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Medication Days' Supply, Adherence, Wastage, and Cost Among Chronic Patients in Medicaid

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Background: In an attempt to contain Medicaid pharmacy costs, nearly all states impose dispensing limits on medication days' supply. Although longer days' supply appears to increase the potential for medication wastage, previous studies suggest that it may also decrease pharmacy expenditures by reducing dispensing fees and drug ingredient costs. This study was conducted to determine whether 90-day refills at community pharmacies could improve adherence, minimize wastage, and control costs.
Methods: This retrospective observational study used California Medicaid claims, from the Walgreens pharmacy chain dated January 2010, to identify 52,898 patients prescribed statin, antihypertensive, selective serotonin reuptake inhibitor (SSRI), or oral hypoglycemic medications. Adherence was measured by medication possession ratio (MPR) and persistency with a 30-day gap. Medication wastage was defined as a switch of drug or drug strength within the same therapeutic class that occurred before the expected refill date.
Results: Adherence was 20% higher and persistency was 23% higher for the 90-day group than the 30-day group. This amounted to an average increase of 0.14 MPR and 44 days of continuous therapy. The two groups had comparable proportions of patients with wastage. After subtracting an average wastage cost of $7.34 per person per year (PPPY), all therapeutic classes had PPPY savings: statins ($7.70), antihypertensives ($10.80), SSRIs ($18.52), and oral hypoglycemics ($26.86).
Conclusion: Across four drug categories and compared to 30-day refills, patients with 90-day refills had greater medication adherence, greater persistency, nominal wastage, and greater savings.

Keywords: Day Supply; Adherence; Medication Wastage; Drug Utilization; Medicaid; Pharmacy; Un-used Medication
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Introduction

In 2007, Medicaid pharmacy costs were estimated to be over $20 billion, accounting for 10% of total Medicaid expenditures (Bagchi, Verdier, & Esposito, 2011). In an attempt to contain pharmacy costs, the Centers for Medicare & Medicaid Services (CMS) allows states the discretion to set all-inclusive quantity limits applicable to all medications as a tool for controlling potential medication wastage and cost (Smith, 2009). Nearly all states impose dispensing limits on medication days' supply; most have a dispensing limit of 34 days and only 13 states allow up to a 90-day supply for some medications (National Pharmaceutical Council, 2007). However, by setting broad limits, states may not benefit from the advantages of longer days' supply, particularly for patients taking medications for chronic conditions. Notably, in order to reduce drug dispensing costs, the state of Washington mandated that certain maintenance medications be dispensed with a minimum 90-day supply (Smith, 2009).

Based on the literature, transitioning Medicaid beneficiaries with chronic conditions from 30-day to 90-day refills may improve adherence while also controlling total cost. To expand upon prior work, this study was conducted to determine whether 90-day refills at community pharmacies could improve adherence, minimize wastage, and control costs. Medication wastage is the amount of leftover medicine due to a variety of reasons, including: a change in prescription/dose, adverse drug events, poor adherence, repeat filling without checking current supply, or death (Daughton, 2010). This study focuses on Medicaid patients taking statin, selective serotonin reuptake inhibitor (SSRI), oral hypoglycemic, and antihypertensive medications. We explore two hypotheses: 1) patients on 90-day prescriptions will have higher adherence compared to patients on 30-day prescriptions; 2) after accounting for wastage, patients on 90-day prescriptions, compared to patients on 30-day prescriptions, will have lower pharmacy costs.

Methods

This retrospective, observational study identified a cohort of 52,898 California Medicaid (Medi-Cal) patients from Walgreens pharmacy claims data in January 2010 and followed them for 12 months. We limited the cohort to patients filling prescriptions for at least one of four therapeutic classes: statins, antihypertensives, SSRIs, and oral hypoglycemics. We used the Medi-Span Generic Product Identifier (GPI) codes to identify these therapeutic classes. Patients filling prescriptions for these medications represented 45.7% of all Medi-Cal patients filling prescriptions at a Walgreens pharmacy in 2010.

For each of the four therapeutic classes, we categorized patients into two groups based on the days' supply of their prescriptions in January 2010: a 30-day group (days' supply < 84) or a 90-day group (days' supply ≥ 84). Patients with prescriptions in more than one class could be

assigned to more than one group. The actual days' supply was chosen to correspond with the contracted definition of 90-day pricing that applies to prescriptions with greater than or equal to 84 days' supply. The mean days' supply for the 30-day group was 33 days and only 1% had greater than 60 days' supply. The 90-day group had a mean days' supply of 92 days and 1% had greater than 100 days' supply. A review of the copay amounts found that 97% of the prescriptions had a zero copay.

Medication adherence was measured by the medication possession ratio (MPR) and was calculated as the sum of the days' supply for each therapeutic class divided by 365, the number of days in the follow-up period (Cramer et al., 2008). To mitigate the potential impact of patients' days' supply exceeding the measurement period, MPRs greater than 1.0 were truncated to 1.0.

Medication persistency was measured for each therapeutic class as the number of continuous days of therapy without a 30-day gap within the measurement period. Once a patient demonstrated a 30-day gap in therapy, any subsequent days of therapy were not counted (Cramer et al., 2008).

Medication wastage was defined as a switch of drug type or strength within the same therapeutic class that occurred before the expected refill date. Prescriptions within the same class that were filled on the same day were not counted as a switch, but rather an augmentation to therapy. For example, a 10 mg supply and a 20 mg supply filled on the same day were not categorized as wastage, because 30 mg is an accepted dosage for SSRIs. While excessive switching of drugs could appear as wastage, consistent patterns suggest a valid, prescribed treatment regimen. Therefore, we applied additional filters to reduce potential bias or overestimation of wastage. If the difference between the number of drug changes and the number of unique drugs was ≥ 2 for 30-day prescriptions and ≥ 1 for 90-day prescriptions, then we considered the change in drugs/doses to be concomitant and hence not a switch. This methodology for wastage is an enhancement to other previous methodologies, because usage patterns were assessed to identify concomitant or non-standard therapies.

The mean days of wastage and the proportion of patients with wastage were calculated for each group by therapeutic class. We used Student's *t*-tests to compare the differences between the 30-day and 90-day groups. We examine these differences after controlling for age, gender, comorbidity, and new-to-therapy status using analysis of covariance. Comorbidity was measured as the number of comorbid conditions using the Chronic Illness and Disability Payment System (CDPS) risk profiler (University of California, 2011). New-to-therapy was defined as the absence of a prescription claim for the respective therapeutic class in 180 days prior to the January 2010 claim.

We conducted a savings opportunity analysis to estimate the per patient per year (PPPY) savings that could result if the 30-day prescriptions had been filled according to the 90-day profile. The claims from the 30-day group were assigned the average price observed for the same drug class in the 90-day group. We calculated gross savings as the 30-day cost per day minus the

90-day cost per day multiplied by the total number of days' supply in the 30-day group. Likewise, we projected wastage days by assigning the 30-day group the average waste per day observed in the 90-day group. Wastage cost was calculated as the wastage days multiplied by the average daily cost of the 90-day group. Finally, we calculated net savings as gross savings minus wastage cost.

In addition, we adjusted the savings opportunity results using analysis of covariance to control for group differences in age, gender, and comorbidity, because observed group differences on these factors could influence their medication usage (Farley, Harley, & Devine, 2006). Our analysis showed new-to-therapy status to be associated with both wastage days and adherence. Further, as the savings calculation was an opportunity analysis we stratified on new-to-therapy status (Gagne, Polinski, Avorn, Glynn, & Seeger, 2012) to analyze the difference in savings between the two groups. Statistical significance was assessed at the alpha=0.05. All data analysis was performed with SAS software (SAS Institute Inc., Cary NC).

Results

A total of 52,898 unique individuals met the study criteria. Exhibit 1 contains patient demographic information for each therapeutic class. Across the four therapeutic classes, patients were significantly younger in the 30-day group, with average ages between 42–55 years, compared to the 90-day group, with average ages between 51-60 years ($p < .001$). The overall percentage of males was 38% for the 30-day group and 40% for the 90-day group. In the 90-day group, there were statistically higher percentages of males in the antihypertensive ($p < .05$) and statin ($p < .01$) therapeutic classes. Compared to the 30-day group, the average number of comorbidities in the 90-day group was higher for SSRIs (6.8 vs. 6.1; $p < .001$) but lower in the statins (6.2 vs. 6.5; $p < .001$), antihypertensives (5.9 vs. 6.0; $p < .01$), and oral hypoglycemic agents (6.2 vs. 6.5; $p < .01$). There was a greater proportion of new-to-therapy patients in the 90-day group for statins and antihypertensives (15.9% vs. 11.5%; $p<.001$) and hypertensives (12.4% vs. 10.1%; $p<.01$) Due to these significant findings, subsequent analyses controlled for age, gender, comorbidity, and new-to-therapy status.

Across all therapeutic classes, adherence was 20% ($p < .001$) higher for the 90-day group compared to the 30-day group. These differences persisted after controlling for age, gender, number of comorbidities, and new-to-therapy status. Exhibit 2 presents the MPR for each group by therapeutic class. In the unadjusted 90-day group, all drug classes had MPR results greater than or equal to the clinically important 80% level (Cramer et al., 2008). In contrast, adherence in the 30-day group was consistently lower than 80%. In addition, all drug classes had a significantly higher MPR in the 90-day group ($p < .001$); after adjustment, antihypertensives had the highest adherence (0.83) while SSRIs had the lowest adherence (0.74).

Exhibit 1. Demographics comparing patients with 30-day versus 90-day refills by therapeutic class

	N		Average Age			% Male			Comorbidities			New-to-Therapy		
Therapeutic Class	30d	90d	30d	90d	*p*	30d	90d	*p*	30d	90d	*p*	30d	90d	*p*
Antihypertensives	33,009	5,835	51	59	<.001	39%	40%	<.05	6.0	5.9	<.01	10.6%	10.0%	NS
Statins	12,136	2,162	55	60	<.001	40%	44%	<.01	6.5	6.2	<.001	11.5%	15.9%	<.001
SSRIs	7,017	266	42	51	<.001	28%	24%	NS	6.1	6.8	<.001	14.9%	16.2%	NS
Hypoglycemics	11,841	1,511	53	58	<.001	37%	38%	NS	6.5	6.2	<.01	10.1%	12.4%	<.01

NOTE. 30d = patients on 30-day refill; 90d = patients on 90-day refill. Hypoglycemics were limited to oral, non-insulin agents.
NS = non-significant at $p < .05$ level. Number of comorbidities calculated from pharmacy claims using CDPS disease algorithms. New-to-therapy was defined as the absence of a prescription claim for the respective therapeutic class in 180 days prior to the January 2010 claim.
SOURCE: Walgreens pharmacy claims data, January 2010–January 2011.

Exhibit 2. Comparison of Medication Possession Ratio (MPR) across days' supply groups by therapeutic class

	n		Unadjusted			Adjusted		
Therapeutic Class	30d	90d	30d	90d	*p*	30d	90d	*p*
Antihypertensives	33,009	5,835	0.77	0.91	<.001	0.71	0.83	<.001
Statins	12,136	2,162	0.68	0.81	<.001	0.62	0.77	<.001
SSRIs	7,017	266	0.61	0.82	<.001	0.56	0.74	<.001
Hypoglycemics	11,841	1,511	0.75	0.87	<.001	0.69	0.80	<.001

NOTE. Hypoglycemics were limited to oral, non-insulin agents. 30d = patients on 30-day refill; 90d = patients on 90-day refill. Adjusted by age, gender, number of comorbidities, and new-to-therapy status.
SOURCE: Walgreens pharmacy claims data, January 2010–January 2011

Exhibit 3. Persistency across days' supply groups by therapeutic class

	n		Unadjusted			Adjusted		
Therapeutic Class	30d	90d	30d	90d	*p*	30d	90d	*p*
Antihypertensives	33,009	5,835	229	276	<.001	200	242	<.001
Statins	12,136	2,162	219	262	<.001	195	237	<.001
SSRIs	7,017	266	194	257	<.001	172	228	<.001
Hypoglycemics	11,841	1,511	220	265	<.001	195	235	<.001

NOTE. Persistency is the average number of days on therapy without a 30-day gap. Hypoglycemics were limited to oral, non-insulin agents. 30d = patients on 30-day refill; 90d = patients on 90-day refill. Adjusted by age, gender, number of comorbidities, and new-to-therapy status.
SOURCE: Walgreens pharmacy claims data, January 2010 – January 2011

Similarly, across all therapeutic classes, persistency was 23% ($p < .001$) higher for the 90-day group compared to the 30-day group. There was an additional average of 44 days on therapy for the 90-day group compared to the 30-day group. These differences were also observed after controlling for age, gender, number of comorbidities, and new-to-therapy status. Exhibit 3 presents persistency by group and therapeutic class as measured by continuous days of therapy without a 30-day gap. Antihypertensives had the highest persistency after adjustment (242 average days of therapy) while SSRIs had the lowest persistency (228 average days of therapy).

All four classes showed a greater number of wastage days in the 90-day group; however, none of the groups showed a statistically significant difference in the percentage of patients who had at least one day of medication wastage (Exhibit 4). This was true for both new-to-therapy and existing therapy patients.

As seen in Exhibit 5A, the savings opportunity for patients converting from a 30-day to a 90-day supply was positive for all therapeutic classes. After removing the cost of wastage, the adjusted net savings PPPY was $7.70 for statins, $10.80 for antihypertensives, $18.52 for SSRIs, and $26.86 for oral hypoglycemics. Overall, patients converting from a 30-day to a 90-day supply had a projected gross savings of $21.29 after adjusting for the effects of age, gender, and comorbidity. With a wastage cost of $7.34, the projected overall net savings was $13.95 PPPY. Additionally, the existing therapy patients had a higher net savings ($14.92 PPPY) than the new-to-therapy patients ($5.63 PPPY net savings) after adjusting for age, gender, and number of comorbidities (Exhibit 5B).

Exhibit 4 Comparison of medication wastage results across days' supply groups by therapeutic class

	Percent of Patients with Wastage			Average Wastage Days		
Therapeutic Class	30d	90d	*p*	30d	90d	*p*
All Patients						
Antihypertensives	11.9	12.2	NS	4.0	9.2	<.001
Statins	9.1	9.8	NS	2.3	5.8	<.001
SSRIs	13.9	14.7	NS	3.5	10.4	<.001
Hypoglycemics	10.6	11.6	NS	3.3	7.9	<.001
New-to-Therapy Patients						
Antihypertensives	17.0	17.4	NS	5.2	12.6	<.001
Statins	9.9	12.0	NS	2.2	6.8	<.001
SSRIs	17.5	16.3	NS	3.4	14.9	<.001
Hypoglycemics	14.4	15.4	NS	3.4	10.6	<.001
Existing Therapy Patients						
Antihypertensives	11.2	11.7	NS	3.9	8.8	<.001
Statins	9.0	9.4	NS	2.3	5.6	<.001
SSRIs	13.3	14.4	NS	3.5	9.6	<.001
Hypoglycemics	10.2	11.9	NS	3.3	7.5	<.001

NOTE. 30d = patients on 30-day refill; 90d = patients on 90-day refill; NS = non-significant at $p < .05$ level. New-to-therapy and existing therapy were defined as the absence or presence of a prescription claim for the respective therapeutic class in 180 days prior to the January 2010 claim.

SOURCE: Walgreens pharmacy claims data, January 2010–January 2011

Exhibit 5A. Savings opportunity PPPY for converting 30-day prescriptions to 90-day prescriptions after accounting for wastage costs by therapeutic class

Therapeutic Class	Unadjusted			Adjusted		
	Gross Savings	Wastage Cost	Net Savings	Gross Savings	Wastage Cost	Net Savings
Antihypertensives	$15.89	$5.51	$10.38	$16.49	$5.69	$10.80
Statins	$14.40	$7.00	$7.40	$14.97	$7.27	$7.70
SSRIs	$31.60	$13.12	$18.48	$32.98	$14.46	$18.52
Hypoglycemics	$34.30	$8.17	$26.13	$35.17	$8.31	$26.86
Overall	$20.65	$7.11	$13.54	$21.29	$7.34	$13.95

NOTE. PPPY = per patient per year. Adjusted by age, gender, and number of comorbidities.
SOURCE: Walgreens pharmacy claims data, January 2010–January 2011

Exhibit 5B. Stratification of savings opportunity PPPY for converting 30-day prescriptions to 90-day prescriptions after accounting for wastage costs by therapeutic class and therapy status

Therapeutic Class	New-to-Therapy			Existing Therapy		
	Gross Savings	Wastage Cost	Net Savings	Gross Savings	Wastage Cost	Net Savings
Antihypertensives	$9.77	$6.71	$3.06	$17.24	$5.60	$11.64
Statins	$7.45	$8.22	($0.77)	$15.93	$7.21	$8.72
SSRIs	$22.25	$12.12	$10.13	$34.73	$14.78	$19.95
Hypoglycemics	$25.44	$8.37	$17.07	$36.21	$8.35	$27.86
Overall	$13.64	$8.01	$5.63	$22.21	$7.29	$14.92

NOTE. PPPY = per patient per year. Adjusted by age, gender, and number of comorbidities. New-to-therapy and existing therapy were defined as the absence or presence of a prescription claim for the respective therapeutic class in 180 days prior to the January 2010 claim.
SOURCE: Walgreens pharmacy claims data, January 2010–January 2011.

Discussion

This study shows that medication adherence and persistency was significantly higher in Medicaid patients on 90-day prescriptions than for those on 30-day prescriptions. This finding is especially relevant to Medicaid patients with chronic conditions who often face major socioeconomic challenges that affect their ability to remain adherent to their medications. Almost half (45%) of Medicaid beneficiaries have three or more chronic conditions, and these individuals account for 75% of total costs. Three of the most prevalent chronic conditions among Medicaid beneficiaries are cardiovascular disease (CVD), psychiatric illness, and diabetes, and patients often have multiple comorbidities (Kronick, Bella, & Gilmer, 2009). Compounding their high burden of disease, Medicaid populations have lower income, lower literacy rates, poorer nutrition, less access to transportation, are more transient, and have a higher prevalence of homelessness than commercially insured populations (Landon, Tobias, & Epstein, 1998; Raven, Billings, Goldfrank, Manheimer, & Gourevitch, 2009; Wachino, 2007).

Given their combined burden of disease and socioeconomic challenges, individuals with chronic conditions enrolled in Medicaid are prone to poor medication adherence in which they do not take their medication as prescribed (Nichol, Knight, Priest, Wu, & Cantrell, 2010).

Between 2002 and 2004, non-adherence ranged from 41% for patients with diabetes to 69% for patients with hypertension (Nichol et al., 2010). Further, poor adherence to medication is associated with high hospitalization costs (Sokol, McGuigan, Verbrugge, & Epstein, 2005). Consequently, providing cost effective, high-quality health care to this vulnerable population is challenging. While a monthly refill schedule may be challenging for Medicaid beneficiaries, quarterly refills at a retail pharmacy can provide both convenience and the opportunity to interact with a healthcare professional. In the past, 90-day prescriptions have been supplied predominantly by mail-order pharmacies. However, pharmacy benefit plans are increasingly offering the option of 90-day prescriptions at retail pharmacies (Motheral, 2011). Increasing days' supply improves cost effectiveness by decreasing administrative dispensing costs and allowing for drug ingredient volume discounts (Frank, 2001; Walton, Arondekar, Johnson, & Schumock, 2001). Improved medication adherence should translate into improved health and eventually lower healthcare costs.

Evidence in the literature is inconclusive regarding whether increasing days' supply will increase medication wastage (Daughton, 2010; Paterson & Anderson, 2002). At first glance, longer days' supply appears to add cost to the healthcare system by increasing the potential for medication wastage. However, previous studies suggest that while longer days' supply may increase wastage, it may also decrease pharmacy expenditures by reducing dispensing fees and drug ingredient costs (Vuong, Fenrick, Starner, Gunderson, & Gleason, 2011; Walton et al., 2001; White, 2010). For example, using data from the Veterans Administration's Chicago Health Care System, Walton et al. found higher wastage, but lower unnecessary costs, in 90-day fills compared to 30-day fills (Walton et al., 2001). In addition, an analysis of commercial claims for statins found greater wastage but lower total costs in 90-day compared with 30-day supply (Vuong et al., 2011). Furthermore, a study conducted in the United Kingdom found that improved prescribing efficiencies (e.g., increased use of generics and decreased overprescribing) may have reduced the cost of medications to a level at which the dispensing fees for monthly fills are greater than the potential wastage cost of longer fills (White, 2010).

In the present study, the proportion of patients who had *any* medication wastage was similar for both 30-day and 90-day groups. However, as expected, patients on 90-day prescriptions had a greater number of medication wastage days than patients on 30-day prescriptions. These results are similar to previous research on medication wastage. The average number of waste days among statin patients in both the 30-day and 90-day groups were slightly higher (2.3 and 5.8 days, respectively) compared with average waste days reported in a large commercial population (1.7 and 4.0 days, respectively; Vuong et al., 2011). Further, the percent of patients with at least one waste day was higher in the current study (9.1%, ranging from 9.0% for existing therapy patients to 9.9% for new-to-therapy patients) than the 7.8% reported by Vuong et al. (2011). Unlike the comparison study, the present study focused on a Medicaid population and controlled for potential differences between the 30-day and 90-day groups on age, gender, comorbidity, and new-to-therapy status.

While other research has shown the advantages of 90-day fills, limited research has addressed the implications of wastage and wastage cost. The results of this analysis show that despite greater medication wastage days, the 90-day group did not have a significantly greater percentage of patients with drug wastage compared to the 30-day group. Finally, after accounting for the cost of medication wastage, and the benefit of reduced fees and volume discounts, the 90-day group had significantly greater savings.

Limitations & Recommendations

A limitation of this study is its reliance on pharmacy claims to estimate medication use. While measuring adherence or wastage using pharmacy claims is a standard method, it is only a proxy for actual medication use; we do not know if the patient actually ingested the medication. Thus, lack of direct observation may result in artificially higher medication adherence estimates, especially in the 90-day group. Further studies to validate these estimates could be performed, such as patient self-report through standardized and validated questionnaires, counting the number of pills remaining in a patient's supply at follow-up visit, or measuring the concentration of a drug in the blood of a patient. Additional enhancements to wastage methodology might include advanced cluster analysis and neural networks, where the algorithm can be trained to identify multiple drug regimen patterns to better assess true wastage.

We selected medications used to treat the most prevalent chronic conditions in Medicaid (Kronick et al., 2009). However, SSRIs, typically used to treat depression, may have a planned discontinuation of therapy, which may partially explain why this therapeutic class had the lowest medication adherence and persistency.

Although the observable adjustment variables (e.g., age, gender, comorbidity, and new-to-therapy status) control for potential influences on medication adherence, a major limitation to the study is that other unobserved residual confounders could have influenced the results. For example, a previous study suggests that patient cost sharing (copay) can influence medication adherence (Eaddy, Cook, O'Day, Burch, & Cantrell, 2012). However, the study population consisted entirely of California Medicaid patients, and 97% of the prescriptions had a zero copay amount. Therefore, the homogeneity of the study population in this regard mitigated potential bias. Ethnicity has also been demonstrated to influence medication adherence (Opolka, Rascati, Brown, & Gibson, 2003). Due to our data limitations, we could not identify patient ethnicity.

In addition, this study assumed that the 90-day profile would be valid for individuals who switched from 30-day fills to 90-day fills in terms of their projected wastage. Readers should understand that the savings model is based on a "what if" scenario of the actual California Medicaid study population.

Data for this study were from Walgreens pharmacy claims only, and Medicaid eligibility data were not available. Therefore, patients who filled some of their medications at other

pharmacies or had changes to their eligibility may appear to have lower adherence. However, wastage is determined when patients switch medications and are eligible at the time of the fill. This should have minimal differential impact to the study groups.

Finally, this study focused on four therapeutic classes in a California Medicaid population; therefore, results for other therapeutic classes or populations may differ. Further studies examining medication adherence and wastage in additional therapeutic classes and populations should be conducted.

Conclusion

After controlling for age, gender, comorbidity, and new-to-therapy status, adherence to maintenance medications was higher among California Medicaid patients with 90-day compared to 30-day prescriptions. Although the 90-day group had greater wastage days, the overall percentage of patients with medication wastage between the groups was not statistically different. Moreover, the cost of medication wastage was offset by the overall savings.

Estimated savings resulting from the use of 90-day rather than 30-day prescriptions ranged from $7.70 to $26.86 PPPY for the four therapeutic areas assessed. These savings were based on reductions in pharmacy costs and did not include expected savings in medical spending associated with improved adherence (Sokol et al., 2005). Considering California's budget crisis (Zirker, Gershon, & Swain, 2010), expanding the availability of 90-day prescriptions to the large number of chronic patients in California Medicaid would provide substantial financial relief.

Disclaimer

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