

Supplementary table S1. Final model selection

Data	Outcome	Model specification	Covariate selection method*	Covariate list	Model fit statistics**
Residential subgroup	Potentially avoidable admissions	Negative Binomial	freelasso	intervention; age; male; f_dependence24h; p_cancother24h; p_chrpulm24h; p_dementia24h; p_hempara24h; findexdateq2; findexdateq3; findexdateq4; avem12h; avem24m12h; em12h; bdays12h; chnbeds	RMSE: 0.52 Total deviance p-value: 1.000 Obs:Pred: 83%:84% Over-dispersion p-value: 0.034
	Emergency admissions	Negative Binomial	freelasso	intervention; age; male; white; f_dependence24h; f_mobprob24h; p_chrpulm24h; p_dementia24h; p_hempara24h; findexdateq2; findexdateq3; findexdateq4; em12h; em24m12h; ae12h; bdays12h; el12h; chnbeds	RMSE: 0.91 Total deviance p-value: 0.990 Obs:Pred: 67%:69% Over-dispersion p-value: <0.001
	A&E attendances	Negative Binomial	nofreelasso	intervention; age; male; white; charlson; f_comorbfrailty24h; f_anxdep24h; f_dependence24h; f_fallsfract24h; f_incont24h; f_pulcers24h; p_cancother24h; p_chrpulm24h; p_conheart24h; p_livoth24h; p_pervasc24h; findexdateq2; findexdateq3; findexdateq4; avem12h; em12h; em24m12h; ae12h; bdays12h; el12h; op12h; chnbeds; ru11ru; imd15grp2; imd15grp3	RMSE: 1.14 Total deviance p-value: 0.777 Obs:Pred: 60%:62% Over-dispersion p-value: <0.001
	Hospital bed days	Negative Binomial	freelasso	intervention; age; male; f_anxdep24h; f_incont24h; f_pulcers24h; p_cancother24h; p_livoth24h; bdays12h; chnbeds; ru11ru	RMSE: 20.04 Total deviance p-value: 1.000 Obs:Pred: 66%:65% Over-dispersion p-value: <0.001
	Outpatient attendances	Negative Binomial	core. unbalanced	intervention; age; male; white; charlson; f_comorbfrailty24h; f_anxdep24h; f_dependence24h; f_fallsfract24h; f_incont24h; f_pulcers24h; p_cancother24h;	RMSE: 2.32 Total deviance p-value: 0.707 Obs:Pred: 57%:58% Over-dispersion p-value: <0.001

				p_chrpulm24h; p_conheart24h; p_livoth24h; p_pervasc24h; findexdateq2; findexdateq3; findexdateq4; avem12h; em12h; ae12h; bdays12h; el12h; op12h; chnbeds; ru11ru; imd15grp2; imd15grp3	
	Deaths outside hospital	Binomial	freelasso	intervention; age; male	RMSE: 0.45 Total deviance p-value: 0.058 Obs:Pred: 28%:28% Over-dispersion p-value: NA
	Deaths	Binomial	freelasso	intervention; age; male; p_mets24h; p_chrpulm24h; p_conheart24h; p_pervasc24h; em12h	RMSE: 0.41 Total deviance p-value: 0.171 Obs:Pred: 73%:73% Over-dispersion p-value: NA
Nursing subgroup	Potentially avoidable admissions	Poisson	freelasso	intervention; age; male; em12h	RMSE: 0.36 Total deviance p-value: 1.000 Obs:Pred: 90%:90% Over-dispersion p-value: 0.061
	Emergency admissions	Poisson	freelasso	intervention; age; male; white; f_comorbfrailty24h; f_anxdep24h; f_cogimpair24h; f_dependence24h; f_fallsfract24h; f_incont24h; f_mobprob24h; p_mets24h; p_cancother24h; p_chrpulm24h; p_hempara24h; p_liv24h; p_livoth24h; p_pervasc24h; p_renal24h; findexdateq2; findexdateq3; findexdateq4; avem24m12h; em12h; em24m12h; ae12h; bdays12h; el12h; op12h; chelderonly; chnbeds; ru11ru; imd15grp2; imd15grp3	RMSE: 0.59 Total deviance p-value: 1.000 Obs:Pred: 76%:77% Over-dispersion p-value: 0.051
	A&E attendances	Negative Binomial	freelasso	intervention; age; male; f_comorbfrailty24h; p_livoth24h; p_pervasc24h; p_renal24h; em12h; em24m12h; ae12h; ru11ru	RMSE: 0.64 Total deviance p-value: 1.000 Obs:Pred: 73%:75% Over-dispersion p-value: 0.012

	Hospital bed days	Negative Binomial	freelasso	intervention; age; male; charlson; f_dependence24h; p_livoth24h; p_pervasc24h; p_renal24h; avem12h; em24m12h; ae12h; chelderonly	RMSE: 10.81 Total deviance p-value: 1.000 Obs:Pred: 74%:73% Over-dispersion p-value: <0.001
	Outpatient attendances	Negative Binomial	nofreelasso	intervention; age; male; white; charlson; f_comorbfrailty24h; f_anxdep24h; f_dependence24h; f_fallsfract24h; f_incont24h; f_pulcers24h; p_cancother24h; p_chrpulm24h; p_conheart24h; p_livoth24h; p_pervasc24h; findexdateq2; findexdateq3; findexdateq4; avem12h; em12h; ae12h; bdays12h; el12h; op12h; chnbeds; ru11ru; imd15grp2; imd15grp3	RMSE: 2.96 Total deviance p-value: 1.000 Obs:Pred: 67%:66% Over-dispersion p-value: <0.001
	Deaths outside hospital	Binomial	nofreelasso	intervention; age; male; white; charlson; f_comorbfrailty24h; f_anxdep24h; f_dependence24h; f_fallsfract24h; f_incont24h; f_mobprob24h; f_pulcers24h; p_cancother24h; p_chrpulm24h; p_conheart24h; p_diabetesc24h; p_hempara24h; p_liv24h; p_livoth24h; p_pervasc24h; p_renal24h; findexdateq2; findexdateq3; findexdateq4; avem12h; avem24m12h; em12h; em24m12h; ae12h; bdays12h; el12h; op12h; chnbeds; ru11ru; imd15grp3	RMSE: 0.29 Total deviance p-value: 1.000 Obs:Pred: 14%:14% Over-dispersion p-value: N/A
	Deaths	Binomial	freelasso	intervention; age; male; charlson; f_cogimpair24h; f_dependence24h; f_incont24h; f_mobprob24h; f_pulcers24h; p_mets24h; p_cancother24h; p_chrpulm24h; p_diabetesc24h; p_hempara24h; p_liv24h; findexdateq2; findexdateq3; findexdateq4; em12h; el12h; op12h; chelderonly; chnbeds	RMSE: 0.44 Total deviance p-value: 0.002 Obs:Pred: 58%:58% Over-dispersion p-value: NA

Interaction model	Potentially avoidable admissions	Poisson	nofrelasso	intervention; age; male; white; charlson; f_comorbfrailty24h; f_anxdep24h; f_cogimpair24h; f_dependence24h; f_fallsfract24h; f_incont24h; f_mobprob24h; f_pulcers24h; p_cancother24h; p_chrpulm24h; p_conheart24h; p_dementia24h; p_diabetesc24h; p_hempara24h; p_liv24h; p_livoth24h; p_pervasc24h; p_renal24h; findexdateq2; findexdateq3; findexdateq4; avem12h; avem24m12h; em12h; em24m12h; ae12h; bdays12h; el12h; op12h; chresidential; chelderonly; chnbeds; ru11ru; imd15grp2; imd15grp3; intervention:chresidential	RMSE: 0.40 Total deviance p-value: 1.000 Obs:Pred: 87%:88% Over-dispersion p-value: 0.068
	Emergency admissions	Negative Binomial	base	intervention; age; male; white; charlson; f_comorbfrailty24h; f_anxdep24h; f_cogimpair24h; f_dependence24h; f_fallsfract24h; f_incont24h; f_mobprob24h; f_pulcers24h; p_mets24h; p_cancother24h; p_chrpulm24h; p_conheart24h; p_dementia24h; p_diabetesc24h; p_hempara24h; p_liv24h; p_livoth24h; p_pervasc24h; p_renal24h; findexdateq2; findexdateq3; findexdateq4; avem12h; avem24m12h; em12h; em24m12h; ae12h; bdays12h; el12h; op12h; chelderonly; chnbeds; ru11ru; imd15grp2; imd15grp3; chresidential; intervention:chresidential	RMSE: 0.73 Total deviance p-value: 1.000 Obs:Pred: 73%:75% Over-dispersion p-value: <0.001
	A&E attendances	Negative Binomial	frelasso	intervention; age; male; white; p_chrpulm24h; p_livoth24h; p_pervasc24h; p_renal24h; em12h; em24m12h; ae12h; op12h ; chresidential; chnbeds; ru11ru; intervention:chresidential	RMSE: 0.85 Total deviance p-value: 1.000 Obs:Pred: 68%:70% Over-dispersion p-value: <0.001

Hospital bed days: count part	Hurdle: Negative Binomial	nofreelasso	Count part: intervention; age; male; white; charlson; f_comorbfrailty24h; f_anxdep24h; f_dependence24h; f_fallsfract24h; f_incont24h; f_mobprob24h; f_pulcers24h; p_cancother24h; p_chrpulm24h; p_conheart24h; p_hempara24h; p_liv24h; p_livoth24h; p_pervasc24h; p_renal24h; findexdateq2 ; findexdateq3; findexdateq4; avem12h; avem24m12h; em12h; em24m12h; ae12h; bdays12h; el12h; op12h; chresidential; chelderonly; chnbeds; ru11ru; imd15grp2; imd15grp3; intervention:chresidential	RMSE: 19.63 Total deviance p-value: NA Obs:Pred: 71%:71% Over-dispersion p-value: NA
Hospital bed days: zero part	Hurdle: Negative Binomial	nofreelasso	Zero part: intervention; age; male; white; charlson; f_comorbfrailty24h; f_anxdep24h; f_dependence24h; f_fallsfract24h; f_incont24h; f_mobprob24h; f_pulcers24h; p_cancother24h; p_chrpulm24h; p_conheart24h; p_hempara24h; p_liv24h; p_livoth24h; p_pervasc24h; p_renal24h; findexdateq2; findexdateq3; findexdateq4; avem12h; avem24m12h; em12h; em24m12h; ae12h; bdays12h; el12h; op12h; chresidential; chelderonly; chnbeds; ru11ru; imd15grp2; imd15grp3; intervention:chresidential	RMSE: 19.63 Total deviance p-value: NA Obs:Pred: 71%:71% Over-dispersion p-value: NA
Outpatient attendances	Negative Binomial	nofreelasso	intervention; age; male; white; charlson; f_comorbfrailty24h; f_anxdep24h; f_dependence24h; f_fallsfract24h; f_incont24h; f_pulcers24h; p_cancother24h; p_chrpulm24h; p_conheart24h; p_livoth24h; p_pervasc24h; p_renal24h; findexdateq2; findexdateq3;	RMSE: 6.48 Total deviance p-value: 1.000 Obs:Pred: 63%:63% Over-dispersion p-value: <0.001

				findexdateq4; avem12h; em12h; ae12h; bdays12h; el12h; op12h; chresidential; chnbeds; ru11ru; imd15grp2; imd15grp3; intervention:chresidential	
Deaths outside hospital	Binomial	freelasso		intervention; age; male; white; p_mets24h; p_cancother24h; p_chrpulm24h; p_conheart24h; p_diabetesc24h; p_liv24h; p_livoth24h; p_renal24h; findexdateq2; findexdateq3; findexdateq4; avem24m12h; em12h; em24m12h; ae12h; el12h; op12h; chresidential; chnbeds; imd15grp2; imd15grp3; intervention:chresidential	RMSE: 0.34 Total deviance p-value: 0.999 Obs:Pred: 18%:18% Over-dispersion p-value: NA
Deaths	Binomial	freelasso		intervention; age; male; white; charlson; f_cogimpair24h; f_dependence24h; f_fallsfract24h; f_incont24h; f_mobprob24h; f_pulcers24h; p_mets24h; p_cancother24h; p_chrpulm24h; p_dementia24h; p_diabetesc24h; p_hempara24h; p_liv24h; p_pervasc24h; findexdateq2; findexdateq3; findexdateq4; avem24m12h; em12h; ae12h; el12h; chresidential; chelderonly; chnbeds; imd15grp2; imd15grp3; intervention:chresidential	RMSE: 0.43 Total deviance p-value: 0.001 Obs:Pred: 63%:63% Over-dispersion p-value: NA

*\*Covariate selection method: base: included all observed baseline characteristics (see table 2) as covariates; core.unbalanced: included pre-specified 'core' variables (age, gender, 2015 Index of Multiple Deprivation (IMD) groupings, Charlson Index, number of frailty conditions, all hospital activity measures from previous year and care home type) and variables found to be unbalanced across the intervention groups following the matching (see supplementary table S2); freelasso: variables most predictive of a given outcome (identified using LASSO regression); nofreelasso: variables in 'core.unbalanced' and other variables most predictive of a given outcome (identified using LASSO regression).*

*\*\*Model fit was assessed by examining diagnostic statistics, such as the Root Mean Squared Error (RMSE), the deviance statistic, excess zeros - the proportion of observed vs predicted zeros (obs:pred), and by testing for over-dispersion. We also compared AIC between models within each outcome (not presented). The deviance statistic is used as a goodness-of-fit test for the model to the observed data; for fitted Hurdle models no deviance statistic could be obtained. Over-dispersion in count data is checked via a likelihood ratio test comparing a Negative Binomial model with a nested Poisson formulation.*

*Note: Due to data sparsity in lower IMD deciles (table 2), these were grouped according to deciles 1-5, 6-8 and 9-10 in the regression models. The interaction model selected for the hospital bed days outcome was a Hurdle model.*