Impact of Potential Drug-Drug Interactions on Health Outcomes and Cost to Medicaid: The Monetary Benefits of Quality Care

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BACKGROUND & OBJECTIVE

Drug-drug interactions (DDIs) resulting in increased morbidity and mortality is a widely recognized public health issue. Economic costs related to drug interactions and resultant adverse drug events (ADE) have been estimated at as much as $177.4 billion (Ernst and Grizzle, 2001). The objective of this study was to examine the impact of potential DDIs on health outcomes and the associated cost to the Mississippi Medicaid program.

METHODOLOGY

A retrospective matched cohort study was conducted in Mississippi Medicaid enrollees for years 2002-2004. Enrollees were classified as exposed to a potential DDI if the object and precipitant drugs were possessed concomitantly, with first day of overlap being the DDI event date. Exposed enrollees were matched with those taking object drugs without any overlapping use of a precipitant drug for the potential DDI under consideration, on gender (exact match), age (+/- 10 years), race (exact match), specific comorbidities for which the object drug may be prescribed (exact match), first fill date of the object drug (+/- 45 days), and number of days on object drug (+/- 90 days). Controls were assigned the index date of the potential DDI event for the matched exposed case. Conditional logistic regression was used to analyze the effect on health outcomes (hospitalizations and ER visits within 30 days of potential DDI) and paired t-tests to compare costs to Mississippi Medicaid.

RESULTS

The results of the conditional logistic regressions and t-tests can be viewed in the table on the right. The top DDIs prioritized for potential intervention based on the three primary outcome variables were:

- Increased odds of hospitalization
  - Warfarin with thyroid hormones (odds ratio (OR) = 2.47)
  - Warfarin with amiodarone (OR = 1.78)
  - ACE/ARBs with potassium sparing diuretics (OR = 1.75)
  - Clonidine with beta-blockers (OR = 1.67)
- Increased odds of emergency room visits
  - Warfarin with thyroid hormones (OR = 1.96)
  - Warfarin with amiodarone (OR = 1.71)
  - Warfarin with macrolide (OR = 1.55)
  - ACE/ARBs with potassium sparing diuretics (OR = 1.39)
- Average per patient increase in program costs for hospitalizations and ER visits 30 days post index date
  - Warfarin with amiodarone $302
  - Warfarin with thyroid hormones $206
  - ACE/ARBs with potassium sparing diuretics $187
  - Warfarin with NSAIDs $164

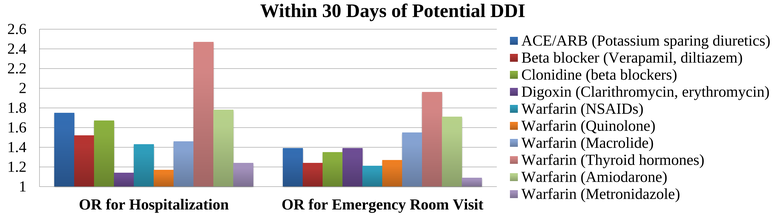
Potential DDI [Object drug (precipitant drugs)]	Beneficiaries at Risk		Odds Ratio for Hospitalization Within 30 Days of Potential DDI*‡	Odds Ratio for Emergency Room Visit Within 30 Days of Potential DDI*‡	Average Per Patient Hospital Payments Within 30 Days of Potential DDI (PPHP) ($)‡		Average Per Patient Emergency Room Payments Within 30 Days of Potential DDI (PPERP) ($)‡	
	Taking Object Drug (% of population)	Potential DDI (% of those taking object drug) ≡			Exposed	Controls	Exposed	Controls
ACE/ARB (potassium sparing diuretics)	10.58	8.06	*1.75 (1.47 – 2.09)*	*1.39 (1.18 – 1.63)*	*198.33*	*74.48*	*112.36*	*48.95*
Beta-blocker (verapamil, diltiazem)	5.97	9.07	*1.52 (1.16 – 1.99)*	1.24 (0.97 – 1.58)	*184.58*	*106.45*	*116.41*	*72.74*
Clonidine (beta-blockers)	2.95	21.30	*1.67 (1.26– 2.21)*	*1.35 (1.06 – 1.73)*	*169.01*	*118.65*	*92.35*	*84.18*
Digoxin (clarithromycin, erythromycin)	2.66	7.17	1.14 (0.78 – 1.67)	1.39 (0.91 – 2.12)	*105.55*	*123.01*	*48.31*	*99.26*
Nitrate (sildenafil, tardalafil, vardenafil)	3.92	< 0.01	-	-	-	-	-	-
Warfarin (all precipitants)	2.50	53.92	-	-	-	-	-	-
Warfarin (NSAIDs)	2.50	13.45	*1.43 (1.13 - 1.82)*	1.21 (0.96 – 1.53)	1630.38	1440.23	1233.63	1259.45
Warfarin (anabolic steroid)	2.50	0.16	-	-	-	-	-	-
Warfarin (quinolone)	2.50	31.75	1.17 (0.98 – 1.40)	*1.27 (1.06 – 1.52)*	*208.13*	*124.78*	*127.32*	*79.18*
Warfarin (macrolide)	2.50	15.08	*1.46 (1.13 – 1.89)*	*1.55 (1.20 - 1.99)*	145.18	162.96	93.94	102.37
Warfarin (sulfonamide)	2.50	0.09	-	-	-	-	-	-
Warfarin (thyroid hormones)	2.50	6.25	*2.47 (1.64 – 3.73)*	*1.96 (1.30 – 2.97)*	*176.66*	*70.63*	*120.49*	*20.16*
Warfarin (cimetidine)	2.50	0.76	-	-	-	-	-	-
Warfarin (amiodarone)	2.50	5.19	*1.78 (1.22 – 2.59)*	*1.71 (1.15 – 2.54)*	*322.39*	*98.72*	139.63	61.66
Warfarin (dicloxacillin)	2.50	0.35	-	-	-	-	-	-
Warfarin (metronidazole)	2.50	2.53	1.24 (0.69 – 2.23)	1.09 (0.64 – 1.85)	340.60	219.96	138.32	136.73
Warfarin (tetracycline)	2.50	0.73	-	-	-	-	-	-
Warfarin (sufinpyrazone)	2.50	0.01	-	-	-	-	-	-

≡ Only potential DDIs in which the risk is > 1% have been used in subsequent analyses.

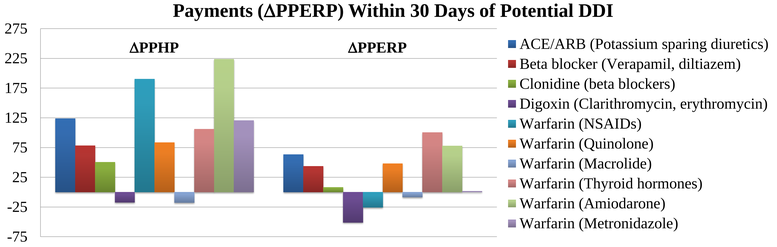
* Odds ratio for beneficiaries classified as exposed compared to those classified as matched controls. Point estimate odds ratio from conditional logistic regression analysis with model including confounder variables, exposed-control classification variable, and outcome variable.

‡ DDI types that have statistically significant differences in the matched control and exposed groups have been italicized.

Odds of Having a Hospitalization or an ER Visit Within 30 Days of Potential DDI



Difference in Average Per Patient Hospitalization (ΔPPHP) and ER Payments (ΔPPERP) Within 30 Days of Potential DDI



CONCLUSIONS

The findings of the study are of importance to researchers and policy makers alike. The general methodology implemented here can be used by researchers to study both, clinical and economic effects of other DDIs. From a policymakers' standpoint, prioritizing development of intervention strategies to reduce incidence of DDIs identified as most harmful in this study will offer an excellent opportunity to cost-effectively improve health and health care quality in the Mississippi Medicaid program.

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