

Supplementary Appendix

This appendix has been provided by the authors to give readers additional information about their work.

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Supplementary Appendix

Appendix Table 1. High Risk Medications for the Elderly and Harmful Drugs

A. High Risk Medications for the Elderly

Description	Prescription		
Antianxiety (includes combination drugs)	• aspirin-meprobamate	• meprobamate	
Antiemetics	• scopolamine	• trimethobenzamide	
Analgesics (includes combination drugs)	• ketorolac		
Antihistamines (includes combination drugs)	<ul style="list-style-type: none"> • APAP/dextromethorphan/diphenhydramine • APAP/diphenhydramine/phenylephrine • APAP/diphenhydramine/pseudoephedrine • acetaminophen-diphenhydramine • carbetapentane/diphenhydramine/phenylephrine • codeine/phenylephrine/promethazine • codeine-promethazine • cyproheptadine • dexchlorpheniramine • dexchlorpheniramine/dextromethorphan/PSE • dexchlorpheniramine/guaifenesin/PSE • dexchlorpheniramine/hydrocodone/phenylephrine 	<ul style="list-style-type: none"> • dexchlorpheniramine/methscopolamine/PSE • dexchlorpheniramine-pseudoephedrine • dextromethorphan-promethazine • diphenhydramine • diphenhydramine/hydrocodone/phenylephrine • diphenhydramine-magnesium salicylate • diphenhydramine-phenylephrine • diphenhydramine-pseudoephedrine • hydroxyzine hydrochloride • hydroxyzine pamoate • phenylephrine-promethazine • promethazine 	
Antipsychotic, typical	• thioridazine		
Amphetamines	<ul style="list-style-type: none"> • amphetamine-dextroamphetamine • benzphetamine • dexmethylphenidate 	<ul style="list-style-type: none"> • dextroamphetamine • diethylpropion • methamphetamine • methylphenidate 	<ul style="list-style-type: none"> • phendimetrazine • phentermine
Barbiturates	<ul style="list-style-type: none"> • butabarbital • mephobarbital • pentobarbital 	<ul style="list-style-type: none"> • phenobarbital • secobarbital 	
Long-acting benzodiazepines (includes combination drugs)	<ul style="list-style-type: none"> • amitriptyline-chlordiazepoxide • chlordiazepoxide 	<ul style="list-style-type: none"> • chlordiazepoxide-clidinium • diazepam 	<ul style="list-style-type: none"> • flurazepam
Calcium channel blockers	• nifedipine—short-acting only		
Gastrointestinal anti-spasmodics	• dicyclomine	• propantheline	
Belladonna alkaloids (includes combination drugs)	<ul style="list-style-type: none"> • atropine • atropine/CPM/hyoscyamine/PE/scopolamine • atropine/hyoscyamine/PB/scopolamine • atropine-difenoxin • atropine-diphenoxylate • atropine-edrophonium • belladonna • belladonna/ergotamine/phenobarbital 	<ul style="list-style-type: none"> • butabarbital/hyoscyamine/phenazopyridine • digestive enzymes/hyoscyamine/phenyltoloxamine • hyoscyamine • hyoscyamine/methenam/m-blue/phenyl salicyl 	
Skeletal muscle relaxants (includes combination drugs)	<ul style="list-style-type: none"> • ASA/caffeine/orphenadrine • ASA/carisoprodol/codeine • aspirin-carisoprodol • aspirin-methocarbamol 	<ul style="list-style-type: none"> • carisoprodol • chlorzoxazone • cyclobenzaprine • metaxalone 	<ul style="list-style-type: none"> • methocarbamol • orphenadrine

Oral estrogens (includes combination drugs)	<ul style="list-style-type: none"> • conjugated estrogen • conjugated estrogen-medroxyprogesterone 	<ul style="list-style-type: none"> • esterified estrogen • esterified estrogen-methyltestosterone 	<ul style="list-style-type: none"> • estropipate
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B. Harmful Drugs for Older Adults with Dementia

Tricyclic Antidepressants

Description	Prescription
Psychotherapeutic combinations	<ul style="list-style-type: none"> • amitriptyline-chlordiazepoxide • amitriptyline-perphenazine
Tricyclic antidepressants	<ul style="list-style-type: none"> • amitriptyline • amoxapine • clomipramine • desipramine • doxepin • imipramine • nortriptyline • protriptyline • trimipramine

Anticholinergic Agents

Description	Prescription
Anticholinergic antiemetics	<ul style="list-style-type: none"> • cyclizine • dimenhydrinate • meclizine • scopolamine • trimethobenzamide
Anticholinergic anti-Parkinson agents	<ul style="list-style-type: none"> • benzotropine • trihexyphenidyl
Anticholinergics/antispasmodics	<ul style="list-style-type: none"> • belladonna • dicyclomine • hyoscyamine • propantheline
Antihistamines	<ul style="list-style-type: none"> • azatadine • brompheniramine • chlorpheniramine • clemastine • cyproheptadine • dexchlorpheniramine • diphenhydramine • hydroxyzine hydrochloride • hydroxyzine pamoate • triprolidine
Phenothiazine antiemetics	<ul style="list-style-type: none"> • prochlorperazine • promethazine
Skeletal muscle relaxants	<ul style="list-style-type: none"> • carisoprodol • chlorzoxazone • cyclobenzaprine • metaxalone • methocarbamo • orphenadrine
Upper respiratory combinations	<ul style="list-style-type: none"> • APAP/diphenhydramine/pseudoephedrine • atropine/CPM/hyoscyamine/PSE/scopolamine • brompheniramine/carbetapentane/phenylephrine • brompheniramine/dextromethorphan/phenylephrine • brompheniramine/dextromethorphan/PSE • brompheniramine/DM/guaifenesin/phenylephrine • brompheniramine/DM/guaifenesin/PSE • brompheniramine/DM/phenylephrine • brompheniramine/hydrocodone/phenylephrine • brompheniramine/hydrocodone/pseudoephedrine • brompheniramine-phenylephrine • brompheniramine-pseudoephedrine • carbetapentane/chlorpheniramine/phenylephrine • carbetapentane/CPM/ephedrine/phenylephrine • carbetapentane/diphenhydramine/phenylephrine • carbetapentane-chlorpheniramine • carbetapentane-diphenhydramine • chlorpheniramine-phenylephrine • chlorpheniramine-pseudoephedrine • chlorpheniramine/codeine/PE/K iodide • chlorpheniramine/codeine/pseudoephedrine • chlorpheniramine/dextromethorphan/phenylephrine • chlorpheniramine/dextromethorphan/PSE • chlorpheniramine/dihydrocodeine/phenylephrine • chlorpheniramine/dihydrocodeine/PSE • chlorpheniramine/DM/guaifenesin/phenylephrine • chlorpheniramine/DM/methscopolamine • chlorpheniramine/DM/phenylephrine • chlorpheniramine/guaifenesin/phenylephrine • chlorpheniramine/hydrocodone/phenylephrine • chlorpheniramine/hydrocodone/PSE • chlorpheniramine/methscopolamine/PE • chlorpheniramine/methscopolamine/PSE • chlorpheniramine/PE/phenyltoloxamine • chlorpheniramine/phenylephrine/pyrilamine • chlorpheniramine-hydrocodone • chlorpheniramine-methscopolamine • chlorpheniramine-phenylephrine • chlorpheniramine-pseudoephedrine • codeine/phenylephrine/promethazine • codeine/pseudoephedrine/triprolidine • codeine-promethazine • dexchlorpheniramine/dextrometho/PE/pyrilamine • dexchlorpheniramine/dextromethorphan/PE • dexchlorpheniramine/dextromethorphan/PSE • dexchlorpheniramine/hydrocodone/phenylephrine • dexchlorpheniramine/methscopolamine/PE • dexchlorpheniramine/methscopolamine/PSE • dexchlorpheniramine-pseudoephedrine • dextromethorphan/diphenhydramine/PE • dextromethorphan-promethazine • diphenhydramine/hydrocodone/phenylephrine • diphenhydramine-phenylephrine • hydrocodone/pseudoephedrine/triprolidine • phenylephrine-promethazine • pseudoephedrine-triprolidine
Urinary antispasmodics	<ul style="list-style-type: none"> • butabarbital/hyoscyamine/phenazopyridine • flavoxate • hyoscyamine/methenam/m-blue/phenyl salicyl • oxybutynin • tolterodine

C. Harmful Drugs for Older Adults with a History of Hip Fractures

Table DDE-C: Tricyclic Antidepressants

Description	Prescription
Psychotherapeutic combinations	<ul style="list-style-type: none"> • amitriptyline-chlordiazepoxide • amitriptyline-perphenazine
Tricyclic antidepressants	<ul style="list-style-type: none"> • amitriptyline • amoxapine • clomipramine • desipramine • doxepin • imipramine • nortriptyline • protriptyline • trimipramine

Table DDE-D: Antipsychotics and Sleep Agents

Description	Prescription
Miscellaneous antipsychotic agents	<ul style="list-style-type: none"> • aripiprazole • clozapine • haloperidol • loxapine • molindone • olanzapine • paliperidone • pimozide • quetiapine • risperidone • ziprasidone
Miscellaneous anxiolytics, sedatives and hypnotics	<ul style="list-style-type: none"> • eszopiclone • ramelteon • zaleplon • zolpidem
Phenothiazine antipsychotics	<ul style="list-style-type: none"> • prochlorperazine • chlorpromazine • fluphenazine • mesoridazine • perphenazine • thioridazine • trifluoperazine
Psychotherapeutic combinations	<ul style="list-style-type: none"> • fluoxetine-olanzapine
Thioxanthenes	<ul style="list-style-type: none"> • thiothixene

Table DDE-F: Medications for Dementia

Description	Prescription
Cholinesterase inhibitors	<ul style="list-style-type: none"> • donepezil • galantamine • rivastigmine • tacrine
Miscellaneous central nervous system agents	<ul style="list-style-type: none"> • memantine

Long-acting benzodiazepines

Description	Prescription
Long-acting benzodiazepines (includes combination drugs)	<ul style="list-style-type: none"> • amitriptyline-chlordiazepoxide • chlordiazepoxide • chlordiazepoxide-clidinium • diazepam • flurazepam

D. Harmful Drugs for Older Adults with Chronic Renal Failure

HEDIS Table DDE-I: NSAIDs and Cox-2 Selective NSAIDs

Description	Prescription
Cox-2 inhibitors	<ul style="list-style-type: none"> • celecoxib
Nonsteroidal anti-inflammatory agents	<ul style="list-style-type: none"> • diclofenac potassium • diclofenac sodium • etodolac • fenoprofen • flurbiprofen • ibuprofen • indomethacin • ketoprofen • ketorolac • meclufenamate • mefenamic acid • meloxicam • nabumetone • naproxen • naproxen sodium • oxaprozin • piroxicam • sulindac • tolmetin

Appendix Table 2. Correlation among HEDIS Quality Measures

	Proportion of Elderly Beneficiaries Using High Risk Drugs	Proportion of Elderly Beneficiaries with Dementia Using Harmful Drugs	Proportion of Elderly Beneficiaries with Hip/Pelvic Fractures Using Harmful Drugs *	Proportion of Elderly Beneficiaries with Chronic Renal Disease Using Harmful Drugs	Proportion of Elderly Beneficiaries with At Least one of the Disease Using Harmful Drugs
Proportion of Elderly Beneficiaries Using High Risk Drugs	1	0.75 (p<.001)	0.23 (p<.001)	0.48 (p<.001)	0.75 (p<.001)
Proportion of Elderly Beneficiaries with Dementia Using Harmful Drugs		1	0.20 (p=0.002)	0.45 (p<.001)	0.87 (p<.001)
Proportion of Elderly Beneficiaries with Hip/Pelvic Fractures Using Harmful Drugs *			1	0.15 (p=0.02)	0.38 (p<.001)
Proportion of Elderly Beneficiaries with Chronic Renal Disease Using Harmful Drugs				1	0.74 (p<.001)
Proportion of Elderly Beneficiaries with At Least one of the Disease Using Harmful Drugs					1

Note: * For all the correlations using “proportion of elderly beneficiaries with hip/pelvic fractures using harmful drugs”, only 256 HRRs were used because only 256 HRRs had more than 25 beneficiaries with a history of hip/pelvic fractures. For all the other correlations, 306 HRRs were used.

Appendix Table 3. Correlation between HEDIS Quality Measures and Spending.*

HEDIS Quality Measure	Adjusted Annual Gross Drug Spending per Beneficiary	Adjusted Annual Gross Non-Drug Medical Spending
	correlation coefficient (P value)	
Proportion of elderly beneficiaries using high-risk drugs	0.06 (0.34)	0.30 (<0.001)
Proportion of elderly beneficiaries with dementia using potentially harmful drugs	0.07 (=0.20)	0.24 (<0.001)
Proportion of elderly beneficiaries with hip or pelvic fractures using potentially harmful drugs	0.22 (\leq 0.001)	-0.04 (0.50)
Proportion of elderly beneficiaries with chronic renal disease using potentially harmful drugs	0.00 (0.94)	0.19 (<0.001)
Proportion of elderly beneficiaries with at least one of these conditions using potentially harmful drugs	0.12 (0.04)	0.25 (<0.001)

*Analyses involving the proportion of elderly beneficiaries with hip or pelvic fractures using potentially harmful drugs included only the 256 HRRs with more than 25 beneficiaries who had a history of hip or pelvic fractures. For all the other correlations, all 306 HRRs were used. Less than 1% of total drug spending was devoted to high-risk drugs, and less than 1% was devoted to drugs with potentially harmful interactions with a patient's underlying disease. Correlations to total drug spending are shown here. Correlations to spending on non-high risk and non-harmful drugs are described in text. Correlations are adjusted for age, gender, health status (CMS-HCC or Rx-HCC scores), and in the case of non-drug medical spending, medical price levels.