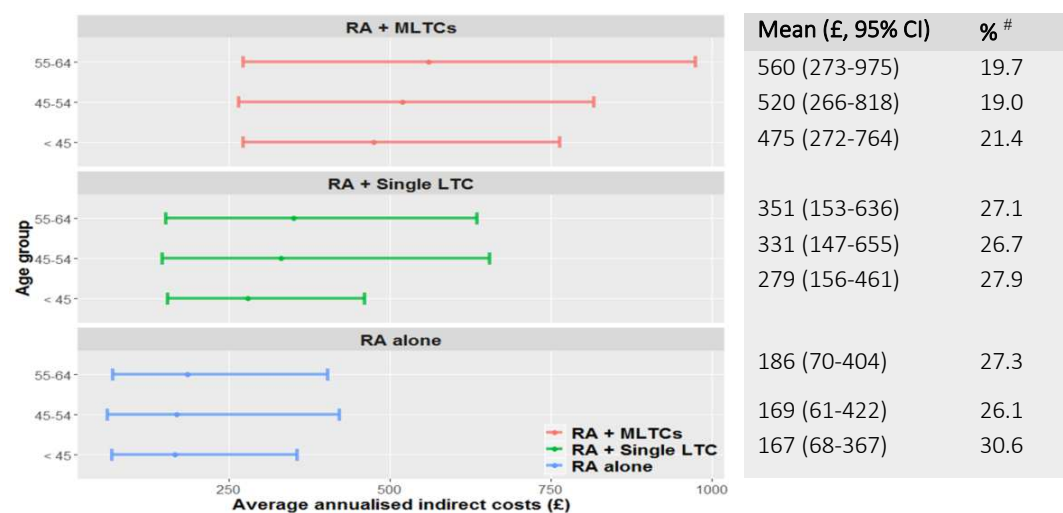
Figure S1 Data preparation for identifying EULAR list of comorbidities

Abbreviations: CVD = cardiovascular diseases, GI = Gastrointestinal diseases, PIS = Prescription Information System, SMR01 = Scottish Morbidity Records-general/acute inpatient daycase, SMR06 = Scottish Morbidity Records – cancer registry



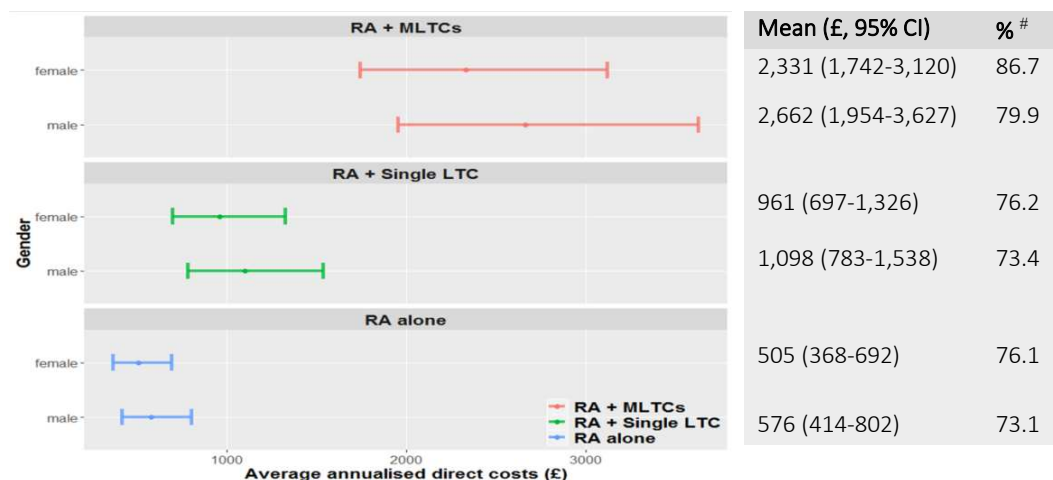
The proportion of direct costs in total (direct and indirect) costs for those aged under 65 years within each age group.

Figure S2A Average annualised direct costs by age and LTC group (EULAR grouping)



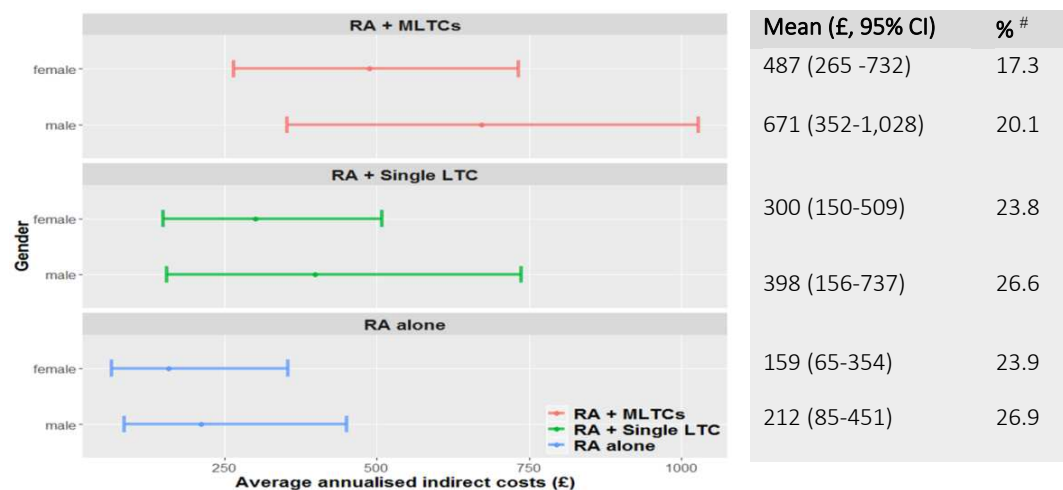
The proportion of indirect costs in total (direct and indirect) costs for those aged under 65 years within each age group.

Figure S2B Average annualised indirect costs by age and LTC group (EULAR grouping)



The proportion of direct costs in total (direct and indirect) costs within each gender group.

Figure S3A Average annualised direct costs by gender and LTC group (EULAR grouping)



The proportion of indirect costs in total (direct and indirect) costs within each gender group.

Figure S3B Average annualised indirect costs by gender and LTC group (EULAR grouping)