

Changing Medication Use in Managed Care: A Critical Review of the Available Evidence

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Objective: To review the effectiveness of strategies to improve the quality and efficiency of medication use in managed care organizations (MCOs).

Study Design: Systematic review of published intervention studies.

Methods: Studies were identified by using computerized and manual literature searches and personal contacts, and were categorized by intervention type and adequacy of research design according to commonly accepted criteria. Reported significance and magnitude of the changes in key outcomes were used to summarize the effects of studies with adequate research designs.

Results: The searches identified 105 studies, 70 of which were reported since 1996. Overall, 46% of the studies met the minimum criteria for methodologic adequacy (n = 48). Consistently effective interventions included dissemination of educational materials with drug samples, participatory clinical guideline development, group or one-to-one educational outreach, and enhanced patient-specific feedback. Disease management (primarily for depression and diabetes) showed promise in improving short-term outcomes. Dissemination of educational materials and aggregated feedback alone were ineffective. Interventions in staff-model health maintenance organizations were more effective than those conducted in group-model health maintenance organizations.

Conclusion: High-quality studies of interventions to improve drug use in MCOs are increasing in frequency. There is evidence for the effectiveness of several strategies to change drug use, but little is known about longer-term clinical outcomes. Few well-designed, published studies have assessed the efficacy or safety of financial incentives for physicians, tiered copayments for patients, or formularies—despite their widespread use.

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with more than 200 million enrollees¹ and more than 90% of physicians having some form of managed care contract.²

One significant challenge facing MCOs today is controlling rising medical costs without denying or limiting access to care that improves health outcomes. Medication expenses, driven by increased ingredient costs per prescription and higher utilization, account for as much as 15% of the total medical costs of some health plans.¹ A variety of approaches have been used by MCOs to improve the quality of medication use and contain escalating medication costs.

Managed care organizations have established financial arrangements that shift drug costs and risk from health plans to members and providers. In recent years, health plans have moved from fixed copayment structures to 3-tier pharmacy benefit designs, where members incur the lowest out-of-pocket costs for generic drugs, higher costs for preferred brand names, and the highest costs for nonpreferred medications. The proportion of health plans offering a 3-tiered design rose from 36% in 1996 to 83% in 2001, the most pronounced change in pharmaceutical benefits management in that period.³ In contrast, fewer than 25% of HMOs used incentive-based financial contracting to influence physician prescribing in 2001, a decline of approximately 20% since

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For editorial comment, see page 711.

The structure of the US healthcare system has changed rapidly over the last few decades. Managed care organizations (MCOs), including health maintenance organizations (HMOs) and preferred provider organizations (PPOs), now dominate the marketplace,

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1999.¹

Most MCOs use formularies to control medication use.^{1,4} Under certain circumstances, MCOs will pay for nonformulary medications. However, 84% of HMOs require physicians to obtain prior authorization to prescribe these medications.¹ Some form of generic substitution is used in 86% of HMOs; and stepped-therapy protocols, which require patients to try older, lower-cost drugs in a therapeutic class before resorting to newer, higher-cost alternatives, are used by 76%.¹ Therapeutic interchange, the substitution of a therapeutically equivalent drug for the one prescribed, is increasing in popularity and is used by approximately half of HMOs.^{1,4}

Managed care organizations also are strengthening efforts to monitor and educate physicians to improve the quality of prescribing. Approximately two thirds use physician profiling (peer comparison feedback) in conjunction with recommendations for changes in practice.⁵ Most education is targeted at high-cost physicians and frequently involves in-person pharmacist consultations. A number of plans also have launched member education programs to influence patients' demand for pharmaceuticals.⁶

Finally, many plans are introducing or expanding disease management interventions designed to improve care delivery and health outcomes for high-cost, high-risk populations.⁷ At least one quarter of Americans are enrolled in plans offering disease management programs, which most commonly focus on diabetes, asthma, and congestive heart failure.⁸ Although not viewed as a primary strategy for containing pharmaceutical costs, these programs frequently shift patterns of use of key medications.⁶

More than 80% of MCOs evaluate quality improvement initiatives on a regular basis,^{5,8} but anecdotes about the impacts of these efforts far outweigh solid evidence. The aims of this review are:

- To describe interventions to improve the quality and efficiency of medication use in the US managed care setting.
- To detail the key features of the interventions.
- To summarize the effects of the studies with methodologically acceptable designs.
- To identify intervention strategies that appear to be most successful in changing outcomes.

METHODS

Search Strategy

We performed a systematic review of published and unpublished studies of interventions to improve the quality or efficiency of medication use in MCOs. Studies

were included in the review if they were conducted in the US managed care setting (all forms of HMOs, independent practice associations [IPAs], and PPOs); described an intervention or policy targeting drug use (including over-the-counter medications or herbals); included a clear description of methods; and measured drug-related outcomes. Clinical effectiveness trials of medications, descriptive studies, and those examining vaccinations were excluded.

We searched computerized retrieval systems (including Medline, Healthstar, Current Contents, Cochrane Collaboration, EMBASE, ASI, IPA, and the International Network for Rational Use of Drugs [INRUD] database) from 1966 through June 2001. We combined search terms that characterized the study setting (eg, managed care programs, HMOs, PPOs), drug use (eg, prescription and nonprescription drugs, drug therapy, drug utilization, drug monitoring, herbals, vitamins), health professions and practice patterns (eg, physician, physician practice patterns, pharmacist, clinical pharmacy, pharmacy services, nurses), intervention types (eg, formulary, disease and disease management, education, practice guidelines, cost containment, quality assurance/improvement, risk sharing, reimbursement mechanisms) and methodology (eg, intervention studies, randomized controlled trials [RCTs], program evaluation, health services research, comparative studies). We also hand-searched tables of contents of journals not included in the computerized databases, as well as reference lists from reviews and included studies.

Rating Study Quality

We abstracted important features of each study, including setting, objective(s), problem(s) addressed, intervention components, predominant intervention strategy, intervention target(s), and up to 3 primary outcome measures identified by the authors (an additional drug-related outcome was included if the primary outcomes were not drug related). We expressed study outcomes as either absolute or relative changes, depending on the original measurement scale. Outcomes measured as percentages were expressed as absolute differences in percentage; for other outcomes, measured as rates or scores, differences were expressed as relative changes (also stated as percentages).

We classified the research designs of the reviewed studies according to their ability to control for common threats to validity.⁹ Designs that met our definition for methodologic adequacy included RCTs, pre/post studies with nonrandomized comparison group(s), and interrupted time series analysis with or without a comparison group. Designs deemed methodologically inadequate included pre/post studies without a compar-

Table 1. Included Studies According to Key Features and Predominant Intervention Strategy

Study Type	Number of Studies				
	Educational	Monitoring and Feedback	Disease Management	Formulary Change	Financial
All studies	33	20	33	13	6
Acceptable studies	10	9	25	4	1
Acceptable interventions*	11	11	18	4	1
Educational					
Educational materials only	28	8	19	3	0
Educational materials and drug samples	3	1	0	0	0
Group education	20	7	19	2	0
Participatory guideline development	16	4	8	0	0
One-to-one educational outreach	14	3	7	1	0
Monitoring and feedback					
Aggregated feedback	9	7	3	3	1
Patient-specific feedback	2	14	3	1	0
Disease management					
	6	2	33	0	0
Formulary change					
	1	3	0	13	1
Financial incentives					
	0	1	0	0	6

*Studies may have examined more than 1 intervention, and multiple studies may have examined the same intervention.

ison group, nonrandomized post-only designs, and cross-sectional studies. In addition, pre-post designs with comparison groups were required to statistically test differences in change between groups. Finally, we required sample sizes of at least 20 subjects in each comparison group to increase the reliability of reported findings.

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RESULTS

Studies Identified

We identified 105 studies that met our inclusion criteria, of which 48 (46%) met the minimally acceptable methodologic criteria. Intervention studies are being published with increasing frequency; 70% of all studies and 58% of acceptable studies were published since 1996. The majority of studies were conducted in staff, group-, and mixed-model settings; only 7 studies were conducted in IPA and network-model organizations.

Features of Studies

Studies were classified according to predominant strategy and key components of the intervention (Table 1). Disease management and educational studies each accounted for 31% of studies, and monitoring and feedback interventions accounted for another 19% of

studies. Despite the almost universal use of formularies or financial strategies,¹ studies evaluating such policies were relatively few (12% and 6% of all studies, respectively). Interventions almost always were multimodal.

Twenty-five studies of disease management, 10 of educational interventions, and 9 of monitoring and feedback met minimum criteria for methodologic adequacy. Acceptable studies of formulary changes and financial strategies were too few (4 formulary and 1 financial) to draw valid conclusions, and were excluded from further analysis. Table 2 summarizes the key aspects of the 48 interventions evaluated in the 44 published studies.

Educational Interventions

Dissemination of Educational Materials Alone. The dissemination of educational materials alone (eg, newsletters, drug bulletins, audiovisual materials) is a common intervention and assumes that rational information is sufficient to change behavior. Two interventions evaluated the effects of such programs. The first aimed to improve patient compliance with a range of cardiac risk reduction therapies (benazepril, metoprolol, simvastatin, and transdermal estrogen) by mailing videotapes about prescribed medications and associated disease states.¹⁰ The second attempted to decrease total

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Table 2. Key Features of 48 Methodologically Acceptable Studies*

Authors	Design and Focus	Target Group and Setting	Goal(s)	Intervention(s)	Key Outcomes	Magnitude of Effect (%) [†]
Educational Interventions						
<i>Educational materials alone</i>						
Powell and Edgren 1995 ¹⁰	RCT Medication compliance	4246 patients from large Midwest HMO	Increase compliance with drug therapy using mailed educational videotapes	One of four mailed videotapes on cardiac risk medication	<ul style="list-style-type: none"> • % Days of overall drug supply • % Compliant subjects 	0 +2
Gonzales et al 1999 ¹¹	Adjusted TS&C Acute uncomplicated bronchitis in adults	2027 patients in 4 primary care practices of group-model HMO in Colorado	Decrease total antibiotic use for uncomplicated acute bronchitis in adults	Posters and information sheets in primary care examination rooms	<ul style="list-style-type: none"> • % Cases receiving antibiotic prescription for uncomplicated acute bronchitis • % Cases receiving nonantibiotic prescriptions (bronchodilators) • % Cases with return office visits (acute bronchitis) 	-1 -1 0
<i>Educational materials and drug samples</i>						
Duggan et al 1999 ¹²	RCT Acute diarrhea	479 patients of 7 health centers of large HMO	Increase ORS use and decrease unscheduled follow-up visits by providing ORS during office visits for acute diarrhea	2 quarts of ORS and written materials	<ul style="list-style-type: none"> • % Patients with unscheduled follow-up care visits for diarrhea • % Patients using ORS after visit 	-36 [‡] +14 [§]
Sciar et al 1991 ¹³	RCT Atenolol compliance	453 patients of staff-model HMOs from Delaware, Wisconsin, and Texas	Increase prescription refill compliance in hypertensive patients	30-day supply of atenolol and written materials	<ul style="list-style-type: none"> • % 180-day drug supply obtained (existing patients) • % 180-day drug supply obtained (new patients) 	+34 [‡] +41 [‡]
<i>Group education</i>						
Finkelstein et al 2001 ¹⁵	RCT Antibiotic prescribing for otitis media	8815 children in 12 practices affiliated with 2 MCOs in Massachusetts and Washington State	Decrease antimicrobial drug prescribing for children ≤ 6 y of age using educational outreach for families and MDs	Two group detailing meetings of practice MDs with "peer leader," using CDC summaries of prescribing recommendations and feedback; parents received CDC brochure on antibiotic use; supporting materials were displayed in waiting rooms	<ul style="list-style-type: none"> • Antimicrobial courses dispensed per person per year (children age 3 to <36 mo) • Antimicrobial courses dispensed per person per year (children age 36 to <72 mo) 	-7 -5
Gonzales et al 1999 ¹¹	Adjusted TS&C Acute uncomplicated bronchitis in adults	2027 patients in 4 primary care practices of group-model HMO in Colorado	Decrease total antibiotic use for uncomplicated acute bronchitis in adults	Written materials and magnets sent to households and posters in MD offices; group detailing and practice feedback on prescribing	<ul style="list-style-type: none"> • % Cases receiving antibiotic prescription for uncomplicated acute bronchitis • % Cases receiving nonantibiotic prescriptions (bronchodilators) • % Cases with return office visits (acute bronchitis) 	-15 [‡] 4 0

(continued)

Table 2. Key Features of 48 Methodologically Acceptable Studies* (*Continued*)

Authors	Design and Focus	Target Group and Setting	Goal(s)	Intervention(s)	Key Outcomes	Magnitude of Effect (%) [†]
Educational Interventions (<i>continued</i>)						
<i>Group education (continued)</i>						
Legorreta et al 2000 ¹⁶	PP&C	1043 patients of large HMO in California	Improve quality of life, functional status, and self-management behavior using an asthma management education program	Small-group education by nurse educator, written materials, peak flow meter, diary, spacer device, and video	<ul style="list-style-type: none"> • % Patients with need for specialty care • % Patients using steroid inhaler daiy • % Patients using peak flow meter daiy 	+3
	Asthma					+10
Brown et al 2000 ¹⁷	RCT	211 healthcare providers of group-model HMO in Oregon	Increase number of depressed patients receiving treatment and decrease symptoms of depression by implementing a clinical practice depression guideline	CQI: Identification of causes of nonadherence, defining and piloting solutions, implementation	<ul style="list-style-type: none"> • Change in depression score • % Patients taking antidepressant medications 	+4
	Depression					-4.5
<i>Participatory guideline development</i>						
Gregory et al 1999 ¹⁸	RCT	120 healthcare providers of staff-model and network-model HMO in New Mexico	Improve health outcomes among patients with allergic rhinitis	Guidelines developed and disseminated to MDs; written materials for patients	<ul style="list-style-type: none"> • Preventive behavior score during allergy season 	+4 [‡]
	Allergic rhinitis					
Santos et al 1999 ¹⁹	RCT	See Gregory et al 1999 ¹⁸	Assess costs associated with treating allergic rhinitis in program to improve outcomes	See Gregory et al 1999 ¹⁸	<ul style="list-style-type: none"> • Total direct costs • Total indirect costs • Total service encounters • % Patients with prescription fills 	-3 [†]
	Allergic rhinitis					-23
						+3 [†]
						-2
<i>One-to-one educational outreach</i>						
Lee et al 1999 ²¹	RCT	125 patients of a large MCO in New England	Improve compliance with BMT triple therapy for <i>H pylori</i> infection using an enhanced compliance program	Medication counseling by pharmacist, medication pillbox and calendar, coupons for subsequent prescriptions, and telephone follow-up	<ul style="list-style-type: none"> • % Patients able to complete 60% or more of 2-wk regimen • % Patients able to complete 90% or more of 2-wk regimen 	+6
	Compliance with <i>Helicobacter pylori</i> therapy					+22
Brown et al 2000 ¹⁷	RCT	211 healthcare providers in group-model HMO in Oregon	Increase number of depressed patients receiving treatment and decrease symptoms of depression by implementing a clinical practice depression guideline	Academic detailing, 4 one-to-one visits by pharmacist, letter-sized illustrated handouts	<ul style="list-style-type: none"> • Change in depression score • % Patients taking antidepressant medications 	+1
	Depression					+14 [‡]
Monitoring and Feedback Interventions						
<i>Lists of prescribed medications</i>						
Johnson et al 1976 ²³	RCT	MDs of 1632 medically indigent patients in HMO in Oregon	Examine the impact of drug profiling on drug utilization	Computer-based, monthly profiles of patients' drug use inserted into front page of medical record	<ul style="list-style-type: none"> • % Prescriptions prescribed per capita • Prescription expenditure per capita • % Prescription users 	0
	All prescribed medications					0
						-2

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Table 2. Key Features of 48 Methodologically Acceptable Studies* (*Continued*)

Authors	Design and Focus	Target Group and Setting	Goal(s)	Intervention(s)	Key Outcomes	Magnitude of Effect (%) [†]
Educational Interventions (<i>continued</i>)						
<i>Aggregated feedback</i>						
Schectman et al 1995 ²⁴	RCT H ₂ blocker prescribing	63 MDs in group- and network-model HMO in Washington, DC	Increase cimetidine prescribing over other H ₂ blockers Compared results in group-model and network-model settings	(I) Mailed memo promoting cimetidine as preferred agent plus MD feedback about H ₂ blocker prescribing in preceding 6 mo (C) Mailed memo alone	<ul style="list-style-type: none"> • % H₂ blocker prescriptions for cimetidine 	-4
<i>Patient-specific feedback</i>						
Benedetto et al 2000 ²⁵	Unadjusted TS Loratadine and fexofenadine (antihistamines)	4 HMOs in Northeast (2), Midwest, and West Coast	Shift prescribing from loratadine to fexofenadine	Voluntary switch with letters to MDs identifying change plus list of patients on drug	<ul style="list-style-type: none"> • % Market share fexofenadine • % Market share loratadine 	+3 [†] -2 [†]
Winickoff et al 1985 ²⁶	PP&C Hypertension	Medical center of a large HMO in Massachusetts	Improve initial laboratory testing, blood pressure control, and follow-up using a quality assurance program	(I) Surveillance with feedback to MDs on individual patients. (C) Peer comparison	<ul style="list-style-type: none"> • % Patients satisfying test criteria • % Patients satisfying blood pressure control criteria • % Patients satisfying follow-up criterion 	+1 -1 +2
Simon et al 2000 ²⁷	RCT Depression	613 patients of 5 primary care clinics of a large HMO in Washington State	Increase the frequency of follow-up visits and dose and duration of anti-depressant therapy, and decrease severity of depressive symptoms	Written feedback on individual patients and algorithm-based treatment recommendations to MDs	<ul style="list-style-type: none"> • % Patients receiving adequate pharmacotherapy • Average number of patient visits • Average depression score 	+5 -5 +2
Barnett et al 1978 ²⁸	Unadjusted TS Strep throat	60 MDs and 45 nurses of a large HMO in Massachusetts	Improve follow-up of throat cultures positive for group A beta-hemolytic streptococcus, using concurrent audit and rapid feedback	Surveillance with reminders plus copy of patient record to responsible MD	<ul style="list-style-type: none"> • % Treatment unrecorded at 10 days 	-9 [†]
Barnett et al 1983 ²⁹	RCT Hypertension	MDs of 115 patients in a Massachusetts HMO	Improve follow-up of patients with newly discovered elevated diastolic blood pressure using surveillance and reminders	Weekly surveillance with messages recommending actions for individual patients according to predefined protocols for 2 mo	<ul style="list-style-type: none"> • % Patients for whom follow-up was attempted or achieved (at 24 mo) • % Patients for whom repeat blood pressure was recorded (at 24 mo) • % Patients who had a diastolic blood pressure < 100 mm Hg or were actively treated (at 24 mo) 	+52 +18 [‡] +18 [‡]

(*continued*)

Table 2. Key Features of 48 Methodologically Acceptable Studies* (Continued)

Authors	Design and Focus	Target Group and Setting	Goal(s)	Intervention(s)	Key Outcomes	Magnitude of Effect (%) [†]
Educational Interventions (continued)						
<i>Enhanced patient-specific feedback</i>						
Benedetto et al 2000 ²⁵	Unadjusted TS	4 HMOs in Northeast (2), Midwest, and West Coast	Shift prescribing from loratadine to fexofenadine	Voluntary switch with educational fact sheet and MD letter identifying patients on drug; letter to patients about change with \$10 coupon for first fexofenadine script	• % Market share fexofenadine	+6 [†]
	Loratadine and fexofenadine (antihistamines)				• % Market share loratadine	-10 [‡]
Brufsky et al 1998 ³⁰	Adjusted TS&C	14 health centers in a staff-model and a group-model HMO in New England	Shift prescribing to cimetidine from other H ₂ RAs using education, therapeutic reevaluation, and performance feedback	"Reevaluation worksheet" sent to MDs for each patient on H ₂ RA treatment, written educational materials, mailed MD feedback between 5 and 8 mo after first reevaluation	• % H ₂ RA market share for cimetidine	+54 [§]
	H ₂ receptor antagonists				• % H ₂ RA market share for ranitidine	-45 [§]
						• % H ₂ RA market share for famotidine
		Compared results in staff-model and group-model settings	(Staff model results reported)			
Kaplan et al 1998 ³¹	Unadjusted TS&C	1349 patients of staff-model HMO in Washington State	Replacement of short-acting nifedipine with alternative medications	MD education and letters for MDs to distribute to patients on short-acting nifedipine	• No. of patients receiving prescription for short-acting nifedipine	-75 [†]
	Short-acting nifedipine					
Simon et al 2000 ²⁷	RCT	613 patients of 5 primary care clinics of large HMO in Washington State	Increase the frequency of follow-up visits and dose and duration of antidepressant therapy, and decrease severity of depressive symptoms	Feedback plus care management: systematic follow-up by telephone, treatment recommendations, and practice support by a care manager	• % Patients receiving adequate pharmacotherapy	+12 [‡]
	Depression				• Average number of patient visits	+1
					• Average depression score	+10
Disease Management Interventions						
<i>Depression</i>						
Katon et al 1995 ³³	RCT	217 patients of a large primary care clinic of large HMO in Washington State	Improve depression treatment and short-term clinical outcomes using a Collaborative Care program	Increased intensity of visits over the first 4 to 6 wks of treatment (visits 1 and 3 with a PCP, visits 2 and 4 with a psychiatrist) and continued surveillance of medication adherence; patient education supplemented with videotapes and written materials	• % Patients using antidepressants at guideline levels at 90 days	+26 [§]
	Depression				• % Rating quality of care as good or excellent at 4 mo	+18 [‡]
						• % Patients with a 50% improvement in depression scores at 7 mo
			(For subgroup of patients with major depression at baseline)			
Katon et al 1999 ³⁴	RCT	228 patients with persistent major depression at 4 primary care clinics in a large HMO in western Washington State	Improve adherence to pharmacotherapy using a Collaborative Care program	Patient education, 2 initial visits with a depression specialist, consultation with PCP about patient progress, telephone monitoring, and follow-up	• % Patients with adherence to adequate dose of medication (at 6 mo)	+18 [§]
	Depression				• % Patients satisfied with treatment (at 6 mo)	+16
						• Change in SCL-20 score (at 6 mo)

(continued)

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Table 2. Key Features of 48 Methodologically Acceptable Studies* (*Continued*)

Authors	Design and Focus	Target Group and Setting	Goal(s)	Intervention(s)	Key Outcomes	Magnitude of Effect (%) [†]
Disease Management Interventions (<i>continued</i>)						
<i>Depression (continued)</i>						
Lin et al 2000 ³⁵	RCT Depression	See Katon et al 1999 ³⁴	Improve disability outcomes of depressed patients who remain persistently symptomatic after initial pharmacotherapy using a Stepped Collaborative Care program	See Katon et al 1999 ³⁴	<ul style="list-style-type: none"> Disability score (at 6 mo) Social functioning score (at 6 mo) Role initiation due to emotional problems score (at 6 mo) 	-14 +13 -3
Katon et al 1996 ³⁶	RCT Depression	153 patients of large primary care clinic of large HMO in Washington State	Improve management of depression in primary care using a Collaborative Care program	Behavioral treatment program by psychologist to increase adaptive coping strategies and counseling to improve medication adherence over 3- to 6-wk period; telephone contact by psychologist up to 24 wk; patient and MD education	<ul style="list-style-type: none"> Change in depression score (7 mo) % Patients adhering to medication (7 mo) % Patients satisfied with treatment (7 mo) (For subgroup of patients with major depression at baseline)	-18 [‡] +25 +27
Katon et al 2001 ³⁷	RCT Depression	386 patients with recurrent major depression or dysthymia at 4 large primary care clinics of HMO in Washington State	Improve adherence to antidepressant medication and depression outcomes using a Collaborative Care program	Patient education, 2 visits with depression specialist, telephone monitoring, and personalized mailings	<ul style="list-style-type: none"> % Patients who filled antidepressant medications (at 12 mo) Change in SCL-90 score (at 12 mo) % Patients reporting a current or interval episode of major depression (at 12 mo) 	+14 +6 [‡] 0
Simon et al 1998 ³⁸	RCT Depression	124 patients with major depression from Katon et al 2001 ³³ and Katon et al 1996 ³⁶	Assess the impact of improved depression treatment on daily functioning and disability	Collaborative Care programs as described in Katon et al 2001 ³³ and Katon et al 1996 ³⁶	<ul style="list-style-type: none"> % Reporting inability to work (at 7 mo) % Reporting change in work (at 7 mo) % Reporting reduction in activities (at 7 mo) 	+11 -6 +2
Lin et al 1999 ³⁹	RCT Depression	19-mo follow-up assessment of 156 patients from Katon et al 2001 ³³ and Katon et al 1996 ³⁶	Determine whether improved outcomes seen at 90 days post-intervention in depressed patients would persist over time (19 mo)	Collaborative Care programs as described in Katon et al 2001 ³³ and Katon et al 1996 ³⁶	<ul style="list-style-type: none"> Depression score (at 19 mo) Depressive symptomatology score (at 19 mo) % Patients adhering to medication regimen (at 19 mo) 	<1 +11 +2

(continued)

Table 2. Key Features of 48 Methodologically Acceptable Studies* (Continued)

Authors	Design and Focus	Target Group and Setting	Goal(s)	Intervention(s)	Key Outcomes	Magnitude of Effect (%) [†]
Disease Management Interventions (continued)						
<i>Depression (continued)</i>						
Von Korff et al 1998 ⁴⁰	RCT Depression	370 patients from Katon et al 2001 ³³ and Katon et al 1996 ³⁶	Estimate the treatment costs, cost-offset effects, and cost-effectiveness of Collaborative Care of depressive illness in primary care	Collaborative Care programs as described in Katon et al 2001 ³³ and Katon et al 1996 ³⁶	<ul style="list-style-type: none"> • % Patients successfully treated (major depression) • Cost per patient treated (major depression) • Cost of treatment per case successfully treated 	+31 [†] +57 [†] -7 [†]
Katzelnick et al 2000 ⁴¹	RCT Depression	1465 depressed "high utilizers" of nonpsychiatric services in 163 primary care practices in 3 geographically diverse HMOs	Determine impact of a systematic primary care-based depression treatment program on treatment received, clinical outcomes, functional status, and healthcare utilization	Patient education materials, MD education, telephone treatment coordination, and antidepressant pharmacotherapy managed by PCPs according to a specific algorithm	<ul style="list-style-type: none"> • % Patients filling at least 3 antidepressant scripts (at 6 mo) • Change in depression score (at 12 mo) • Change in physical functioning score (at 12 mo) 	+51 [§] -19 [§] -14
Katon et al 1992 ⁴²	Depression	251 high users of primary care at 2 clinics of large HMO in western Washington State	Increase adequacy and duration of pharmacologic treatment in patients with depression using psychiatric consultation services	PCP education; 1-hr diagnostic patient interview by psychiatrist, 30-min interview by psychiatrist and PCP to plan treatment; written psychiatric consultation and treatment protocol; duration 6 mo	<ul style="list-style-type: none"> • % Patients filling 1 or more scripts • % Patients filling 3 or more scripts • % Receiving adequate antidepressant treatment 	+17 +12 [‡] +9
Hunkeler et al 2000 ⁴³	RCT Depression	302 patients starting antidepressant therapy at 2 managed care adult primary care clinics in Northern California	Reduce depressive symptoms and improve functioning, satisfaction with care, and medication adherence using 2 augmentations to usual antidepressant drug treatment	(I1) Telehealthcare: focused behavioral interventions in 10 6-min calls during 4 mo by primary care nurses (I2) Telehealth and in-person supportive contacts by trained health plan members who have recovered from depression	<ul style="list-style-type: none"> • Hamilton depression score at 6 mo • Beck depression score at 6 mo • Treatment satisfaction score at 6 mo (I1 results presented in paper)	-10 -2 +7 [§]
Wells et al 2000 ⁴⁴	RCT Depression	1356 patients of 7 staff and network MCOs with 46 primary care clinics in diverse locations	Improve quality of care, health outcomes, and employment using QI programs for depression	Institutional QI: training local experts, clinician education, training nurses for patient assessment and education (I1) Medication and psychotherapy; nurse specialists provide follow-up assessments and support with 6-12 monthly contacts plus access to usual therapists (I2) 12-16 sessions of group and individual psychotherapy; reduced copayment (UC) Mailed practice guidelines	<ul style="list-style-type: none"> • Depressive symptoms at 12 mo • Health-related quality of life at 12 mo • Total number of medical visits for emotional problems at 12 mo • % Appropriate use of antidepressant medication at 12 mo (QI results pooled for analyses)	-10 [‡] +4 [‡] +7 +7

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Table 2. Key Features of 48 Methodologically Acceptable Studies* (*Continued*)

Authors	Design and Focus	Target Group and Setting	Goal(s)	Intervention(s)	Key Outcomes	Magnitude of Effect (%) [†]
Disease Management Interventions (<i>continued</i>)						
<i>Depression (continued)</i>						
Sherbourne et al 2001 ⁴⁵	RCT	See Wells et al 2000 ⁴⁴	Improve clinical outcomes and health-related quality of life for depressed patients using short-term QI interventions	See Wells et al 2000 ⁴⁴	<ul style="list-style-type: none"> • (I1) % Patients with probable depression at 24 mo • Level of functioning at 24 mo • Level of well-being at 24 mo 	+2
	Depression					<ul style="list-style-type: none"> • (I2) % Patients with probable depression at 24 mo • Level of functioning at 24 mo • Level of well-being at 24 mo
Schoenbaum et al 2001 ⁴⁶	RCT	See Wells et al 2000 ⁴⁴	Determine societal cost-effectiveness of 2 QI interventions to improve treatment of depression in primary care	See Wells et al 2000 ⁴⁴	<ul style="list-style-type: none"> • Healthcare costs at 24 mo • Quality-adjusted life years at 24 mo • Depression burden days at 24 mo 	+12
	Depression					<ul style="list-style-type: none"> • (QI results pooled for analyses)
Meredith et al 2000 ⁴⁷	RCT	See Wells et al 2000 ⁴⁴	Assess effects of a combined educational and QI intervention on primary care clinician knowledge	See Wells et al 2000 ⁴⁴	<ul style="list-style-type: none"> • (I1) Knowledge of treatment • Knowledge of anti-depressant medication • Knowledge of psychotherapy • (I2) Knowledge of treatment • Knowledge of anti-depressant medication • Knowledge of psychotherapy 	+7
	Depression					181 primary care clinicians
<i>Anxiety</i>						
Price et al 2000 ⁴⁹	PP&C	137 patients of a family practice department at an HMO in Colorado	Reduce symptoms, improve functional status, and increase satisfaction with care using a primary care model integrating mental health and medical services	PCP referred GAD patients to psychologist on site; patient, PCP, and psychologist formulated treatment plan, including medication, CBT, or both; psychiatrist also was available for consultation with team	<ul style="list-style-type: none"> • Anxiety symptoms at 6 mo • % Patients with clinically significant anxiety symptoms at 6 mo • % Patients satisfied with care at 6 mo 	-14 [‡]
	GAD and anxiety secondary to depression					-34 [‡] +67 [§]
<i>Diabetes</i>						
O'Connor et al 1996 ⁵¹	PP&C	134 patients of a staff-model HMO in the Midwest	Improve glycemic control in patients with diabetes attending a primary care clinic	13-step CQI process, including scrutiny of the care process, problem identification, clinic system changes, and evaluation; patients were continuously assessed and referred for appropriate testing; nurses delivered educational outreach	<ul style="list-style-type: none"> • HbA_{1c} level at 12 mo • Mean number of outpatient visits • Charges for outpatient medical care 	-10 -6 -2

(continued)

Table 2. Key Features of 48 Methodologically Acceptable Studies* (*Continued*)

Authors	Design and Focus	Target Group and Setting	Goal(s)	Intervention(s)	Key Outcomes	Magnitude of Effect (%) [†]
Disease Management Interventions (<i>continued</i>)						
<i>Diabetes (continued)</i>						
Wagner et al 2001 ⁵²	RCT Diabetes	707 patients of a large mixed model HMO in Washington State	Evaluate impact of primary care group clinics on process and outcomes of care for diabetic patients	Periodic (every 3-6 mo) half-day clinics for groups of diabetic patients in doctors' practices with standardized assessments; visits with MD, nurse, and clinical pharmacist; group education and peer support	<ul style="list-style-type: none"> • General health score • HbA_{1c} level • Primary care visits 	+4 [‡] -2 +18 [‡]
Sadur et al 1999 ⁵³	RCT Diabetes	185 patients of a large HMO in Northern California	Evaluate effect of group visit model for delivering outpatient care management on glycemic control, patient satisfaction, healthcare utilization, and cost of care	Multidisciplinary outpatient management delivered by diabetes nurse educator, psychologist, nutritionist, and pharmacist in groups of 10-18 patients per month for 6 mo	<ul style="list-style-type: none"> • HbA_{1c} level • Visits to nutritionist • Blood glucose monitoring at home 	-14 [§] +36 [§] +7
Kelly and Rodgers 2000 ⁵⁴	RCT Diabetes	48 patients of group practice in Virginia	Evaluate impact of pharmacist-managed diabetes service on changes in HbA _{1c} , blood pressure, lipids, and smoking status in diabetic patients	Patient and pharmacist established individualized plan including medication, nutrition, lifestyle change, and glucose monitoring; follow-up based on degree of monitoring; continuing education on self-management topics	<ul style="list-style-type: none"> • HbA_{1c} level • Systolic blood pressure • Diastolic blood pressure 	-12 [‡] -5 -2
Aubert et al 1998 ⁵⁵	RCT Diabetes	138 patients with type I and type II diabetes at primary care clinics in a group-model HMO	Improve diabetic control in patients receiving nurse case management	Nurse case manager followed written management algorithms under direction of family MD and endocrinologist; changes were communicated to PCPs	<ul style="list-style-type: none"> • Change in HbA_{1c} level • Change in fasting blood glucose • Change in diastolic blood pressure 	-12 [§] -17 0
<i>Cardiac risk factor modification</i>						
DeBusk et al 1994 ⁵⁶	RCT Coronary risk factor modification	585 patients hospitalized for acute myocardial infarction at 5 medical centers of a large HMO in California	Evaluate efficacy of MD-directed, nurse-managed, home-based case-management system for coronary risk factor modification	In hospital, nurses initiated interventions for smoking cessation, exercise training, diet and drug therapy for hyperlipidemia; patients were contacted by telephone and mail after discharge, with visits to lab and nurse as needed	<ul style="list-style-type: none"> • % Patients who quit smoking (at 12 mo) • Plasma low density lipoprotein cholesterol (at 12 mo) • Functional capacity score (at 6 mo) 	+17 [‡] -19 [§] +11 [§]
<i>Multiple conditions</i>						
Beck et al 1997 ⁵⁷	RCT Heart, joint & lung disease; and diabetes	321 patients with high health service utilization and 1 or more chronic conditions in a group-model HMO in Colorado	Compare impact of group outpatient visits with traditional care on health service utilization and cost, self-reported health status, and satisfaction	Monthly group visits with PCP and nurse, including health education, prevention, socialization, mutual support, and one-to-one PCP consultations	<ul style="list-style-type: none"> • Mean number of internal MD visits • Mean number of same-day visits • Mean number of medical subspecialist visits • Mean number of scripts filled 	-17 -32 [‡] -18 [‡] ≤1

(continued)

Table 2. Key Features of 48 Methodologically Acceptable Studies* (Continued)

Authors	Design and Focus	Target Group and Setting	Goal(s)	Intervention(s)	Key Outcomes	Magnitude of Effect (%) [†]
Disease Management Interventions (continued)						
<i>Multiple Conditions (continued)</i>						
Coleman et al 1999 ⁵⁸	RCT Urinary incontinence, falls, depression, high-risk medications, functional impairment	169 patients of a large HMO in Washington State	Improve outcomes of common geriatric syndromes (urinary incontinence, falls, depressive symptoms, high-risk medications, functional impairment) in frail older adults	Half-day chronic care clinics every 3 to 4 mo involving extended visits with MD and nurse, pharmacist visit (addressing polypharmacy and medications), and patient self-management support group	<ul style="list-style-type: none"> • Physical function score (at 24 mo) • Depression score (at 24 mo) • Incontinence score (at 24 mo) • No. of prescriptions for high-risk medications filled (at 24 mo) 	0 +19 +18 -27
Johnston et al 2000 ⁵⁹	RCT Wound care, diabetes, COPD, anxiety	212 patients at a medical center of a large HMO in California	Evaluate use of remote video in-home healthcare to replace some in-person visits without compromising patient care or increasing home care costs	Routine home visits; telephone contact; remote video system allowed nurses to assess cardiovascular status and correct medication dosages	<ul style="list-style-type: none"> • % Patients complying with medication regimen • % Patients with knowledge of disease • % Patients achieving self-care 	+2 +2 -2

*BMT indicates bismuth subsalicylate, metronidazole, and tetracycline hydrochloride; C, comparison group; &C, with comparison group; CBT, cognitive-behavioral therapy; CDC, Centers for Disease Control and Prevention; COPD = chronic obstructive pulmonary disease; CQI, continuous quality improvement; GAD, generalized anxiety disorder; H₂RA, histamine H₂-receptor antagonist; HbA_{1c} = glycosylated hemoglobin; HMO, health maintenance organization; I1, intervention 1; I2, intervention 2; MCO, managed care organization; MD, physician; ORS, oral rehydration solution; PCP, primary care physician; PP, pre-post; QI, quality improvement; RCT, randomized controlled trial; SCL-20, Hopkins Symptom Checklist-20n; SCL-90 = Hopkins Symptom Checklist-90n; TS, time series; UC, usual care.

[†]The procedure for calculating effect size depended on the outcome in question. If the outcome was measured as a percentage, effect size was computed as the relative gain in the intervention group; that is, the net difference between the percent improvement in the intervention group and the percent improvement in the control group $[(\%POST - \%PRE)_{intervention} - (\%POST - \%PRE)_{control}]$. If the outcome was a rate or a score, the changes (ie, improvements preintervention to postintervention) were converted to percent improvements by dividing the absolute changes by baseline values $[(POST - PRE)/PRE]_{intervention} - [(POST - PRE)/PRE]_{control}$. In the methodologically acceptable studies without a control group (ie, time series, repeated measures), effect size was calculated as the percent improvement between the preintervention percentage and the postintervention percentage; short-term shifts in percentage immediately before or after an intervention were regarded as transitory.

[‡] $P < .05$.

[§] $P < .001$.

^{||} $P < .01$.

^{††}Statistical analysis was not performed.

antibiotic use for acute bronchitis by placing posters and information sheets in primary care examination rooms. Both interventions were unsuccessful in changing target outcomes.¹¹

Dissemination of Educational Materials with Drug Samples. For many years pharmaceutical companies have given healthcare providers free drug samples to distribute to patients to increase use of new medications or reinforce the use of existing medications. This strategy was combined with the dissemination of educational materials in 2 interventions. Providing 2 quarts of oral rehydration solution (ORS) to the parents of

children with an office visit for acute diarrhea increased ORS use and decreased unscheduled follow-up visits.¹² A second study, providing patients with a 30-day supply of atenolol to promote prescription refill compliance, resulted in more new and existing patients acquiring a 180-day supply of the drug.¹³

Group Education. Group education relies on didactic or problem-based approaches to effect behavior change.¹⁴ Despite the widespread use of conferences, seminars, and tutorials to educate physicians, only 4 studies in this review used group education as the primary strategy to improve medication use. One inter-

vention successfully decreased the number of antibiotics dispensed to children less than 6 years of age by using group detailing conducted by a "peer leader," brochures on antibiotic prescribing endorsed by the Centers for Disease Control and Prevention (CDC), and feedback on previous prescribing, in conjunction with CDC brochures mailed to patients and supporting materials in waiting rooms.¹⁵ Another intervention reduced antibiotic prescribing for acute uncomplicated bronchitis in adults without increasing the number of nonantibiotic prescriptions and return office visits by combining group detailing, feedback on previous prescribing, mailed written materials and magnets sent to patients' homes, and posters in physicians' offices.¹¹ A small-group patient education program conducted by a nurse educator, coupled with printed and audiovisual materials and asthma management devices, increased daily use of steroid inhalers and peak flow meters. However, the proportion of patients requiring specialty care did not change.¹⁶

The final study, using an 11-member continuous quality improvement (CQI) team, attempted to increase the percentage of patients taking antidepressant medication and reduce self-reported depression symptoms.¹⁷ Although the team produced a number of recommendations to improve adherence to published guidelines (eg, a hotline for psychiatric consultations, a primary care-based screening and diagnosis process, a method for pharmacist-assisted management of depression care), only the hotline was implemented. Not surprisingly, significant changes in process or outcomes were not found.

Participatory Guideline Development. Participatory guideline development involves a structured group process that combines learning, consideration of evidence about appropriate treatment, and discussion about how actual practice conforms with group standards. An intervention utilizing this approach for allergic rhinitis was associated with modest improvements in patients' self-reported allergy prevention scores and reductions in indirect costs.^{18,19}

One-to-One Educational Outreach. One-to-one educational outreach (often referred to as academic detailing) is among the most effective techniques used to change prescribing.²⁰ Two interventions in this review were effective in changing medication use. A patient-focused intervention used one-to-one clinical pharmacist counseling coupled with medication coupons for subsequent prescriptions, follow-up telephone calls, medication pillboxes, and medication calendars to improve patient compliance with bismuth subsalicylate, metronidazole, and tetracycline hydrochloride therapy for *Helicobacter pylori* infec-

tion.²¹ Another study used 4 one-to-one pharmacist visits to physicians to increase the percentage of depressed patients taking antidepressant medications and decrease self-reported depressive symptoms.¹⁷

Monitoring and Feedback Interventions

Feedback interventions report a physician's past or current prescribing and are frequently compared with peer behavior or accepted standards. The assumption underlying these strategies is that physicians are likely to change their behavior due to discomfort about outlier status or as a result of specific recommendations from credible individuals or programs.²²

Lists of Prescribed Medications. Monthly profiles of medications taken by patients, inserted into their medical records, had no impact on the number of prescriptions written or on expenditures.²³

Aggregated Feedback. One study used a mailed memo to physicians promoting cimetidine over other histamine H₂-receptor antagonists (H₂ blockers), along with aggregated reports about the number, type, and cost of their H₂-blocker prescriptions.²⁴ Compared with a mailed memo alone, the medication listings had no impact on cimetidine prescribing. However, a significant response to the intervention was observed in the group-model but not in the network-model HMO.

Patient-Specific Feedback. The effects of patient-specific feedback were mixed. An intervention designed to reduce costs by shifting prescribing from one antihistamine (loratidine) to another (fexofenadine) included letters to physicians about the preferred medication plus lists of patients taking loratidine.²⁵ However, this feedback was unsuccessful in changing the market share of the 2 drugs. In another study, an automated record system with feedback to physicians about individual patients who did not comply with standards of hypertension care was unable to improve initial laboratory testing, blood pressure control, or patient follow-up compared with a peer comparison intervention.²⁶ In addition, written feedback to physicians on patient-specific compliance with depression treatment algorithms was unable to increase the proportion of patients receiving adequate pharmacotherapy or to reduce patient visits and self-reported depressive symptoms.²⁷

Two feedback interventions were successful in achieving improved outcomes. One involved concurrent audit to detect deficiencies in patient care and automated rapid feedback to the responsible provider in time for the provider to correct the deficiency.²⁸ The system resulted in an improvement in the follow-up of positive throat cultures for group A beta-hemolytic streptococcus (strep throat). The other study used

weekly surveillance, with messages recommending actions for individual patients according to predefined hypertension protocols. In patients with newly discovered elevated diastolic blood pressure, the system improved patient follow-up, increased the number of repeat blood pressure measurements, and increased the number of patients with a diastolic blood pressure of less than 100 mm Hg.²⁹

Enhanced Patient-Specific Feedback. All of the interventions using patient-specific feedback combined with additional strategies (most often educational) improved outcomes. In the previously described study aimed at decreasing the number of prescriptions written for loratidine and increasing the number of prescriptions written for fexofenadine, patient-specific feedback alone was unsuccessful. However when educational fact sheets for physicians, letters to patients, and a coupon for the first fexofenadine prescription were added, the market share of fexofenadine was increased while use of loratidine was reduced.²⁵ A multifaceted intervention involving letters and materials mailed to physicians, patient-specific therapeutic re-evaluation forms, and performance feedback shifted prescribing to cimetidine rather than other H₂-receptor antagonists; the magnitude of the effect was greater in a staff-model versus a group-model HMO.³⁰ Another program successfully replaced short-acting nifedipine with alternative medications by using preprinted letters for physicians to mail to patients (either indicating an automatic change in medication or requesting that the patient schedule an appointment for medication review) plus physician education (treatment guidelines for ischemic heart disease and a summary of the evidence questioning the safety of short-acting nifedipine).³¹ In the same depression study mentioned previously, an intervention using the feedback strategy plus care management (telephone monitoring of antidepressant use, side effects, and severity of depression symptoms) increased the number of patients receiving adequate pharmacotherapy and decreased self-reported depressive symptoms, but did not change the number of patient visits.²⁷

Disease Management Interventions

Disease management programs are population-based approaches for identifying, treating, and monitoring persons at risk of chronic illness.⁸ These programs improve care by providing teams of trained healthcare personnel and organized systems of care.⁷

Depression. Patients with depression tend to have high medical costs, multiple unexplained symptoms, and greater social and vocational disability compared with other patients.³² Stepped collaborative care inter-

ventions³³⁻⁴⁰ educate patients, bolster the function of primary care physicians (PCPs), provide on-site psychiatric consultants, and provide pharmacologic treatment when necessary. For patients with major depression at baseline, this approach improved adherence to antidepressant medication at 90 days,³³ 6 months,³⁴ and 12 months,³⁷ and decreased self-reported depressive symptoms at 90 days³³ and 7 months.³⁶ However, the improved outcomes seen in the early stages of some interventions^{33,36} did not persist at 24 months.³⁹

A program using patient education, physician training, telephone treatment coordination, and PCP-managed antidepressant therapy increased antidepressant medication use and decreased self-reported depressive symptoms. However, self-reported physical functioning did not change.⁴¹ A psychiatric consultation service coupled with physician education also improved antidepressant medication compliance and the number of patients receiving adequate antidepressant treatment.⁴² In addition, an approach using only nurse-managed telephone care decreased self-reported depressive symptoms and increased antidepressant use and patient satisfaction.⁴³

In a quality improvement program, primary care leaders trained nursing and medical staff to administer psychotherapy and pharmacotherapy.⁴⁴⁻⁴⁷ The program decreased depressive symptomatology, increased antidepressant medication use, and increased health-related quality of life.⁴⁴ However, these effects were not maintained at 24 months.⁴⁵ The average costs of the intervention were significantly higher than those of usual care. However, intervention patients had fewer days with depression burden and were employed for more days during the study period.⁴⁶ The intervention increased PCP knowledge of psychotherapy but did not change knowledge of depression treatment and antidepressant medication.⁴⁷

Anxiety. Anxiety disorders are associated with significant morbidity, disability, and cost.⁴⁸ Psychologist and PCP teams used psychotherapy and medication to reduce self-reported symptoms and increase satisfaction with care for patients with generalized anxiety disorder or anxiety secondary to depression.⁴⁹

Diabetes. Fewer than half of diabetic patients have good glycemic control, which is associated with improved clinical outcomes.⁵⁰ The following interventions had mixed success at reducing blood glucose levels. A CQI program, involving modifications to the diabetes care process, and educational outreach by trained diabetes resource nurses reduced patient glycosylated hemoglobin (HbA_{1c}) levels at 12 months but did not reduce the number of outpatient medical visits.⁵¹

Clinics involving physicians, nurse and pharmacist visits, and peer support meetings improved self-report-

ed general health and increased primary care visits, but had no impact on reducing HbA_{1c} levels.⁵² A program coordinated by a diabetes nurse educator—also involving psychologists, nutritionists, and pharmacists—improved HbA_{1c} levels and the number of visits to a nutritionist, but did not increase home blood glucose monitoring.⁵³ A pharmacist-managed program successfully reduced HbA_{1c} levels but not blood pressure,⁵⁴ whereas a nurse-coordinated program under the supervision of a PCP and an endocrinologist reduced HbA_{1c} and fasting blood glucose levels, but had no impact in reducing blood pressure.⁵⁵

Cardiac Risk Factor Modification. Systematic modification of coronary risk factors is rarely integrated into the medical care of patients treated for acute myocardial infarction.⁵⁶ A physician-directed and nurse-managed program increased smoking cessation and patient functional capacity and reduced plasma low density lipoprotein.⁵⁶

Multiple Conditions. Group outpatient visits with a PCP and nurse plus one-to-one consultations with the PCP reduced primary care, subspecialist physician, and same-day visits. However, the number of prescriptions filled remained unchanged.⁵⁷ Chronic care clinics involving nurse, pharmacist, and physician visits and peer support failed to improve self-reported physical functioning or reduce self-reported depression, incontinence, or the number of high-risk medications filled at 24 months.⁵⁸ Remote home healthcare, using telephone and video visits to replace some in-person visits, was as effective as in-person care, as measured by medication compliance, patient knowledge, and achievement of self-care.⁵⁹

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DISCUSSION

Principal Findings

Several findings from this review are consistent with systematic reviews of interventions in other settings. These data confirm that dissemination of educational materials alone is ineffective and unlikely to change behavior.^{60,61} Implementation of clinical practice guidelines is effective when combined with a local consensus process,⁶² and one-to-one educational outreach visits are effective in reducing inappropriate prescribing.^{14,61} Further, multifaceted interventions that help to predispose, enable, and reinforce desired behaviors are more likely to be successful.⁶³

Of the 3 provider-focused group interventions in our review, 2 reported improvements in prescribing practices. The third study, a CQI program, proved ineffective. However, the latter finding is not surprising given

previous work indicating that well-controlled CQI programs are frequently ineffective in changing processes of care and health outcomes.⁶⁴

Previous evaluations of the effectiveness of monitoring and feedback interventions reported small to moderate changes in the quality and cost of care.⁶⁵⁻⁶⁷ The studies in this review support the effectiveness of surveillance systems with patient-specific feedback to physicians, especially when coupled with physician or patient education programs.

Our review also contributes findings that have not been addressed previously. First, the dissemination of educational materials with free medication samples was effective in improving patient compliance. This is a potentially important finding that should be investigated further.

Two studies in this review suggest that interventions are more effective in more heavily managed settings.^{24,30} This finding is not surprising as healthcare providers in staff-model HMOs are employed solely by the MCO and have strong relationships with other providers such as pharmacists. In contrast, physicians in group-model HMOs are only affiliated and are not as well integrated with MCOs. For example, staff pharmacists employed in staff-model plans are more likely to be viewed as clinical partners and educators, whereas less integrated pharmacists in IPA settings often are viewed as regulators and cost cutters.⁶⁸

To our knowledge, this review is the first to examine systematically the effects of disease management programs incorporating pharmacotherapy as a part of the interventions. Our results show that programs focussing on a specific chronic illness are generally effective in changing processes of care and to a lesser extent in improving short-term health outcomes. The results are not as encouraging in the few studies that examined outcomes beyond 12 months.

Limitations

This review has a number of methodologic limitations. Despite our intensive efforts, the collection of intervention studies is incomplete. Many studies on improving pharmaceutical use are not available in the public domain, especially those conducted within MCOs or by the pharmaceutical industry. Publication bias may be present and lead to an overestimate of intervention impacts (for example, well-controlled, negative studies may not have been submitted for publication). Furthermore, study designs frequently were inadequate; more than half of the studies identified in this review were not considered because of design flaws. There also are fundamental difficulties in comparing interventions with diverse objectives, measure-

ment methods, and outcomes. Many of the reviewed interventions are multifactorial and difficult to characterize in a simple classification.

Unanswered Questions and Future Directions

Despite the substantial number of interventions to improve drug use in managed care, our understanding of the impacts of these interventions still is limited. Although PPOs and lightly managed HMOs play prominent roles in the US managed care industry, we found no studies conducted in these settings. The majority of studies in our review were conducted in staff-, group-, and mixed-model HMOs, more heavily managed settings that now play a diminished role in the market. Future research should establish which interventions are effective in less heavily managed settings.

There is a glaring lack of evidence concerning the effects of financial and formulary-related interventions. It is alarming to consider how little publicly available empirical evidence underlies the most common approaches used in managed care today. Because of the far-reaching impact that these strategies may have on outcomes, both intended and unintended, it is imperative that managed care policy decisions be informed by rigorous evidence that addresses both cost and quality of care.

Little attention has been paid to assessing the cost-effectiveness of interventions. Cost-effectiveness data are needed to select among many different approaches for improving the costs and quality of care.

CONCLUSIONS

This review provides encouraging evidence about the growing number and quality of interventions to improve medication use in the last 5 years. As evidenced by the studies in this review, policymakers in managed care environments now have an improved knowledge base on which to build educational, monitoring and feedback, and disease management programs to improve medication use. Despite the widespread use of financial and formulary strategies, there are few publicly available, well-designed studies assessing their efficacy and safety. We encourage MCOs and other organizations to publish existing studies or to develop research initiatives in these areas to further expand our evidence base.

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