

**eAppendix: Medication-Related Problems Identified by Pharmacists
 in an Enhanced Medication Therapy Management Model**

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eAppendix Table 1. Excluded SNOMED CT codes

Excluded non-MRP SNOMED CT (“risk factors”)
Chronic disease present (situation)
Deficient knowledge of disease process (finding)
Deficient knowledge of medication regimen (finding)
Inadequate food diet (finding)
Light tobacco smoker (finding)
Multiple chronic diseases (situation)
Occasional tobacco smoker (finding)
Suspected elderly person maltreatment (situation)
Taking medication for chronic disease (finding)
Taking multiple medications for chronic disease (finding)
Under care of multiple providers (finding)
Excluded recommendation SNOMED CT
Assessment of adverse drug reactions (procedure)
Assessment of compliance with medication regimen (procedure)
Assessment of risk of adverse drug interaction (procedure)
Benefits investigation (procedure)
Blood glucose control education (procedure)
Chronic disease process education (procedure)
Discussed with carer (situation)
Discussed with doctor (situation)
Discussed with patient (situation)
Education about risk of fall (procedure)
Education about timing of medication administration (procedure)
Education about use of pill box (procedure)
Financial resource assistance (regimen/therapy)
Medication administration education (procedure)
Medication efficacy education (procedure)
Medication interaction education (procedure)
Medication monitoring education (procedure)
Medication side effects education (procedure)
Pain assessment (procedure)

Pain education (procedure)
Pain medication review (procedure)
Patient referral (procedure)
Patient referral to dietitian (procedure)
Recommendation to continue a medication (procedure)
Recommendation to monitor laboratory results (procedure)
Recommendation to monitor physiologic parameters (procedure)
Recommendation to start medication monitoring (procedure)
Refer for falls assessment (procedure)
Referral for warfarin monitoring (procedure)
Referral to different healthcare provider (procedure)
Referral to financial service (procedure)
Referral to pharmacist (procedure)
Referral to physician (procedure)
Referral to psychologist (procedure)
Referral to service (procedure)
Referral to Social Services (procedure)
Timing of medication administration education (procedure)

MRP, medication-related problem; SNOMED CT, Systematized Nomenclature of Medicine–Clinical Terms.

eAppendix Table 2. Grouping of SNOMED CT by Hepler-Strand Medication-Related Problem Taxonomy

Medication-related problems	n
Adverse drug reaction	14,788
Adverse reaction caused by drug (disorder)	10,831
At risk of medication side effect (finding)	3357
Anticholinergic adverse reaction (disorder)	543
At risk for falls (finding) ^a	43
Allergic reaction to drug (disorder)	11
Nondose-related adverse reaction to medication (disorder)	3
Drug interaction	9716
Adverse drug interaction with drug (disorder)	7100
At risk of adverse drug interaction (finding)	1003
Competitive inhibition, function (observable entity)	792
Adverse drug interaction (disorder)	316
Active ingredient availability decreased due to interaction (finding)	242
Substance induction of cytochrome p450 CYP3A enzyme (finding)	62
Drug inhibition of cytochrome p450 CYP2D6 enzyme (finding)	57
Substance inhibition of cytochrome p450 CYP3A enzyme (finding)	53
Drug inhibition of cytochrome p450 CYP2C9 enzyme (finding)	31
Drug inhibition of cytochrome p450 CYP2C19 enzyme (finding)	27
Adverse drug interaction with food (disorder)	25
Toxic adverse drug interaction with drug (disorder)	5
Adverse drug interaction with tobacco (disorder)	1
Adverse drug interaction with alcohol (disorder)	1
Drug induction of cytochrome p450 CYP2C19 enzyme (finding)	1
Drug use without indication	6496
Medication therapy unnecessary (finding)	4924
Duration of medication therapy too long (finding)	1487
Drug treatment not indicated (situation)	47
Medication taken to treat adverse drug reaction (finding)	25
Patient condition appropriate for non-medication therapy (finding)	13
Untreated/undertreated indication	2553
More effective medication therapy available (finding)	802
Medication not effective (finding)	635
Preventive medication therapy needed (situation)	503
New medication therapy needed for condition (situation)	430
Additional medication therapy required (finding)	129
Additional medication required for additive effect (finding)	37
Additional medication required for synergistic effect (finding)	10
Duration of medication therapy too short (finding)	6
At risk for falls (finding)	1

Dose too high	1945
Medication dose too high (finding)	1780
Medication dosage interval too short (finding)	135
Medication administered too rapidly (finding)	17
Takes medication more frequently than recommended (finding)	10
Medication taken at higher dose than recommended (finding)	3
Dose too low	475
Medication dose too low (finding)	192
Medication dosage interval too long (finding)	185
Takes medication less frequently than recommended (finding)	85
Medication taken at lower dose than recommended (finding)	13
Adherence/cost problem	381
Improper medication administration technique (finding)	78
Financial burden (formulary related) (finding)	67
Cost-effective medication alternatives available (finding)	67
Noncompliance with medication regimen (finding)	33
Financial burden (not formulary related) (finding)	26
Drugs - partial noncompliance (finding)	23
Patient forgets to take medication (finding)	23
Financial problem (finding)	19
Patient refuses to take medication (situation)	16
Patient misunderstood treatment instructions (finding)	12
Patient unable to obtain medication (finding)	11
Patient does not understand why taking all medication (finding)	5
Drugs - total noncompliance (finding)	1
Improper drug selection	101
Patient takes inappropriate over-the-counter medication (finding)	46
Medication dosage form inappropriate (finding)	28
Drug formulation inappropriate (finding)	27

MRP, medication-related problem; SNOMED CT, Systematized Nomenclature of Medicine–Clinical Terms.

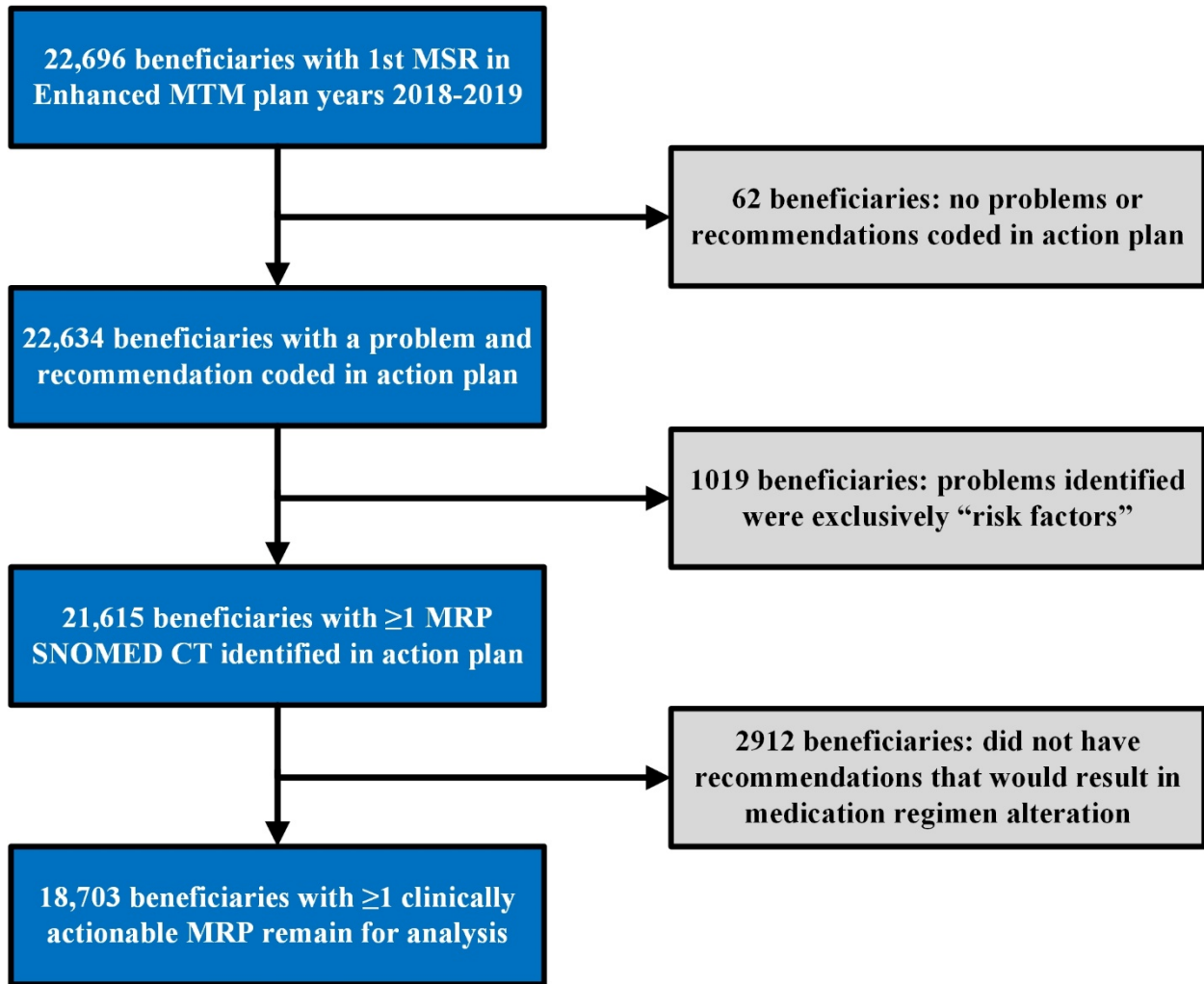
^aThis SNOMED CT was also classified as “adverse drug reaction.” However, it was recommended to start calcium + vitamin D for a patient who was at risk of falls.

eAppendix Table 3. Grouping of SNOMED CT by Hoth et al Recommendation Taxonomy

Recommendations	n
Start alternative therapy	12,219
Recommendation to change medication (procedure)	12,056
Recommendation to change medication to therapeutic equivalent (procedure)	157
Recommendation to change medication to generic equivalent (procedure)	6
Discontinue medication	12,059
Recommendation to discontinue prescription medication (procedure)	8203
Recommendation to discontinue over-the-counter medication (procedure)	3539
Recommendation to discontinue dietary supplement (procedure)	310
Recommendation to discontinue herbal supplement (procedure)	7
Change time of administration	6459
Recommendation to change medication timing of administration (procedure)	6459
Change dose	4393
Recommendation to decrease medication dose (procedure)	3337
Recommendation to increase medication dosing interval (procedure)	600
Recommendation to decrease medication dosing interval (procedure)	259
Recommendation to increase medication dose (procedure)	197
Start medication	1163
Recommendation to start prescription medication (procedure)	818
Recommendation to start over-the-counter medication (procedure)	337
Recommendation to start dietary supplement (procedure)	8
Change dosage form	151
Recommendation to change medication dose form (procedure)	151
Change duration of treatment	10
Recommendation to shorten medication course duration (procedure)	8
Recommendation to shorten medication course (procedure)	2
Recommendation to lengthen medication course (procedure)	1

SNOMED CT, Systematized Nomenclature of Medicine–Clinical Terms.

eAppendix Figure 1. Subject Workflow for Determination of Clinically Actionable Medication-Related Problems



MSR, medication safety review; MTM, medication therapy management; MRP, medication-related problem; SNOMED CT, Systematized Nomenclature of Medicine–Clinical Terms.