Online Appendix: A Taste of Their Own Medicine: Guideline Adherence and Access to Expertise

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Table A1: Guidelines Covering the Use of Antibiotics

Guideline	**Risk set**		**Adherence**	
	Definition	**Share**	**Definition**	**Share**
Don't initiate UTI treatment with quinolones, elderly	Elderly with first prescription for antibiotics against UTI in/after July 2007; age 75+	0.0038	Individual's first antibiotics prescription is not for quinolones	0.63
Initiate UTI treatment with recommended antibiotics, elderly	Elderly with first prescription for antibiotics against UTI in/after July 2007; age 75+	0.0038	Individual's first antibiotics prescription is for nitrofurantoin or pivmecillinam	0.55
Initiate RTI treatment with penicillin V, children	Individuals with first prescription for antibiotic against RTI in/after July 2007; age 0–6	0.01	Individual's first antibiotics prescription is for penicillin V	0.79
Don't initiate UTI treatment with quinolones, women	Women with first prescription for antibiotics against UTI in/after July 2007; age 18–79	0.018	Individual's first antibiotics prescription is not for quinolones	0.84
Initiate antibiotics treatment with penicillin V, children	Individuals with first prescription for antibiotics in/after July 2007; age 0–17	0.021	Individual's first antibiotics prescription is for penicillin V	0.64
Initiate antibiotics treatment with penicillin V, adults	Individuals with first prescription for antibiotics in/after July 2007; age 18+	0.076	Individual's first antibiotics prescription is for penicillin V	0.4
Average		0.00076		0.53

Note: All guidelines but the first are recommendations that patients start with narrower- as opposed to broader-spectrum antibiotics. UTI: urinary tract infection; RTI: respiratory tract infection. We define that an individual initiates antibiotic treatment if she did not have an antibiotic prescription within 2 years before the first prescription we observe in the drug claims data. As we start observing drug claims made in July 2005, we consider individuals with first prescription in/after July 2007. Column "share" under "risk set" lists the share of the Swedish population in each guideline's risk set in the reference year; column "share" under "adherence" lists the adherence rate for those without access to expertise. We do not classify these guidelines as "do take" or "don't take" because they recommend in favor of some drugs over others conditional on taking an antibiotic. In other words, the recommendations worded "don't initiate with" (a broader-targeted antibiotic) are implicitly recommending initiating with a narrower-targeted antibiotic. The last row shows the average of age-specific guideline prevalence in the reference year across all ages and guidelines and lifecycle-prevalence weighted average of adherence among those without access to expertise. For regressions involving the guidelines listed in this table, the unit of analysis is the patient.

Table A2: Guidelines Covering Medication Use by the Elderly (Ages 75+)

Guideline	Risk set		Adherence		Do vs. don't take	Strength of evidence
	Definition	Share	Definition	Share		
Don't take hazardous drugs after ischemic heart disease & heart failure diagnoses, elderly	Elderly with first inpatient or outpatient diagnosis for ischemic heart disease, with heart failure diagnosis; discharge in/after July 2005	0.000082	No prescription for diltiazem or verapamil after discharge	0.98	Don't take	Ungraded
Don't take hazardous drugs after ischemic heart disease & Afib diagnoses, elderly	Elderly with first inpatient or outpatient diagnosis for ischemic heart disease, with Afib diagnosis; discharge in/after July 2005	0.00011	No prescription for diltiazem or verapamil in combination with beta blockers after discharge	0.96	Don't take	Ungraded
Take digoxin after heart failure & Afib diagnoses, elderly	Elderly with first inpatient or outpatient diagnosis for heart failure, with Afib diagnosis; discharge in/after July 2005	0.00034	Prescription after discharge	0.35	Do take	Below 1A
Don't take hazardous drugs after dementia diagnosis, elderly	Elderly with first inpatient or outpatient diagnosis for dementia; discharge in/after July 2005	0.00051	No prescription for drugs with anticholinergic effects, sleeping agents, or antipsychotic drugs not for severe psychotic symptoms	0.32	Don't take	Below 1A
Take recommended drugs after dementia diagnosis, elderly	Elderly with first inpatient or outpatient diagnosis for dementia; discharge in/after July 2005	0.00051	Prescription for a recommended drug (one of tacrine, donepezil, rivastigmine, or memantine) after discharge	0.62	Do take	Below 1A
Don't take hazardous drugs after heart failure diagnosis, elderly	Elderly with first inpatient or outpatient diagnosis for heart failure; discharge in/after July 2005	0.00078	No prescription for NSAIDs, heart rate lowering calcium antagonists, disopyramide, propafenone, flecainide, dronedarone or sotalol after discharge	0.78	Don't take	Below 1A

Guideline (continued)	**Risk set**		**Adherence**		**Do vs. don't take**	**Strength of evidence**
	Definition	**Share**	**Definition**	**Share**		
Take ACE inhibitors or ARBs after heart failure diagnosis, elderly	Elderly with first inpatient or outpatient diagnosis for heart failure; discharge in/after July 2005	0.00078	Prescription for either drug after discharge	0.86	Do take	Below 1A
Take beta blockers & ACE inhibitors or ARBs after heart failure diagnosis, elderly	Elderly with first inpatient or outpatient diagnosis for heart failure; discharge in/after July 2005	0.00078	Prescription for beta blockers and one of ACE inhibitors or ARBs after discharge	0.77	Do take	Below 1A
Don't take antipsychotic drugs, elderly	Elderly (age above 75) with prescription for antipsychotic drug at age 74	0.00079	No prescription for antipsychotic drug in a given year	0.32	Don't take	Ungraded
Don't take antiplatelet drugs after Afib diagnosis, elderly	Elderly with first inpatient or outpatient diagnosis for Afib; discharge in/after July 2005	0.001	No prescription after discharge	0.66	Don't take	Below 1A
Take anticoagulants after Afib diagnosis, elderly	Elderly with first inpatient or outpatient diagnosis for Afib; discharge in/after July 2005	0.001	Prescription after discharge	0.86	Do take	1A
Avoid drugs with certain interactions, elderly	Elderly with claims for drugs of certain interactions (see the next column) in a quarter of the year they turn 74	0.0011	Defined at patient-year level; individual has no claims for these interaction of drugs in the same quarter of a given year: warfarine and aspirin; warfarine and NSAIDs; potassium and potassium-sparing diuretics; beta blockers and verapamil; diltiazem and verapamil; ditalopram and donepeztil	0.66	Don't take	Ungraded

Guideline (continued)	**Risk set**		**Adherence**		**Do vs. don't take**	**Strength of evidence**
	Definition	**Share**	**Definition**	**Share**		
No polypharmacy w.r.t. psychotropic drugs, elderly	Elderly with claims for three or more different psychotropic drugs in a quarter of the year they turn 74	0.0022	Defined at patient-year level; individual has claims for no more than two psychotropic drugs in the same quarter of a given year	0.4	Don't take	Ungraded
Take oxazepam conditional on anxiolytics, elderly	Elderly-years with prescription for anxiolytics, 2006-2017	0.0065	Defined at patient-year level; all anxiolytics prescriptions in a given year are for oxazepam	0.28	Do take	Ungraded
No polypharmacy w.r.t. drugs in the same therapeutic group, elderly	Elderly with claims for two or more drugs from the same therapeutic ATC group in a quarter of the year they turn 74	0.0075	Defined at patient-year level; individual has claims for no more than one drug from the same therapeutic ATC group in the same quarter of a given year	0.61	Don't take	Ungraded
No polypharmacy w.r.t. all drugs, elderly	Elderly with claims for 10 or more different drugs in a quarter of the year they turn 74	0.0088	Defined at patient-year level; individual has claims for no more than nine different drugs in the same quarter of a given year	0.28	Don't take	Ungraded
Don't take NSAIDs, elderly	Elderly with prescription for NSAID at age 74	0.011	Defined at patient-year level; no prescription for NSAID in a given year	0.69	Don't take	Ungraded
Don't take specific drugs, elderly	Elderly with prescription for drug that should be avoided at age 74	0.013	Defined at patient-year level; no prescription for diazepam, nitraepam, flunitrazepam, tramadol, propiomazine, codeine and paracetamol or other non-opioid analgesics, glibenclamide, or drugs with anticholinergic effects in a given year	0.49	Don't take	Ungraded

Guideline (continued)	**Risk set**		**Adherence**		**Do vs. don't take**	**Strength of evidence**
	Definition	**Share**	**Definition**	**Share**		
Take zopiclone conditional on taking hypnotics and sedatives, elderly	Elderly-years with prescription for hypnotics and sedatives, 2006-2017	0.013	Defined at patient-year level; all hypnotics and sedatives prescriptions in a given year are for zopiclone	0.37	Do take	Below 1A
Don't take hazardous sleep medication, elderly	Elderly-years with prescription for sleep medication, 2006-2017	0.016	Defined at patient-year level; no sleep medication prescriptions in a given year for long-acting benzodiazepines (diazepam, nitrazepam, flunitrazepam), propiomazine, hydroxizine, alimemazine or promethazine	0.72	Don't take	Ungraded
Average		0.00078		0.53		

Note: UTI: urinary tract infection; RTI: respiratory tract infection; Afib: atrial fibrillation; TIA: transient ischemic attack; NSAID: nonsteroidal anti-inflammatory drugs. Column "share" under "risk set" lists the share of Swedish population in each guideline's risk set in the reference year; column "share" under "adherence" lists the adherence rate for all those without access to expertise. We classify a guideline as "do take" if it recommends taking certain drug, and as "don't take" if it recommends against taking certain drug. As rated by UpToDate, grade 1A guidelines (indicated in column "strength of evidence") are supported by high quality scientific evidence, and the benefits of compliance clearly outweighs risks and burdens, if there are any; a guideline is ungraded if it is not rated by UpToDate. The last row shows the average of age-specific guideline prevalence in the reference year across all ages and guidelines and lifecycle-prevalence weighted average of adherence among those without access to expertise. Prevalence is measured in 2017 for guidelines whose risk sets are not defined by the Board. For regressions involving the guidelines listed in this table, the unit of analysis is the patient unless specified as the patient-year in the "adherence" column.

Table A3: Guidelines Covering Medication Use following Specific Diagnoses

Guideline	Risk set		Adherence		Do vs. don't take	Strength of evidence
	Definition	Share	Definition	Share		
Take anticoagulants 0–1m after TIA & Afib diagnoses	Individuals with first inpatient diagnosis for TIA, with Afib diagnosis; discharge in/after July 2005; age 18+	0.000093	Prescription within 0–1 month after discharge	0.5	Do take	1A
Take anticoagulants 12–18m after ischemic stroke & Afib diagnoses	Individuals with first inpatient main diagnosis for ischemic stroke, with Afib diagnosis; discharge in/after July 2005, in/before June 2016; age 18–79	0.00016	Prescription within 12–18 months after discharge	0.55	Do take	1A
Take anticoagulants 0–1m after ischemic stroke & Afib diagnoses	Individuals with first inpatient diagnosis for ischemic stroke, with Afib diagnosis; discharge in/after July 2005; age 18+	0.00019	Prescription within 0–1 month after discharge	0.55	Do take	1A
Take antipsychotics 12–18m after schizophrenia diagnosis	Individuals with first inpatient or outpatient diagnosis for schizophrenia; discharge in/after July 2005, in/before June 2016; age 18+	0.00055	Prescription within 12–18 months after discharge	0.46	Do take	Below 1A
Take antipsychotics 0–6m after schizophrenia diagnosis	Individuals with first inpatient or outpatient diagnosis for schizophrenia; discharge in/after July 2005; age 18+	0.00056	Prescription within 0–6 months after discharge	0.69	Do take	1A
Take antiplatelet drugs 0–1m after TIA w/o Afib diagnoses	Individuals with first inpatient diagnosis for TIA, without Afib diagnosis; discharge in/after July 2005; age 18+	0.00069	Prescription within 0–1 month after discharge	0.71	Do take	1A
Take RAAS inhibitors or beta blockers 12–18m after heart failure diagnosis	Individuals with first inpatient main diagnosis for heart failure; discharge in/after July 2005 and in/before June 2016; age 20+	0.00073	Prescription for either drug within 12–18 months after discharge	0.66	Do take	Below 1A

Guideline (continued)	**Risk set**		**Adherence**		**Do vs. don't take**	**Strength of evidence**
	Definition	**Share**	**Definition**	**Share**		
Take antihypertensives 0–1m after TIA diagnosis	Individuals with first inpatient diagnosis for TIA; discharge in/after July 2005; age 18+	0.00078	Prescription within 0–1 month after discharge	0.32	Do take	Below 1A
Take statins 0–1m after TIA diagnosis	Individuals with first inpatient diagnosis for TIA; discharge in/after July 2005; age 18+	0.00078	Prescription within 0–1 month after discharge	0.5	Do take	1A
Take antiplatelet drugs 0–1m after ischemic stroke w/o Afib diagnoses & no claim for anticoagulants within 30 days after discharge	Individuals with first inpatient diagnosis for ischemic stroke, without Afib diagnosis and with no claim for anticoagulants within 30 days after discharge; discharge in/after July 2005; age 18+	0.00086	Prescription within 0–1 month after discharge	0.74	Do take	1A
Take RAAS inhibitors & beta blockers 0–6m after heart failure diagnosis	Individuals with first inpatient main diagnosis for heart failure; discharge in/after July 2005; age 20+	0.00088	Prescription for both drugs within 0–6 months after discharge	0.6	Do take	Below 1A
Take ADP receptor blocker 0–1m after myocardial infarction diagnosis	Individuals with first inpatient diagnosis for myocardial infarction; discharge in/after July 2005 and at age 18–79	0.0011	Prescription within 0–1 month after discharge	0.78	Do take	1A
Take statins 0–1m after ischemic stroke diagnosis	Individuals with first inpatient diagnosis for ischemic stroke; discharge in/after July 2005; age 18+	0.0011	Prescription within 0–1 month after discharge	0.56	Do take	1A
Take antihypertensives 0–1m after acute stroke diagnosis	Individuals with first inpatient diagnosis for TIA; discharge in/after July 2005; age 18+	0.0013	Prescription within 0–1 month after discharge	0.44	Do take	Below 1A

Guideline (continued)	**Risk set**		**Adherence**		**Do vs. don't take**	**Strength of evidence**
	Definition	**Share**	**Definition**	**Share**		
Take statins 12–18m after myocardial infarction diagnosis	Individuals with first inpatient main diagnosis for myocardial infarction; discharge in/after July 2005, in/before June 2016; age 40–79	0.0014	Prescription within 12–18 months after discharge	0.53	Do take	1A
Take statins 12–18m after cerebral infarction diagnosis	Individuals with first inpatient main diagnosis for cerebral infarction; discharge in/after July 2005, in/before June 2016; age 18+	0.0014	Prescription within 12–18 months after discharge	0.44	Do take	1A
Take osteoporosis drugs 0–12m after fracture diagnosis	Individuals with first inpatient diagnosis for fracture; discharge in/after July 2005; age 50+	0.0022	Prescription within 0–12 months after discharge	0.2	Do take	Below 1A
Take anticoagulants 0–6m after Afib diagnosis with high stroke risk	Individuals with first inpatient diagnosis for Afib and stroke risk score above two; discharge in/after July 2005; age 18+	0.0026	Prescription within 0–6 months after discharge	0.62	Do take	1A
Take RAAS inhibitors & beta blockers 0–24m after heart failure diagnosis	Individuals with first inpatient or outpatient diagnosis for heart failure; discharge in/after July 2005, in/before December 2015; age 18+	0.0042	Prescription for both drugs within 0–24 months after discharge	0.78	Do take	Below 1A
Continue with antidepressant treatment	Individuals with first prescription for antidepressant in/after January 2006; age 18+	0.071	Patient has another claim within 60–150 days after the first claim	0.54	Do take	Below 1A
Average		0.000084		0.55		

Note: Afib: atrial fibrillation; TIA: transient ischemic attack. We restrict the risk set to first inpatient cases which we observe all drug prescriptions over the time period that we measure adherence—for example, for the guideline *Statins after myocardial infarction diagnosis, 12-18m* we restrict the sample to first inpatient cases with discharge more than 18 months before December 2017, i.e., with discharge in/before June 2016. Column "share" under "risk set" lists the share of the Swedish population in each guideline's risk set in the reference year; column "share" under "adherence" lists the adherence rate for those without access to expertise. We classify a guideline as "do take" if it recommends taking certain drug(s), and as "don't take" if it recommends against taking certain drug(s). The last row shows the average of age-specific guideline prevalence in the reference year across all ages and guidelines and lifecycle-prevalence weighted average of adherence among those without access to expertise. For regressions involving the guidelines listed in this table, the unit of analysis is the patient.

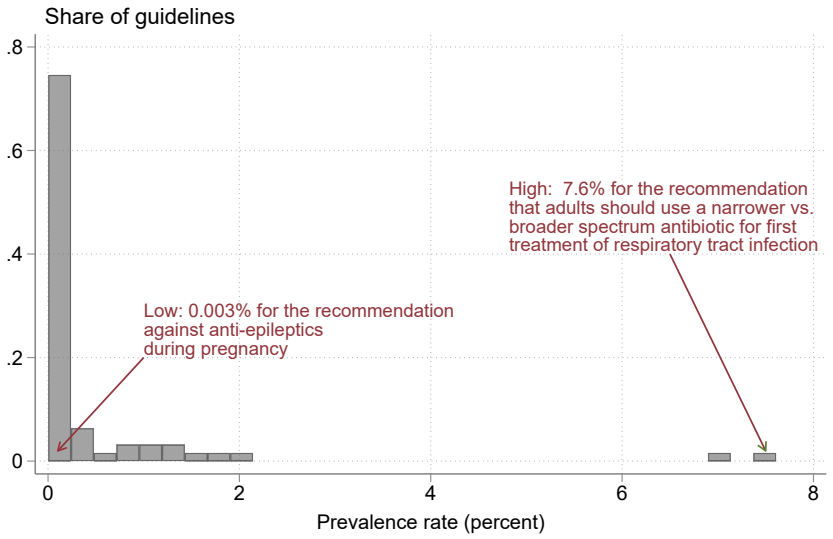
Table A4: Guidelines Covering Medication Use in Pregnancy

Guideline	**Share in risk set**	**Share adhering**	**Do vs. don't take**	**Strength of evidence**
Don't take D-class antiepileptics, pregnancy	0.000032	0.66	Don't take	D-drug
Don't take D-class immunosuppressants, pregnancy	0.000044	0.7	Don't take	D-drug
Don't take D-class macrolides, lincosamides or streptogramins, pregnancy	0.000092	0.98	Don't take	D-drug
Don't take C-class psychostimulants, pregnancy	0.000095	0.76	Don't take	C-drug
Don't take other D-drugs, pregnancy	0.00018	0.93	Don't take	D-drug
Don't take C-class hypothalamic hormones, pregnancy	0.00033	0.85	Don't take	C-drug
Don't take C-class hypnotics and sedatives, pregnancy	0.0004	0.87	Don't take	C-drug
Don't take D-class progestogens, pregnancy	0.00052	0.99	Don't take	D-drug
Don't take C-class corticosteroids (systemic use), pregnancy	0.00056	0.89	Don't take	C-drug
Don't take D-class tetracyclines, pregnancy	0.00062	0.99	Don't take	D-drug
Don't take C-class antibiotics (other), pregnancy	0.00067	0.86	Don't take	C-drug
Don't take C-class anxiolytics, pregnancy	0.00071	0.93	Don't take	C-drug
Don't take C-class corticosteroids, pregnancy	0.00075	0.88	Don't take	C-drug
Don't take C-class opioids, pregnancy	0.00099	0.85	Don't take	C-drug
Don't take C-class antidepressants, pregnancy	0.0011	0.68	Don't take	C-drug
Don't take other C-drugs, pregnancy	0.0013	0.72	Don't take	C-drug
Don't take C-class NSAIDs, pregnancy	0.0017	0.97	Don't take	C-drug
Average	0.00000593	0.86		

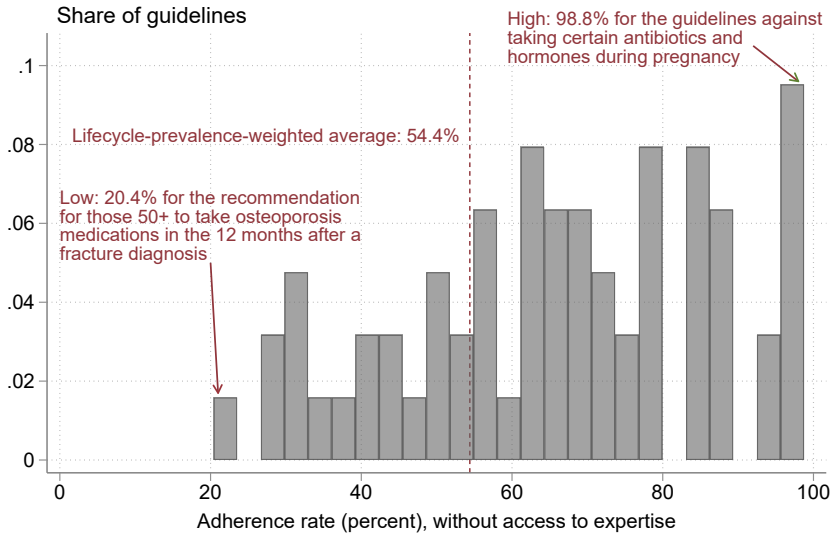
Note: NSAID: nonsteroidal anti-inflammatory drugs. For each guideline, the risk set contains all pregnancies for which the mother has a prescription of the drug within 24 months before conception. The outcome variable is an indicator for not having the specified drug during the pregnancy. We classify a guideline as "do take" if it recommends taking certain drug, and as "don't take" if it recommends against taking certain drug. The letter grade classification of a drug (as indicated in the "strength of evidence" column) is determined based on the strength of evidence about its harms to the fetus, with D capturing drugs that are likely the most harmful. Column "share in risk set" lists the share of the Swedish population in each guideline's risk set in the reference year; column "share adhering" lists the adherence rate for those without access to expertise. The last row shows the average of age-specific guideline prevalence in the reference year across all ages and guidelines and lifecycle-prevalence weighted average of adherence among those without access to expertise. For regressions involving the guidelines listed in this table, the unit of analysis is the pregnancy.

Figure A1: Distribution of Adherence and Prevalence Rates Across Guidelines

(A) Prevalence Rate

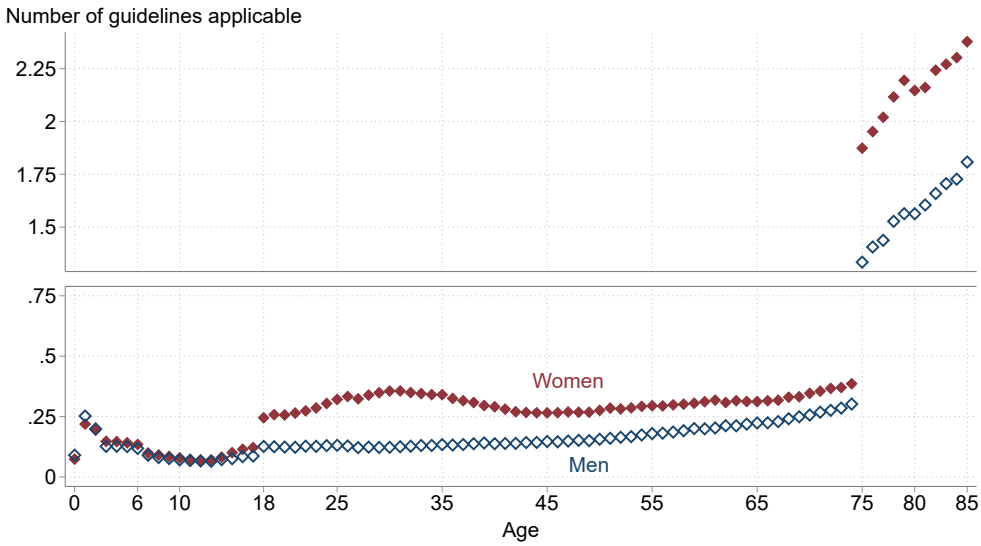


(B) Adherence Rate among Individuals Without Access to Expertise



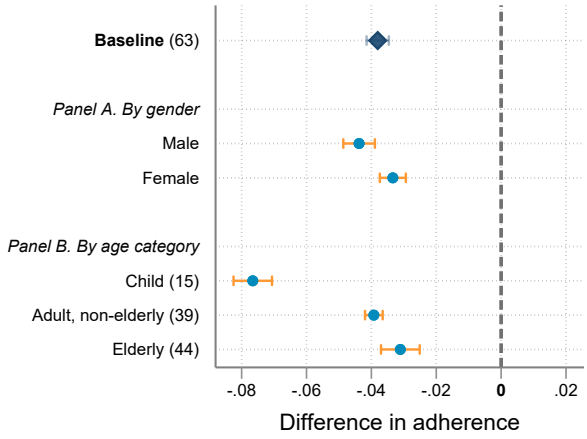
Note: Panel (A) shows the distribution of the prevalence rate (share of population in the risk set) across guidelines. Panel (B) shows the distribution of the adherence rate (share of those in the risk set adhering to the guideline) among those without access to expertise, across guidelines.

Figure A2: Average Number of Guidelines by Age and Gender



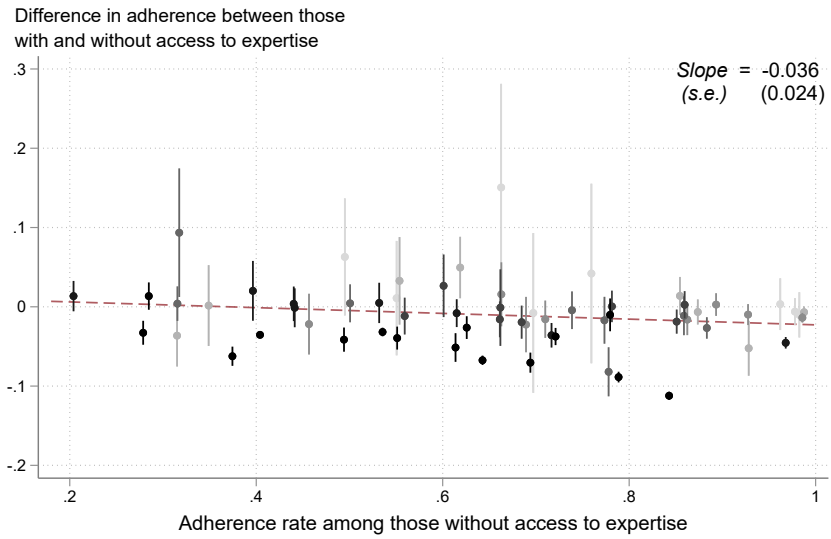
Note: The graph illustrates the number of guidelines applicable to the average female and male at each age from 0 through 85. To construct this number, we compute the prevalence of each guideline (share of individuals in the risk set) in a reference year (2016 or 2017) by age and gender. The plot shows the sum of prevalence across guidelines for each age and gender.

Figure A3: Adherence and Access to Expertise, Averages by Demographic Group



Note: The plot shows the prevalence-weighted average coefficient on access to expertise from the regressions described in Figure 1. Spikes indicate upper and lower bounds of the 95% confidence interval. We bootstrap the estimation with 50 replicates drawn at the patient level, and construct confidence intervals based on the bootstrap standard errors. The prevalence weights are the guideline- and age-specific empirical probabilities of being in the risk set in the reference year. Baseline includes all patients and guidelines. In Panel A, we estimate the regression described in Figure 1 separately by guideline and gender of patient and use gender-specific prevalence weights. In Panel B, we estimate the regression described in Figure 1 separately by guideline and age category of patient. We average the coefficients for each age category (0-17 for children, 18-74 for non-elderly adults, and 75-85 for elderly individuals) across the guidelines applicable to them using age-specific prevalence weights.

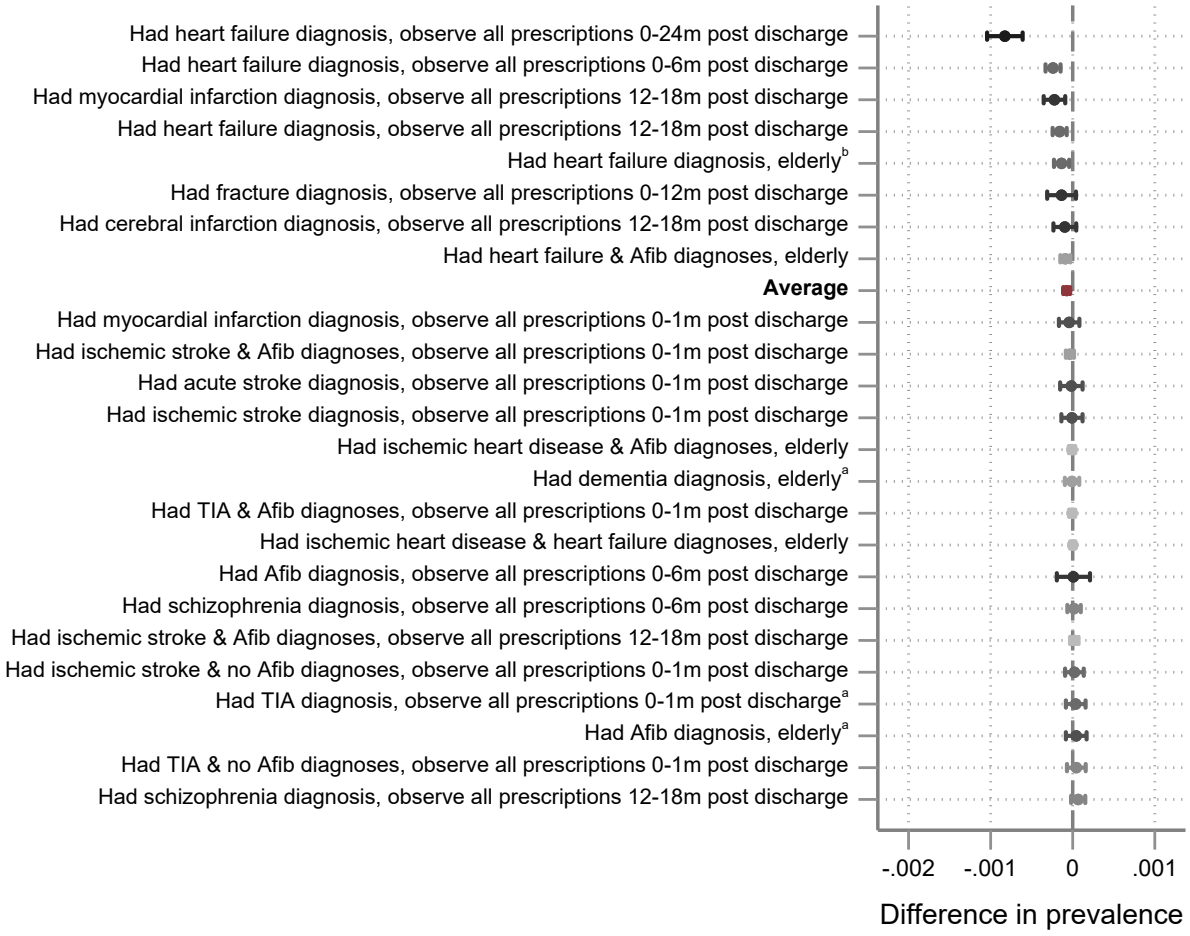
Figure A4: Adherence Gap and Adherence Rate Across Guidelines



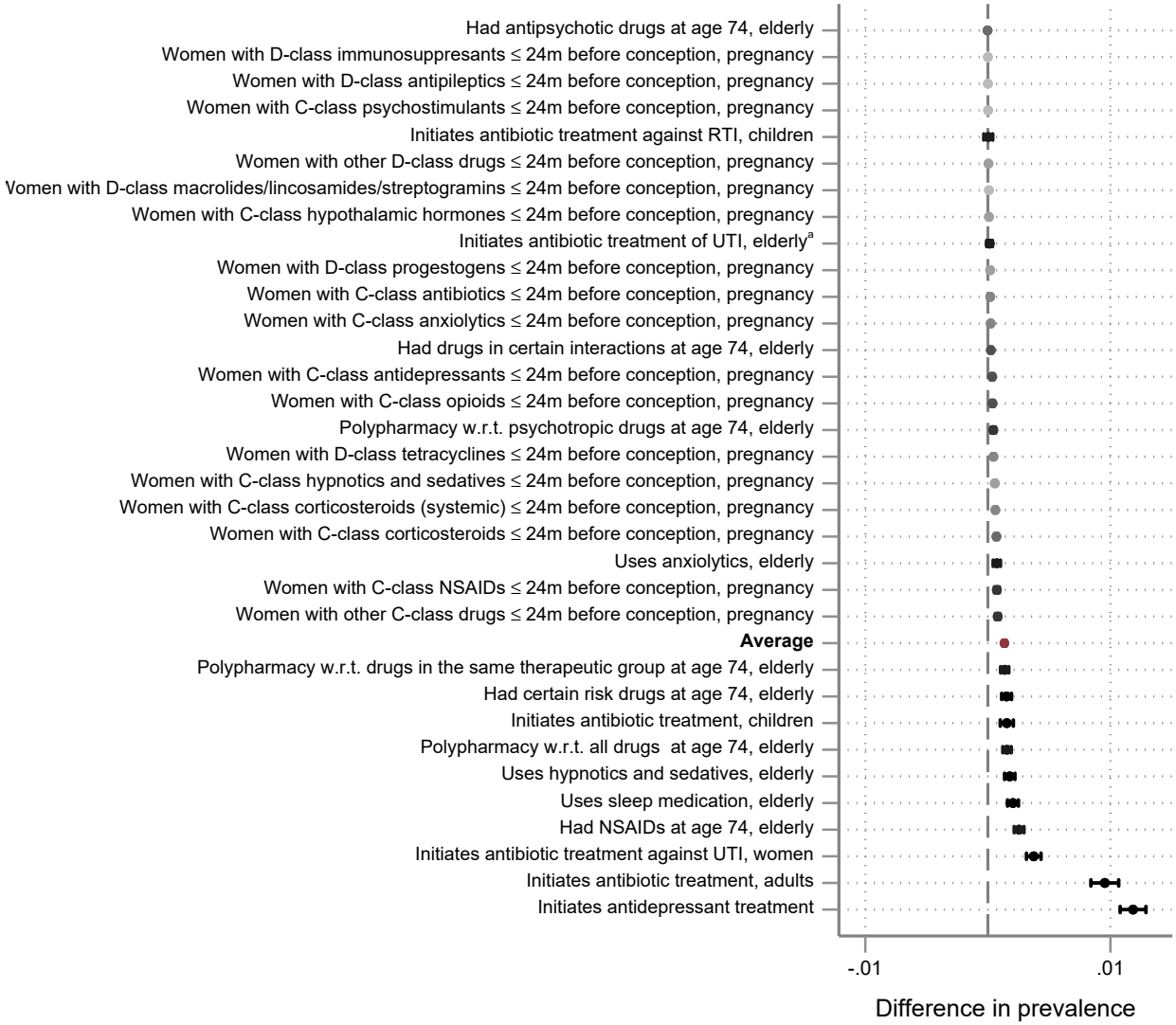
Note: This graph plots, for all 63 guidelines, the estimated difference in adherence between those with and without access to expertise against the share of those without access to expertise adhering to the respective guideline. The estimated difference in adherence is computed as in Figure 1. Spikes indicate 95% confidence intervals of the estimates, computed as in Figure 1. The rate of adherence among those without access to expertise is computed as in Appendix Tables A1-A4. The red dashed line, the slope (and standard error) of which is noted in the top-right corner of the figure, is the line of best fit based on a bivariate regression that weights each guideline equally. The color code represents eight equally-sized bins of guideline prevalence, with darker colors representing higher prevalence.

Figure A5: Prevalence and Access to Expertise, by Guideline

(A) Risk Sets Based on Diagnoses



(B) Risk Sets Based on Use of Medications



Note: For each risk set, we run an OLS regression of an indicator variable for being in the risk set on an indicator for access to expertise and our baseline controls as in Figure 1. The sample is the Swedish population in the reference year. We plot the estimated coefficient on access to expertise together with the 95% confidence interval, computed as in Figure 1. The average difference in prevalence is the simple average of all the coefficients in each panel; we bootstrap the estimation with 50 replicates drawn at the patient level, and construct confidence intervals for the averages based on the bootstrap standard errors. The color code represents the mean prevalence among those without access to expertise, with a darker color representing higher prevalence. Unless otherwise noted, each risk set is associated with one guideline. [a]: the risk set is associated with two guidelines; [b]: the risk set is associated with three guidelines.