The effect of the fit between organizational culture and structure on medication errors in medical group practices

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Background: It is widely acknowledged that many prescription drug errors occur in the ambulatory care setting and that they have serious quality of care implications. Previous research examining this issue has focused on hospitals and on individual-level factors. This study adopts an organizational perspective to assess the effects of organizational culture, organizational structure, and their fit (i.e., their congruence) on medication errors in medical group practices.
Methodology/Approach: Variables that measure the organizational culture and structure were taken from two surveys of medical group practices in Minnesota in 2001. Medication errors data were obtained using a computerized drug utilization review system. Seventy-eight medical group practices were included in the analyses.
Findings: Results revealed that the use of benchmarking and practice guidelines was associated with decreased error rates in group practices that encourage ''patient emphasis'' and ''collegiality.'' However, the relationship between information processing capacity and the cultural dimensions was not statistically significant.
Practice Implications: The interaction between specific cultural traits and structural dimensions can help understand some of the relationships between organizational culture, structure, and medication errors. Organizational structures do not exist in a vacuum, but rather their effect on patient safety outcomes is ''moderated'' by the

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organizational culture. The implications are that medical group practice administrators and medical directors have alternate ways to prevent or reduce medication errors and that they should be attentive to the cultures of their practices when considering those options.

Patient safety is a cornerstone of high-quality care. Never before has an issue of quality in health care reached this high level of public visibility and national concern (Institute of Medicine, 1999). Medical group practices and other health care organizations today are facing increasing pressures to make their systems safer. Therefore, the focus is shifting from a narrow concept of error as a result of human failure to a more sophisticated understanding of the organization in which many factors, such as culture and structure, directly or indirectly affect safety. However, this shift has not been supported by empirical evidence (Hoff, Jameson, Hannan, & Flink, 2004).

Medication errors are very common, extremely costly, and often result in serious injuries, which make the resolution of this "hidden epidemic" a national priority (Ghandi et al., 2001). Despite a substantial shift from inpatient to outpatient care over the last two decades, little is known about efforts to reduce errors in medical group practices. Although studies have documented the high prevalence of medication errors in these settings (Gurwitz et al., 2003), research determining which factors affect errors has been surprisingly rare.

Organizational culture is defined in terms of beliefs, values, and artifacts (Schein, 1985). Studies have explored the effect of organizational culture, among other variables, on health care outcomes in hospitals (Shortell et al., 2001) and on performance in medical group practices (Kralewski, Wingert, Knutson, & Johnson, 1999). Recently, there has been increased interest in the role that culture plays in affecting patient safety outcomes (Institute of Medicine, 1999, 2001; AHRQ, 2005).

Organizational structure refers to recurrent patterns of routine interaction and behavior (Scott, 1998). The importance of structure in affecting patient safety is well documented in the literature: System failures related to impaired access to information and inadequate standardization and formalization, both the result of a lack of an appropriate structure, have been shown to be important determinants of errors (Leape, Bates, & Cullen, 1995).

A relatively new concept is to assess the joint effects of culture and structure (i.e., their compatibility or "fit") on organizational performance. Although fit has been studied extensively between pairs of organizational dimensions, few researchers have examined culture–structure fit. Of these, the work of Baligh (1994) is noteworthy. He argues that the connection between structure and performance is greatly affected by the cultural setting of the structure, and thus, he proposes a theory that identifies structures that perform well and badly in a particular setting. Thus, fit is defined in terms of properties of culture and structure that are logically consistent to one another (Baligh, 1994).

To our knowledge, there has been no research that examines culture–structure fit in medical group practices. In a previous article, we examined the effect of practice cultures on the types of structures used to assure quality of care. Using the same data sets, we found that that the types of structures the group practices develop differ according to their culture (Kaissi, Kralewski, Curoe, Dowd, & Silversmith, 2004). Elsewhere, we examined the separate effects of financial incentives, clinical support systems, physician workload, and practice culture on medication errors, and concluded that although some variables significantly impacted medication errors, the results were difficult to interpret and much of the variance remained unexplained (Kralewski, Dowd, Heaton, & Kaissi, 2005). Therefore, although culture and structure are related to each other and may have separate effects on patient safety, we propose that they also have a joint effect that is manifested through their congruence or "fit" in the group practice. The aim of this article is to assess the effect of this fit on medication error rates in medical group practices.

Conceptual Framework

We examined which properties of culture and structure fit together, and thus lead to high safety levels and lower medication error rates. We define fit as the interaction of pairs of organizational culture–structure. Our hypotheses are based on the rationale that compatibility between culture and structure leads to higher levels of safety.

As noted before, system factors related to impaired access to information and inadequate standardization affect medication errors (Leape et al., 1995). Two structures that measure *information processing capacity* were selected: electronic medical records (EMRs) and computerized drug information systems. Two additional measures that measure *standardization/formalization* were included, namely, clinical practice guidelines and benchmarking. These structures have been included in several studies of care management in group practices and they have an extensive literature relating them conceptually to quality of care (Shortell et al., 2001; Casalino et al., 2003). EMRs have the potential to offer substantial gains in patient safety through access to and management of clinical information (Bates, Ebell, Gotlieb, Zapp, & Mullins, 2003). They can eliminate or reduce errors due to lack of knowledge about the drug and about the patient, two major system failures (Lazarou, Pomeranz, & Coery, 1998). Clinical practice guidelines offer concise instructions on which tests to order and on how to provide medical services, and have been shown to improve quality of care (Grimshaw & Russle, 1993), whereas benchmarking provides reliable data on which to base decisions and practice (Fitzgerald, 1998).

The early group practices were professional organizations, characterized by strong professional values, with ownership and management residing solely in the professional staff. However, in recent years, the importance of administrative values has increased as practices became larger, more diversified, and more accountable for cost (Havlicek, 1996). But the extent of emphasis on either set of values is not uniform across all settings. Some groups might be more administratively oriented as they value efficiency and productivity; as their clinical staff follow strict guidelines for handling patients; as physicians' time is carefully structured and managed. In contrast, other groups might be more professionally oriented, with customized attention to unique patient needs and concern for physician autonomy in time allocation and delivery of care (Bunderson, 1998). However, in most groups, the situation gets even more complex as administrative structures and professional values clash and create misfit between culture and structure. For example, in settings with a high level of autonomy and a focus on standardization structures, a clear conflict exists between the values and the structures. This lack of congruence is hypothesized to diminish the effects of clinical guideline use and benchmarking on reducing errors. More specifically, in a group practice that emphasizes autonomy, benchmarking and practice guidelines will be ignored by clinicians, and thus will have a minimal effect on patient safety. Therefore, we hypothesize that:

H1: Benchmarking methodologies will make a greater contribution to reducing medication errors in cultures that are low on autonomy than in cultures that are high on autonomy.

H2: Clinical practice guidelines will make a greater contribution to reducing medication errors in cultures that are low on autonomy than in cultures that are high on autonomy.

Human factors play an important role in the effectiveness of information technology use by physicians. If physicians do not value these technologies, they will be largely ignored. From the physicians' standpoint, workflow interference, familiarization with the technology, and time commitment might overshadow the potential advantages of the proposed technology (Papshev & Peterson, 2001). Some physicians might view these structures as interference in their practices, and thus a misfit might exist between information processing structures and autonomy. For example, in practices with high physician autonomy, and where the physicians might not be extensively involved in IT decisions, the clear lack of alignment between values and structures will result in one of two scenarios: either the physicians will use these systems inadequately, or they will resist them and refrain from using them all together. Based on this argument, EMRs and drug information systems are expected to be less effective in reducing medication errors in cultures that encourage autonomy among the physicians:

H3: EMRs will make a greater contribution to reducing medication errors in cultures that are low autonomy than in cultures that are high on autonomy.

H4: Providing physicians with computer-based general drug information will make a greater contribution to reducing medication errors in cultures that are low on autonomy than in cultures that are high on autonomy.

A collegial culture denotes a preference to sharing of clinical information by health care providers and is manifested through teamwork and cooperation tying professionals to each other. On the other hand, a different aspect of collegiality, one that makes it difficult to criticize or restrain an erring colleague, that protects the questionable and closes the ranks against outsiders in case of errors, might also exist (Ronsenthal, 1995). However, given the way our culture survey questions are formulated (informal consulting, sharing of clinical information, and candid open communication), we believe that our measure captures more the first definition of collegiality and therefore we expect that the influence of structures on reducing medication errors will be enhanced in practices with collegial cultures and we hypothesize that:

H5: Benchmarking methodologies will make a greater contribution to reducing medication errors in cultures that are high on collegiality than in cultures that are low on collegiality.

H6: Clinical practice guidelines will make a greater contribution to reducing medication errors in cultures that are high on collegiality than in cultures that are low on collegiality.

H7: Providing physicians with computer-based general drug information will make a greater contribution to reducing medication errors in cultures that are high on collegiality than in cultures that are low on collegiality.

H8: EMRs will make a greater contribution to reducing medication errors in cultures that are high on collegiality than in cultures that are low on collegiality.

In group practices that encourage an emphasis on quality of care, there is an unquestionable agreement among physicians that they will do whatever it takes to improve processes of patient care. Moreover, there is an expectation that physicians' work will be closely monitored to ensure the delivery of appropriate care. In these kinds of practices, physicians will be less likely to resist structures that aim to increase standardization and information flow. Therefore, these structures are expected to reach their full potential of significantly preventing or reducing medication errors:

H9: Benchmarking methodologies will make a greater contribution to reducing medication errors in cultures that are high on "quality emphasis" than in cultures that are low on quality emphasis.

H10: Clinical practice guidelines will make a greater contribution to reducing medication errors in cultures that are high on quality emphasis than in cultures that are low on quality emphasis.

H11: EMRs will make a greater contribution to reducing medication errors in cultures that are high on quality emphasis than in cultures that are low on quality emphasis.

H12: Providing physicians with computer-based general drug information will make a greater contribution to reducing medication errors in cultures that are high on quality emphasis than in cultures that are low on quality emphasis.

Methods

The variables that measure the organizational culture were taken from a survey of a random sample of medical group practices in Minnesota conducted for a previous study (see Appendix A). The survey, developed by Kralewski and colleagues, has been discussed in previous articles (Curoe, Kralewski, & Kaissi, 2003; Kralewski, Dowd, Kaissi, Curoe, & Rockwood, 2005; Kaissi et al., 2004; Kralewski et al., 2005). It was sent in 2001 as part of a larger study to all group practices that have a contract with Blue Cross Blue Shield (BCBS) of Minnesota under the "Blue Plus" managed care program (i.e., enrollees are required to choose a primary care clinic). The majority of the clinics are in Minnesota and the survey targeted generalist physicians in 191 group practices. A maximum of five physicians within each of these specialties were surveyed for any one clinic. To minimize nonresponse bias, we only included practices with responses from at least one third of the primary care physicians. In total, 148 clinics returned the survey for an organizational response rate of 77%. The total number of physicians that responded was 529 (RR = 43%). We surveyed primary care physicians because they are the clinicians who play the leading roles in patient care management in these group practices. The practices included have well-developed primary care components and contract with the "Blue Plus" program to manage the care for patients who enroll in their practices. Therefore, we considered these physicians to be the best judges of the culture from a care management perspective. Given that these physicians share similar training and patient care roles, we reasoned that aggregating their responses using simple means was appropriate. Moreover, previous analyses indicate that the physician responses capture the cultural dimensions that differentiate practice organizations (Kralewski et al., 2005).

The structural variables were taken from a survey of the organization structure of group practices serving the same Managed Care plan ("Blue Plus"), administered as part of a larger study (Kralewski et al., 1999). This instrument has been tested in over 600 medical groups. It also has been validated by site visit interviews with ten group practices. We identified 314 medical groups in Minnesota that have three or more physicians, with at least one physician being a family practitioner, general internist, or general pediatrician. This number was reduced to 217 when the multiple sites of a group practice were designated as one practice. The survey was mailed to the administrator or medical director of each clinic. After one follow-up, surveys from 156 groups (RR = 71%) were obtained. Specialty clinics were excluded, thus resulting in a final sample of 127 groups.

Data on medication errors were obtained from the BCBS of Minnesota prescription drug claim files. Traditionally, research in patient safety has relied on chart reviews and patients' and providers' reports to identify medication errors. Recently, it has shifted toward the adoption of more effective methods such as computer programs to detect errors (Bates et al., 2003; Honigman et al., 2001), and this was the approach used in this study. BCBS has a subsidiary organization, Prime Therapeutics, which conducts extensive Retrospective Drug Utilization Review (RDUR). The system has a standard set of edit flags that signal medication errors. Ideally, three pharmacists would review the system to detect any false positives. However, for this study, the raw (unreviewed) error data were used because budget limitations precluded having pharmacists review those errors to determine validity. Although no data on the validity of these flags are readily available from the literature, Prime Therapeutics' pharmacists predict that some false positives (related to medication dose such as overdose and under dose) may be included in the errors. They estimate that as high as 10% of the dosing errors might be due to false positives. For example, some warnings might be raised because of a minor overdose, but the examination of the patient's weight might reveal that the warning was a false positive. Therefore, the data were analyzed using a restricted interpretation of errors excluding dose errors. A close examination of the included errors reveals that these are serious events with possible serious consequences on the health of the patients, rather than alerts that reflect pure clinical choices. Medication errors were first identified at the patient level and then assigned to the specific practice that the patient selected to manage and provide his/her care. Data over a 1-year period (01/01/01 to 12/31/01) on the number of patients per practice, the number of prescriptions per practice, and the number of medication errors (by type) per practice were collected. Identification numbers enabled us to match the practices from the two surveys and the claims data. The final sample size contains seventy-eight group practices.

The culture survey includes thirty-three statements that measure nine dimensions of the practice culture. From these dimensions, we selected autonomy, collegiality, and quality emphasis. These variables are expected to influence physician adoption and use of the structural components included in the analyses. Although several of the other dimensions in the instrument might also have an influence on the effectiveness of structures in reducing errors, we selected the three that have the strongest theoretical argument. The autonomy dimension denotes a culture that values physicians' individuality; collegiality reflects a culture that fosters communication and coordination among physicians, and between physicians and nurses, whereas the quality-emphasis dimension indicates that the organization has a "safety culture" in which failures are discussed without fear of blame and where quality and patients come first (Appendix A).

We examined four structural variables: clinical information systems, measured as having an EMR (Yes/No); prescription drug control systems, measured as providing primary care physicians with general computer-based drug information at the patient care site (Yes/No); clinical practice guidelines use, measured on a scale from 0 to 10 as the number of illnesses, preventive services, diagnostic tests, and/or procedures for which clinical guidelines are well established in the medical group practice (defined in the survey as written stepwise procedures for aiding decisions about diagnoses and/or treatment of a clinical problem); and benchmarking, measured on a scale from 0 to 5 as the number of benchmarking methodologies employed by the group practice. We also controlled for the effect of size (number of physician full-time equivalents [FTEs] per clinic), geographic location (urban vs. rural), physician workload (number of patients scheduled per primary care physician per clinic hour), and complexity of care (number of prescriptions written per patient per clinic).

Medication error rates are calculated in the literature as the number of errors over the opportunities for errors. In our analyses, the main dependent variable is the overall medication error rate per clinic, calculated as the ratio of medication errors to prescriptions written for BCBS patients by physicians in the practice or specialists outside the practice.

Linear regression was used to test for the separate impact of the cultural and structural variables on medication errors. To test the effect of fit between cultural and structural variables on medication error rates, a moderated regression approach was used (Jaccard, Turrisi, & Wan, 1990). For each pair of culture–structure variables, two equations are specified. In Equation 1, one cultural and one structural variable (in addition to all four control variables) are entered as predictors of medication errors. In Equation 2, the interaction term, that is, the cross-product of the cultural and structural variable, is entered in addition to the main effects:

$$\text{Medication error rate} = \beta_0 + \beta_1 C_1 + \alpha_1 S_1 + \text{control variables} + \text{error} \quad (1)$$

$$\text{Medication error rate} = \beta_0 + \beta_1 C_1 + \alpha_1 S_1 + \phi\, C_1 * S_1 + \text{control variables} + \text{error} \quad (2)$$

A separate equation is written for each pair of culture–structure variables and an F test is performed to determine whether the addition of the interaction term resulted in a significant increment in the percent of variance explained (R^2) in the dependent variable over that already explained by the main effect terms (Kerlinger & Pedhazur, 1973). Ideally, all twelve interaction terms would be added to Equation 2 and a similar F test would be used to determine if the explained variance was statistically significant. However, given the relatively small sample size, the addition of all the

Table 1

Descriptive statistics (n = 78 medical group practices)

Variables	Mean or percentage	Median	SD	Min.	Max.
Total MD FTEs	110.53	18.88	184.57	2.00	530.00
No. of patients scheduled per PCP per hour	3.67	3.68	0.71	2.00	6.00
Prescriptions/Patient ratio	2.13	2.02	0.51	1.40	4.17
Urban location	62.80%	—	—	—	—
Autonomy	2.81	2.80	0.38	1.44	3.78
Collegiality	3.20	3.21	0.33	2.50	3.94
Quality emphasis	2.61	2.67	0.40	1.67	3.67
Have EMR	32.10%	—	—	—	—
Have computerized general drug information	46.60%	—	—	—	—
Practice guidelines in place (0–10)	5.90	6.00	3.94	0	10
Benchmarking methodologies employed (0–5)	2.41	3.00	1.07	0	4
Errors/Prescriptions ratio (n = 72,453 prescriptions)	28.98%	—	—	—	—
Nondose errors/Prescription ratio (n = 34,323 prescriptions)	13.73%	—	—	—	—

interaction terms would dramatically decrease the power of the regression equation.

Findings

Descriptive statistics are presented in Table 1. There are approximately 29 errors for every 100 prescriptions written; nearly one out of three prescriptions results in a medication error of some kind. However, as indicated earlier, some of these errors may be due to false positives; the rate drops to 14% when the dosing errors that are more difficult to evaluate are excluded.

Our first multivariate analysis focused on the independent effect of the culture and structure variables on drug errors (Table 2). None of the cultural or structural variables had a statistically significant separate effect on medication errors. Our next analysis assessed the moderating effects of the cultural variables on each of the structural variables in terms of medication errors (Table 3). First, none of the interactions between the autonomy cultural trait and the structural variables were associated with medication error rates at a statistically significant level. Two out of four interaction terms involving collegiality and quality emphasis were significantly related to reduced error rates, and their inclusion resulted in a significant increase in explained variance. In particular, the addition of the collegiality–benchmarking term ($\beta = -0.172$, $p < .05$) and

Table 2

Effect of organizational culture and structure on ratio of errors per prescription

Variables	*B*	SE	Beta	*t*	*p*
Constant	.12	0.04		2.77	.008
Total MD FTEs	−.001	0.001	−.003	−0.17	.987
No. patients scheduled per PCP per hour while in clinic	.003	0.006	.05	0.57	.569
Location (0 = rural, 1 = urban)	−.02	0.007	−.33	−3.23	.002*
Prescriptions/Patient ratio	.03	0.006	.56	5.66	.000*
Collegiality	.006	0.001	−.62	−0.57	.568
Quality emphasis	−.009	0.009	−.12	−1.11	.274
Autonomy	−.009	0.007	−.12	−1.28	.205
EMR (0 = No, 1 = Yes)	.009	0.10	.14	0.99	.323
MDs provided computerized general drug information (0 = No, 1 = Yes)	−.004	0.008	−.72	−0.59	.560
Clinical practice guidelines scale (0–10)	−.001	0.001	−.03	−2.81	.780
Benchmarking methodologies scale (0–5)	−.004	0.004	.13	1.27	.209

R^2 = .651.

* $p \leq .05$.

Table 3

Effect of organizational culture on relationships between structural variables and ratio of errors per prescription

Structures	R^2 main effects	R^2 main and interaction effects	Difference in R^2 increment	F ratio of R^2 increment	Coefficient of interaction term
Effect of Autonomy					
EMRs	.376	.382	0.60%	0.689	−.107
Drug information	.395	.408	1.30%	1.559	−.158
Benchmarking methodologies	.459	.464	0.50%	0.662	.083
Clinical practice guidelines	.497	.497	0.00%	0.000	−.007
Effect of Collegiality					
EMRs	.374	.383	0.90%	1.036	−.112
Drug information	.396	.396	0.00%	0.000	−.026
Benchmarking methodologies	.435	.469	3.40%	4.546*	−.197*
Clinical practice guidelines	.470	.517	4.70%	6.909*	−.229*
Effect of Quality Emphasis					
EMRs	.397	.425	2.80%	3.457*	−.196
Drug information	.422	.427	0.50%	0.620	−.091
Benchmarking methodologies	.450	.497	4.70%	6.634*	−.223*
Clinical practice guidelines	.476	.529	5.30%	7.989*	−.234*

*Denotes significance at the .05 level or lower.

collegiality–clinical practice guidelines terms (β = −0.183, $p < .05$) resulted in an increase of 2.6 and 3.0% in explained variance, respectively (f = 4.03, $p < .05$ and F = 5.18, $p < .05$, respectively). Also, the addition of the quality emphasis–benchmarking methodologies interaction term (β = −.189, $p < .05$) and quality emphasis–clinical practice guidelines interaction term (β = −.223, $p < .05$) resulted in an increase of 3.4 and 4.8% in explained variance, respectively (f = 5.60, $p < .05$ and F = 8.90, $p < .05$, respectively).

Discussion

The findings of this study support the hypotheses that some structural programs are only associated with reduced medication error rates in organizations that have specific cultural characteristics. The use of practice guidelines and benchmarking is associated with reduced medication error rates only in group practices that have a more collegial culture. However, we do not know whether this results from a more widespread use of these decision support programs in these practices or from more informal sharing of information. The collegial culture measures both cooperation and collaboration.

A similar relationship exists between standardization structures and cultures that emphasize quality. The findings suggest that benchmarking and practice guidelines had a stronger association with reducing medication errors in group practices that emphasize quality. In group practices that lack this cultural attribute, either these structures are resisted by the physicians, or they are accepted but not adequately used. Benchmarking methodologies and clinical practice guidelines need to coexist with a collegial organizational culture that emphasizes quality if they are to have any significant effects on reducing medication errors.

Although interaction effects were strong for structures that measure standardization/formalization, this was not the case for those that measure the information processing capacity of the organization. Either these systems are not equipped with decision support tools that provide drug alerts to physicians (e.g., drug–allergy interactions, drug–drug interactions), or they have been in place for only a short period. Evidence suggests that it might take approximately 6 to 12 months to implement an EMR, depending on the size of the practice and the computer literacy of its physicians and support staff. Another possible interpretation is that there are likely to be major variations in the uses that practitioners make of the systems. It could very well be that a system is in place but it is not being used by the physicians because it is time-consuming or difficult to operate. Future research addressing this issue should examine not only whether these systems are in place but also for how long they have been implemented in the practice and the extent of their use by the physicians.

None of the interactions between the autonomy cultural trait and the structural variables were associated with medication error rates at a statistically significant level. Whether this is due to the fact that physicians in practices that value autonomy take more responsibility for quality of care and patient safety, and rely less on organizational systems and structures, or to the fact that they tend to get a different mix of patients that require less prescription drugs, is unclear at this point. In summary, the results suggest that an important predictor of the effect of structural variables on overall medication errors in group practices is whether these group practices have cultures that emphasize quality and collegiality.

It is also important to note that although only four of the twelve interaction terms were statistically significant, the data revealed some clear patterns that largely support our hypotheses, as nine out of the twelve interactions are in the direction predicted in the hypotheses. With only seventy-eight medical group practices, seven explanatory variables (and four control variables) greatly reduce the statistical power of the regression equations. Consequently, the statistically significant relationships identified in the analysis had to have strong correlations in order to reach the specified level of significance. The positive implication is that the effects that emerged as statistically significant are also likely to have practical significance.

Practice Implications

Medical group practice administrators and medical directors may need to consider a paradigm shift in their efforts to improve the performance of their organizations. Although there are numerous programs, technologies, and strategies that can be used to improve performance, implementation in these highly professionalized organizations is problematic and the outcomes are often disappointing. Our data demonstrate that the practice culture may be the main factor influencing the success of these efforts and should be the starting point when attempting to improve practice performance. Managers of medical group practices need to be sensitive to the culture of the organization before implementing organizational structures across the board. There needs to be more attention given to the values and the norms of the providers of the organization prior to taking administrative decisions. Some structures initially designed to improve quality of care and patient safety may become counterproductive if they are not aligned with the organizational culture. If cultural assessment is made and it turns out that the culture in place is not likely to be supportive of the specific structures to be developed, it might be more appropriate to consider other structures that are more compatible with the culture, rather than trying to force unaccepted structures. However, if everything else fails, then culture change needs to take place. Needless to say, this change is always difficult and slow, and it needs to be driven by organizational leaders if it is to be successful.

Several limitations of this study should be noted. First, the group practices included are all located in the upper Midwest area. Although the findings of this study, for the time being, may be only generalizable to mature group practices and this geographic area, the practice of medicine nationally is moving toward the group model, and thus it is reasonable to assume that the findings will have implications nationally as these practice forms continue to grow and expand. Moreover, our data are limited to BCBS of Minnesota clinics, and thus no comparative data are available for clinics who may be insured by other insurers. Therefore, it was not possible to detect structures that are simply the result of differing requirements imposed by the insurers on the physicians.

This study examined the effect of organizational culture and structure, separately and in combination, on medication error rates in medical group practices. The findings suggest that much of the variance in the effectiveness of quality improvement programs in medical group practices may result from the lack of "fit" with the practice culture. The implications are that medical group practice administrators and medical directors have alternate ways to improve patient safety and that they should be attentive to the cultures of their practices when considering these options. Implementing structures that are compatible with the culture of the group practice might be a prerequisite for gaining buy-in from clinicians and for positively influencing patient safety and quality outcomes.

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Appendix A

Assessing the culture of medical group practices

	Loading Scores
Collegiality	
1. A great deal of informal consulting.	.758
2. A great deal of sharing of clinical information.	.689
3. A close collegial relationship among the physicians.	.637
4. A strong sense of belonging to the group.	.552
5. A strong sense of responsibility to help one of our physicians if he/she has a personal problem.	.474
6. Candid and open communication exists between physicians and nurses.	.411
Quality emphasis	
1. Physicians who develop inappropriate patient care practices will be ''talked to.''	.797
2. We encourage internal reporting of adverse events.	.697
3. The quality of each physician's work is closely monitored.	.608
4. There is an open discussion of clinical failures.	.515
5. We emphasize patient satisfaction.	.511
6. Quality of care is goal number one.	.488
Autonomy	
1. An emphasis on physician individuality; each physician has the right to practice according to his/her own style.	.659
2. A feeling that we are each autonomous clinicians, but practicing in the same organization for support services.	.642
3. A great deal of tolerance of a physician's idiosyncratic patient care practices.	.496

All questions are introduced by ''in our medical group practice.'' The response is on a scale of 1 to 4 with 1 = ''not at all,'' and 4 = ''to a great extent.'' Mean scores for each dimension are calculated for each physician responding and then aggregated to the clinic level.