Dialysis Practices That Distinguish Facilities with Below- *versus* Above-Expected Mortality

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Background and objectives: Mortality rates vary widely among dialysis facilities even after adjustment with standardized mortality ratios (SMRs). This variation may occur because top-performing facilities use practices not shared by others, because the SMR fails to capture key patient characteristics, or both. Practices were identified that distinguish top- from bottom-performing facilities by SMR.

Design, setting, participants, & measurements: A cross-sectional survey was performed of staff across three organizations. Staff members rated the perceived quality of their units' patient-, provider-, and facility-level practices using a six-point Likert scale. Facilities were divided into those with above- *versus* below-expected mortality on the basis of SMRs from U.S. Renal Data Service facility reports. Mean Likert scores were computed for each practice using *t* tests. Practices that were statistically significant ($P \leq 0.05$) and achieved at least a medium effect size of ≥0.4 were reported. Significant predictors were entered into a linear regression model.

Results: Dialysis facilities with below-expected mortality reported that patients in their unit were more activated and engaged, physician communication and interpersonal relationships were stronger, dieticians were more resourceful and knowledgeable, and overall coordination and staff management were superior *versus* facilities with above-expected mortality. Staff ratings of these practices explained 31% of the variance in SMRs.

Conclusions: Patient-, provider-, and facility-level practices partly explain SMR variation among facilities. Improving SMRs may require processes that reflect a coordinated, multidisciplinary environment (*i.e.*, no one group, practice, or characteristic will drive facility-level SMRs). Understanding and improving SMRs will require a holistic view of the facility.

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Since 1995, the U.S. Renal Data System (USRDS) has calculated standardized mortality ratios (SMRs) to estimate patient survival in dialysis facilities. Because unadjusted mortality rates cannot capture the inevitable case-mix variations among facilities, the SMR is adjusted for a range of variables including age, sex, race, disease duration, comorbidities, nursing home status, and body mass index (1,2). SMR further adjusts for underlying mortality rates by scaling observed mortality by expected mortality on the basis of national data. Individual facilities are classified as having lower (SMR < 1.0), higher (SMR > 1.0), or as-expected (SMR = 1.0) mortality compared with the national average (1,2). This information is publicly available (3) and allows payers and consumers to monitor quality within individual facilities and to compare quality among facilities.

Despite attempts to adjust for case-mix variations, patient survival varies among dialysis facilities even after adjustment. McClellan and colleagues evaluated mortality rates in a cohort of dialysis units and showed that facility-specific mortality ranged between 2.0 and 10.5 deaths per 10,000 patient days; variations remained after extensive adjustment (4). Goodkin and colleagues found that intra- and international mortality variations also remained after adjusting for a range of demographic characteristics and comorbidities (5). In short, mortality varies from center to center, and this variation is not explained by case-mix adjustment alone.

If case-mix adjustment is inadequate to fully explain mor-

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tality variations, then what else might explain the differences? One possibility is that there may be important differences in facility-level factors that affect SMRs. These factors may include procedural (*e.g.*, implementation patterns of policies in a facility), attitudinal (*e.g.*, staff morale), interpersonal (*e.g.*, staff communication), or structural (*e.g.*, layout of facilities) practices associated with reduced SMRs (6). There may also be additional patient-level characteristics that are unaccounted for with standard case-mix adjustment. These factors may be incremental to standard demographics and comorbidities or may even supersede those factors. For example, it is possible that top-performing units have more compliant, more motivated, or more disciplined patients compared with bottom-performing units—all characteristics that elude standardized adjustments.

To test the hypothesis that there are patient-, provider-, and facility-level factors that are associated with SMRs, and to further elucidate predictors of SMRs, we conducted the Identifying Best Practices in Dialysis (IBPiD) study; this study aims to catalogue best practices associated with improved patient outcomes in dialysis, including SMRs (6). In this study, we identify predictors of mortality that are not traditionally included in case-mix adjustments.

Materials and Methods

IBPiD Overview

IBPiD is a three-phase multidisciplinary study to identify best practices associated with facility-level achievement of dialysis outcomes, including SMRs (6). The study presented here presents data from Phase III of IBPiD. Phases I and II have been described in a previous publication (6), which culminated in the development of 155 candidate best practices for dialysis facilities. These candidate practices were identified through a multistage process, including systematic literature review, cognitive interviews of dialysis staff members, and an online "virtual focus group" of nurse managers, community nephrologists, and academic opinion leaders (6). The resulting practices were qualitatively catalogued (see Appendix) and operationalized in a questionnaire designed for use by dialysis organizations to measure adherence with these practices in their facilities. The primary objective of Phase III, described here, was to test whether the candidate best practices resulting from Phases I and II predict SMR. The study was approved by the University of California at Los Angeles Institutional Review Board and was conducted in accordance with the institutional guidelines regulating human subject research.

Questionnaire Administration

Questionnaire Content. We administered confidential online questionnaires to staff in 90 randomly selected dialysis facilities across three organizations, including one not-for-profit small dialysis organization (Satellite Healthcare), one not-for-profit medium dialysis organization (Dialysis Clinic, Inc [DCI]), and one for-profit small dialysis organization (Renal Ventures Management, LLC). The questionnaire elicited staff perceptions regarding dialysis practices and other facility-level factors developed from our previous work (6). The questionnaire had eight sections regarding facility and staff practices, including (*1*) staff working environment, (*2*) facility characteristics and amenities, (*3*) facility-based health maintenance practices, (*4*) technician practices, (*5*) nursing practices, (*6*) social work practices, (*7*) dietician practices, and (*8*) multidisciplinary conference practices. In addition to facility-level characteristics, personnel rated characteristics of physicians who work in their facility, including the perceived quality of physician-staff interactions, physician-patient interactions, treatment practices, and documentation practices. For each dialysis practice within these sections, respondents indicated their level of agreement that the practice occurs in their facility using a six-point Likert scale (1 = "do not agree at all"; 6 = "agree completely"). Frequency ratings were also rendered on a six-point scale (1 = "never"; 6 = "always"). Dichotomous policies and procedures were answered with a binary "yes" *versus* "no" response. Finally, staff reported characteristics of the patients in their facility, including their perceived willingness to learn, compliance with dietary and medical advice, self-efficacy, and motivation for self-care.

Validating Online Questionnaire Results. Although provider surveys are often a cost-effective way to assess process of care, they are potentially limited because responses may be incongruent with the reality on the ground. On-site assessments can help to verify the responses of provider surveys. We conducted on-site assessments in a sample of 15 dialysis units from our sample. A trained observer visited the centers and abstracted site data while blinded to the performance outcomes of the facilities and the results of online staff surveys. For purposes of inter-rater reliability, a second trained rater was present during four of the visits, and agreement was evaluated with kappa statistic for dichotomized assessments. To test the reliability of the online instrument, we measured correlation coefficients across a core set of items embedded in both types of data collection. We measured cross-instrument correlations for various facility physical characteristics (*e.g.*, layout of chairs and pods, proportion of nursing stations with direct view of patients, use of computers on wheels), staffing characteristics (*e.g.*, staff to patient ratios), and processes of care (*e.g.*, hand washing frequency, glove changing frequency, use of aseptic technique, *etc.*). We found that inter-rater agreement was excellent, with kappa scores between 0.82 and 0.89 for the dual-rater visits. Furthermore, correlations between on-site assessments and staff reporting were positive and achieved expected directionality with most r values of 0.5 to 0.7.

Sampling. Within each facility, we administered online surveys to staff in five roles, including (*1*) medical director, (*2*) nurse manager/supervisor, (*3*) floor nurse, (*4*) dialysis patient care technician, and (*5*) dietician. We developed separate surveys for each staff position that reflected the responsibilities and perspectives of the respondent's role, but also included overlapping questions to help evaluate multiple perspectives on variables common to all roles. To ensure that no one staff member's personal bias skewed results, each question was independently asked of staff from at least two different positions within the facility. Additionally, for facilities that were large enough, we surveyed two nurses and two technicians in lieu of focusing on only one individual's perception.

Calculation of Facility Item Scores. To minimize the influence of social desirability in the response, a subset of items were asked in the negative. The first step in processing item scores was to reverse the scaling on all of these items. To obtain the best, unbiased estimate for each item at a facility level, all available responses, independent of the staff position, were averaged to arrive at a composite-scale score for each question. In instances in which staff skipped items, we imputed data using the mean of available nonmissing items. In instances in which no staff members in a particular role responded to the survey, we were unable to assign item scores to facilities lacking the data.

Statistical Analyses

We sought to identify individual predictors of facility-level SMRs as measuring by the 2007 USRDS Dialysis Facility Report. Because SMRs may vary from month to month in an individual facility, we obtained the 12-month running average for each facility (January through December 2007) in the period directly preceding administration of the staff surveys, which occurred between December 2007 and January 2008.

Because we tested over 150 predictors of facility-level outcomes, we performed sequential analytic steps to focus our analyses on the most important predictors. First, we divided the participating facilities into high *versus* low mortality groups, stratified by USRDS SMR of <1.0 (below expected mortality) *versus* >1.0 (above expected mortality). We then performed bivariate analyses to compare mean facility-level scores for each survey item between groups using the *t* test. To generate a parsimonious list of variables, and in acknowledgment of the fact that statistical significance does not always correspond with clinical significance, we limited our subsequent analyses to predictors fulfilling explicit criteria, including (*1*) the difference in scores between high *versus* low mortality facilities met or exceeded an effect size of 0.4 SD (calculated as the difference in the means in the respective groups divided by the pooled SD), which is considered to be a "medium effect size" (7); and (*2*) the *P* value for the bivariate relationship was significant at the $P \leq 0.05$ level. By limiting our analysis to parameters that were statistically significant and achieved a minimum effect size threshold, we attempted to guard against spurious and potentially noninformative results.

We next evaluated the linear relationship between each predictor selected from our initial screen and facility-level SMRs. We calculated a Spearman correlation coefficient between each facility-level item score and facility-level SMR. For each analysis, we calculated a *P* value for the linear relationship on the basis of a bivariate ordinary least-squares regression analysis. We then selected predictors that met criteria for statistical significance and arranged them within conceptual categories.

Finally, the predictors selected from bivariate analyses were entered as independent variables into an exploratory multiple linear regression model predicting facility SMR as a continuous variable. We entered variables in a forward stepwise regression model while adjusting for organization to identify factors that independently predicted SMR after adjustment. To support a regression model with up to six independent predictors, assuming a minimum of 15 observations per predictor, we required a sample size of 90 total facilities. We used SAS v9.0 for all analyses.

Results

Sample Characteristics

There were 90 participating facilities in which 423 of 508 personnel completed the surveys (80% response rate; mean age 44.8 ±10 years; 19% men; tenure = 6.6 ± 6.3 years). Table 1 provides descriptive information about the participating units. The mean 12-month SMR across facilities was 0.87 ± 0.4. The SMR followed a normal distribution (Kolmogrov–Smironov test for normality: $P = 0.10$; 25th, 50th, 75th percentile = 0.61, 0.81, and 1.1, respectively; range = 0.2 to 2.5).

Sixty-six percent of the facilities achieved an SMR < 1.0; the remainder had above-expected mortality (SMR > 1.0). None of the facilities in this sample achieved an SMR of exactly 1.0. The SMR mean and range for the top- and bottom-performing groups were 0.66 (range = 0.2 to 0.99) and 1.2 (range = 1.01 to 1.8), respectively. The percentage of patients per month with Kt/V ≥1.2, hemoglobin of 11 to 12 g/dl, albumin ≥3.5 g/dl, and parathyroid hormone concentrations of 150 to 300 pg/ml was 91%, 46%, 81%, and 38%, respectively. Among staff that completed the survey, only 4% of items were skipped and required imputation. Of the 90 participating facilities, 73 had complete case ascertainment from all five staff roles. The remaining had data from no fewer than four of five staff roles. There was no difference in staff nonresponse between top- *versus* bottom-performing groups ($P = 0.5$). Of note, there also were no differences in mean facility size or years in operation between facilities in the top- *versus* bottom-performing groups.

Predictors of Facility-Level SMR

We identified 19 predictors of facility-level SMR that met criteria for effect size and statistical significance, including nine patient characteristics, two physician characteristics, three dietician characteristics, and five facility characteristics, policies, and practices. Table 2 lists these predictors, arranges them by category, and provides the relationship between each predictor and SMR. When these were entered into a multivariable linear regression analysis there were five additive factors ($r^2 = 0.31$) that independently predicted facility-level SMR (Table 3). The factors with the highest independent predictive value were (*1*) rapidity that multidisciplinary care conferences are convened after hospital discharge of a patient returning to the dialysis facility ($\beta = -0.05$; $P = 0.01$), (*2*) ability of dieticians to effectively address cultural issues in developing plan ($\beta = -0.05$; $P = 0.01$), (*3*) perceived quality of continuing medical education programs ($\beta = -0.07$; $P = 0.05$), (*4*) willingness of patients to learn from staff and physicians about self-care ($\beta = -0.10$; $P = 0.02$), and (*5*) patient discipline in following medical advice ($\beta = -0.08$; $P = 0.05$). We evaluated for evidence of an organization-level effect on the observed relationships. However, organization was not a significant predictor of SMR in the final regression model.

Discussion

USRDS uses the SMR to adjust for variations in patient populations among dialysis facilities (1,2). This helps to "level the playing field" because facilities with highly morbid populations will yield higher unadjusted mortality rates. Yet there are variations in mortality despite attempts to adjust for case-mix variations. In this study, we identified patient-, provider-, and facility-level predictors of mortality that are not traditionally included in case-mix adjustments.

On the basis of reporting from a range of dialysis personnel, we identified 19 factors that distinguished high *versus* low mortality units by SMRs, of which 5 remained independently associated after multivariable adjustment. The factors cover a range of domains, including patient characteristics, physician practices, dietician practices, staff working climate, and facility policies and practices. This suggests that improving SMRs may require processes that reflect a coor-

Table 1. Characteristics of participating centers

Characteristics	Renal Ventures Management, LLC	Satellite Dialysis	DCI
Organizational characteristics			
profit status of dialysis organization	For profit	Not for profit	Not for profit
size of dialysis organization	Small	Small	Medium
years in operation of dialysis organization	10+	30+	28
number of participating facilities within organization	19	24	47
Facility characteristics and policies			
unit size range (number of patients)	57 ± 21 (range 15 to 68)	61 ± 27 (range 11 to 201)	78 ± 48 (range 10 to 155)
location of participating facilities	Texas, New Jersey, Iowa, West Virginia, Alaska	California, Texas	Alabama, California, Connecticut, Florida, Georgia, Indiana, Louisiana, Missouri, Nebraska, New Jersey, Nevada, New York, Pennsylvania, South Carolina, Tennessee
percent of facilities			
with staff member dedicated to anemia management	94	100	82
with staff member dedicated to vascular access management	94	100	65
with full-time physician assistant working in unit	12	0	5
with full-time nurse practitioner working in unit	6	0	8
employing "wave" technique of staggered run start times for patient scheduling	64	43	42
with after-hour capacity to treat patients	35	6	28
with dialysis machines featuring online clearance calculations	35	44	46
with dialysis machines featuring continuous blood volume monitoring	35	0	18
with explicit policy that sets maximum ultrafiltration rate	64	75	52
with private room for patient interviews/assessments	100	57	73
with beds allowing for supine dialysis	12	0	8
reporting use of computers on wheels	6	75	5
that standardize day of week labs are ordered	94	81	95
that develop patient educational topic of the month	65	56	45
offering formal programs in health maintenance (*e.g.*, smoking cessation, diabetes management, obesity management)	30	7	5
offering formal programs for intradialytic exercise	24	19	5
with formal process for monitoring and tracking immunizations	94	100	84
with formal process for monitoring and tracking lipid panels	87	69	90
with formal process for monitoring and tracking hemoglobin A1c levels	88	88	83
that report offering formal orientation tours to new patients	94	82	65
Respondent characteristics			
total number of staff surveys completed	96	120	207
age of respondents	43 ± 11	45 ± 11	46 ± 11
gender of respondents (% male)	18%	18%	19%
tenure of respondents (years)	6.0 ± 5.7	7.7 ± 7.6	6.5 ± 5.9

The study included data from 90 dialysis facilities across three organizations, including Renal Ventures Management, LLC; Satellite Dialysis; and DCI.

Table 2. Predictors of facility-level SMRs stratified by domain

Factor	*n* Units with SMR < 1.0	Mean in Units with SMR < 1.0	*n* Units with SMR ≥ 1.0	Mean in Units with SMR ≥ 1.0	Effect Size (95% confidence interval)	Spearman *r* Value	*P*[a]
Patient characteristics							
frequency that patients stay for the entirety of their prescribed dialysis session without leaving prematurely	59	4.82	29	4.36	0.6 (0.2 to 1.0)	−0.31	0.018
patient cooperation with staff and other patients in dialysis facility	59	5.29	29	4.86	0.6 (0.2 to 1.0)	−0.24	0.011
willingness of patients to learn from staff and physicians about self-care	59	4.76	29	4.19	0.6 (0.2 to 1.0)	−0.38	0.003
patient compliance with dietary advice	59	3.74	29	3.13	0.6 (0.2 to 1.0)	−0.35	0.004
patient discipline in following medical advice	59	4.21	29	3.6	0.6 (0.2 to 1.0)	−0.25	0.004
patient motivation for self-care	59	3.36	29	3.02	0.4 (0.1 to 0.9)	−0.25	0.052
patient discipline in self-care	59	4.33	29	3.9	0.4 (0.1 to 0.9)	−0.26	0.051
patient independence for self-care	59	3.94	29	3.5	0.4 (0.1 to 0.8)	−0.19	0.043
overall level of patient accountability for their actions related to their ESRD	59	3.22	29	2.88	0.4 (0.1 to 0.9)	−0.18	0.053
Physician characteristics							
ability of physicians to interact with their patients with care and respect	51	4.99	25	4.48	0.4 (0.1 to 0.9)	−0.18	0.041
willingness of physicians to spend time with staff without feeling "bugged"	56	5.38	27	5.01	0.4 (0.1 to 0.8)	−0.13	0.049
Dietician characteristics							
ability of dieticians effectively address cultural issues in developing plan	55	5.49	28	5.64	0.4 (0.1 to 0.9)	−0.32	0.04
knowledge of dieticians regarding resources available to patients	56	5.79	28	5.09	0.4 (0.1 to 0.9)	−0.29	0.055
ability of dieticians to withhold judgment when patients do not follow advice	56	5.71	28	4.78	0.4 (0.1 to 0.9)	−0.20	0.041
Facility characteristics, policies, and practices							
frequency that management calls in *per diem* nursing staff when faced with unexpected staffing shortage	59	3.01	28	2.45	0.4 (0.1 to 0.9)	−0.16	0.009
frequency that nursing staff conduct medication reconciliation	59	5.55	28	4.9	0.8 (0.4 to 1.2)	−0.25	0.0002
rapidity that multidisciplinary care conferences are convened after hospital discharge of a patient returning to the dialysis facility	50	4.19	25	3.31	0.6 (0.2 to 1.1)	−0.32	0.0064
frequency that routine multidisciplinary conferences are convened	61	3.92	29	3.43	0.4 (0.1 to 0.9)	−0.10	0.12
perceived quality of continuing medical education programs	59	3.37	29	2.94	0.4 (0.1 to 1.0)	−0.13	0.05

Facilities were divided into top- *versus* bottom-performing facilities using 12-month facility-level SMRs. The table presents dialysis practices that distinguished between groups using benchmarks for statistical significance ($P \leq 0.05$) and effect size (≥0.4 SD). Values are obtained from staff in dialysis facilities who self-rated their own facilities using six-point Likert scales.

[a]*P* value refers to Spearman correlation coefficient.

dinated, multidisciplinary environment (*i.e.*, no one group, practice, or characteristic will drive facility-level SMRs). Understanding and improving SMRs will require a holistic view of the facility.

These data suggest that the USRDS formula for calculating SMR may be necessary but insufficient to fully adjust for case-mix variations among facilities. It is notable that the predictive factors identified in this hypothesis-generating study explained nearly one-third of the variance in SMR—an endpoint that is itself already adjusted. Because some of these factors pertain to patient characteristics, this suggests that further case-mix adjustment is possible. In our sample of 90 facilities including three participating organizations, we explained 31% of the variation in adjusted mortality among facilities on the basis of empirical ratings from dialysis staff alone. It appears that dialysis personnel have vital knowl-

Table 3. Independent predictors of SMRs across cohort of 90 participating facilities

Factor	β Coefficient	Standard Error	P
Ability of dieticians to effectively address cultural issues in developing plan	−0.05	0.02	0.01
Rapidity that multidisciplinary care conferences are convened after hospital discharge of a patient returning to the dialysis facility	−0.07	0.03	0.01
Perceived quality of continuing medical education programs	−0.07	0.04	0.05
Willingness of patients to learn from staff and physicians about self-care	−0.10	0.04	0.02
Patient discipline in following medical advice	−0.08	0.04	0.05

Five factors jointly explained 31% of the variance in facility-level SMR.

edge about their facility and its patients that the SMRs may not reflect.

In particular, the SMRs may be incapable of adjusting for various patient characteristics that are incremental to standard demographics and comorbidities. We found that personnel in facilities with low mortality rates perceive their patients to be more cooperative, willing to learn, compliant, self-efficacious, independent, and accountable compared with patients in high mortality units. To the degree that staff perception is a reliable surrogate for true patient characteristics, these data indicate that standard SMR adjustments may not fully reflect attributes of patient populations that matter for mortality. It is possible that the "institutional personality" of a dialysis patient population makes a difference. This finding may help dialysis managers gain better insight regarding how to measure population attributes of patients under their care.

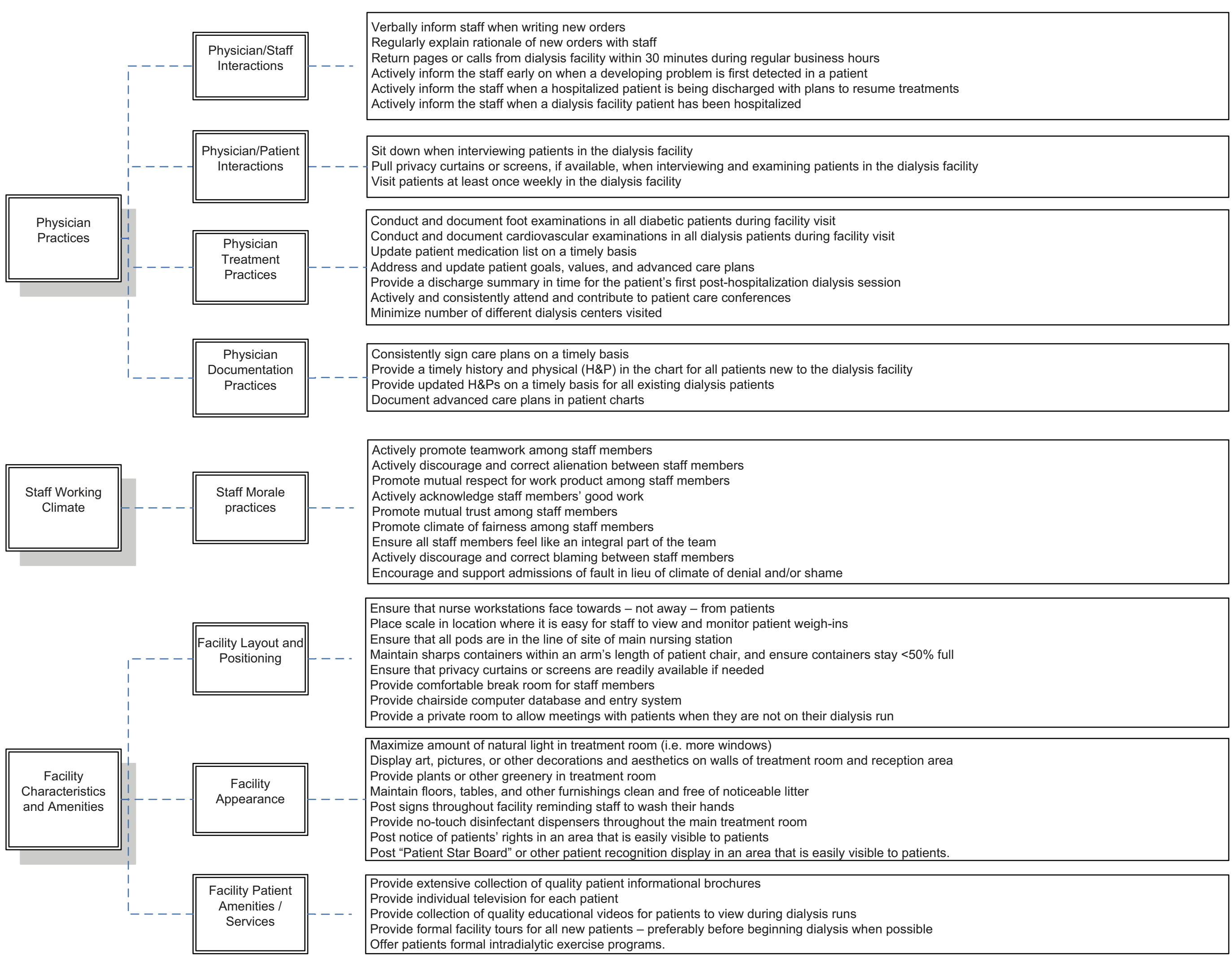
Moreover, measurement of patient attribute scores might help managers in low-performing units identify patient-level barriers to quality performance that the SMR cannot. Managers could use this information to identify strategies to boost the institutional morale of its patients. That is, it may be possible that institutional personalities are malleable in the right setting. Potential interventions might include motivational events, enhanced and tailored educational techniques, or efforts to personalize the oftentimes complex science of dialysis in ways that motivate, inspire, and activate patients. This "patient activation model," as originally expressed by Kaplan and Greenfield (8-12), has been successful in other areas of health care. The model posits that patients who are informed and actively participate in their health care have better outcomes than patients who are inadequately informed, unmotivated, or passive (8-12). Moreover, effective personal care marked by participatory decision-making is linked not only to improved psychosocial and functional outcomes, but also to physiologic outcomes in various chronic diseases (10,11). This suggests that dialysis units with low patient activation scores might consider participatory decision-making approaches to potentially enhance their SMRs.

In addition to patient-level characteristics, we identified physician-level factors that were associated with facility-level SMRs. Compared with high-mortality units, staff in low-mortality units rated their physicians as better able to interact with their patients with care and respect and more willing to spend time with the dialysis staff without feeling "bugged." Of note, the staff ratings of physician technical skill or knowledge were not predictive of SMRs. Instead, characteristics relating to interpersonal relationships and communication were predictive of SMRs, indicating that communication, shared expectations, and plan coordination among staff may be important to enhance outcomes. However, it is notable that these physician-level factors did not remain predictive after adjustment in our hypothesis-generating exploratory regression model. This suggests that although physician factors are likely important, they may be of relatively lower importance in driving SMRs compared with other factors, including patient characteristics, dietician characteristics, and facility practices.

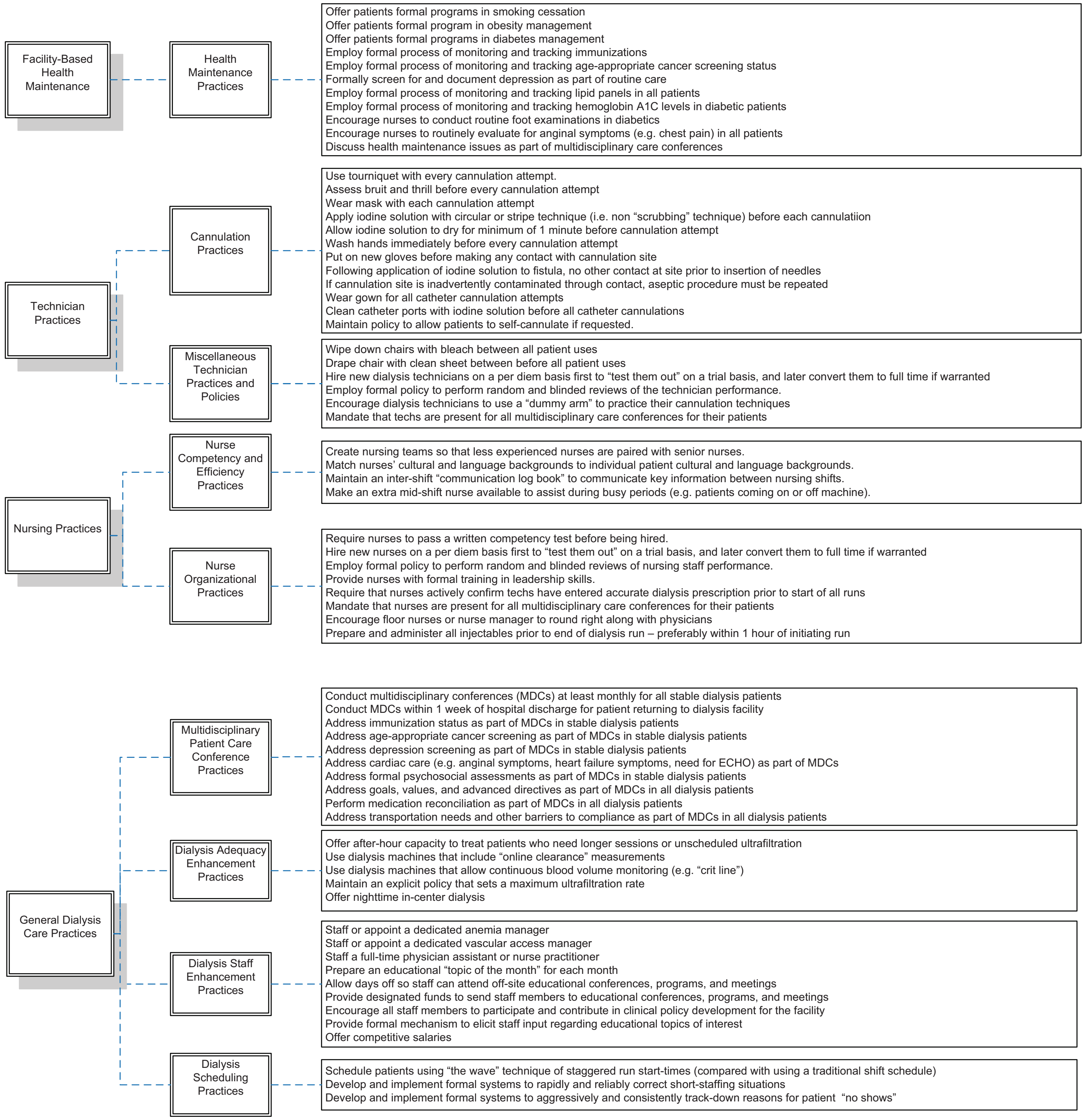
The importance of coordinated care is further emphasized by our finding that low-mortality units report more frequent multidisciplinary care conferences. In addition, low-mortality units convene multidisciplinary conference sooner after dialysis patients return to the facility after hospitalization and perform medication reconciliation more frequently than high-mortality units. Multidisciplinary conferences are an essential component of patient care and are required for dialysis facility reimbursement by the Centers for Medicare and Medicaid Services. Although the enhanced coordination of care is a touted benefit of these conferences, we have previously documented uncertainty among dialysis providers regarding the true effect of these conferences on outcomes (6). Our results here suggest that frequent and timely conferences may be associated with improved mortality. Although this link may not be causal, the relationship suggests that efforts to enhance coordination, such as timely and frequent multidisciplinary conferences, may improve survival.

We found that personnel in top-performing facilities perceive a higher quality of staff management and education. Specifically, top units are more likely to call for *per diem* help if there is unexpected short staffing and have a higher perceived quality of continuing medical education programs for staff. When coupled with the finding that physicians and staff are perceived to get along better in the top-performing units, these data suggest that low-mortality facilities have a more staff-oriented and friendly environment marked by better perceived staffing, a more communal and respectful work place, and a stronger emphasis on quality educational programs. This suggests that dialysis managers should aim to formally identify and correct nonadherence with interpersonal and attitudinal best practices. Doing so may not only improve morale, but may in fact improve outcomes, although this will require empirical testing in a prospective interventional study.

Our analysis has important limitations. First, this is a cross-sectional exploratory study, so we can only comment on associations, not causations. Future research should measure the longitudinal predictive value of the factors identified in this hypothesis-generating study. Second, although we used a comprehensive approach to identify candidate best practices in Phase I to II of IBPiD (6), it is likely that key clinical elements are nonetheless missing. Third, we relied on staff reporting about practices in their facility. It is possible that staff perceptions may not be wholly accurate. However, we sought data from multiple perspectives, so the principle of regression to the mean should tend to stabilize biases from any particular group. Fourth, we did not directly collect data from patients. Although our study did not aim to perform patient-level interviews, we did draw inferences from patient populations from staff reports; it would be ideal to also directly consider patient data. Future research should also



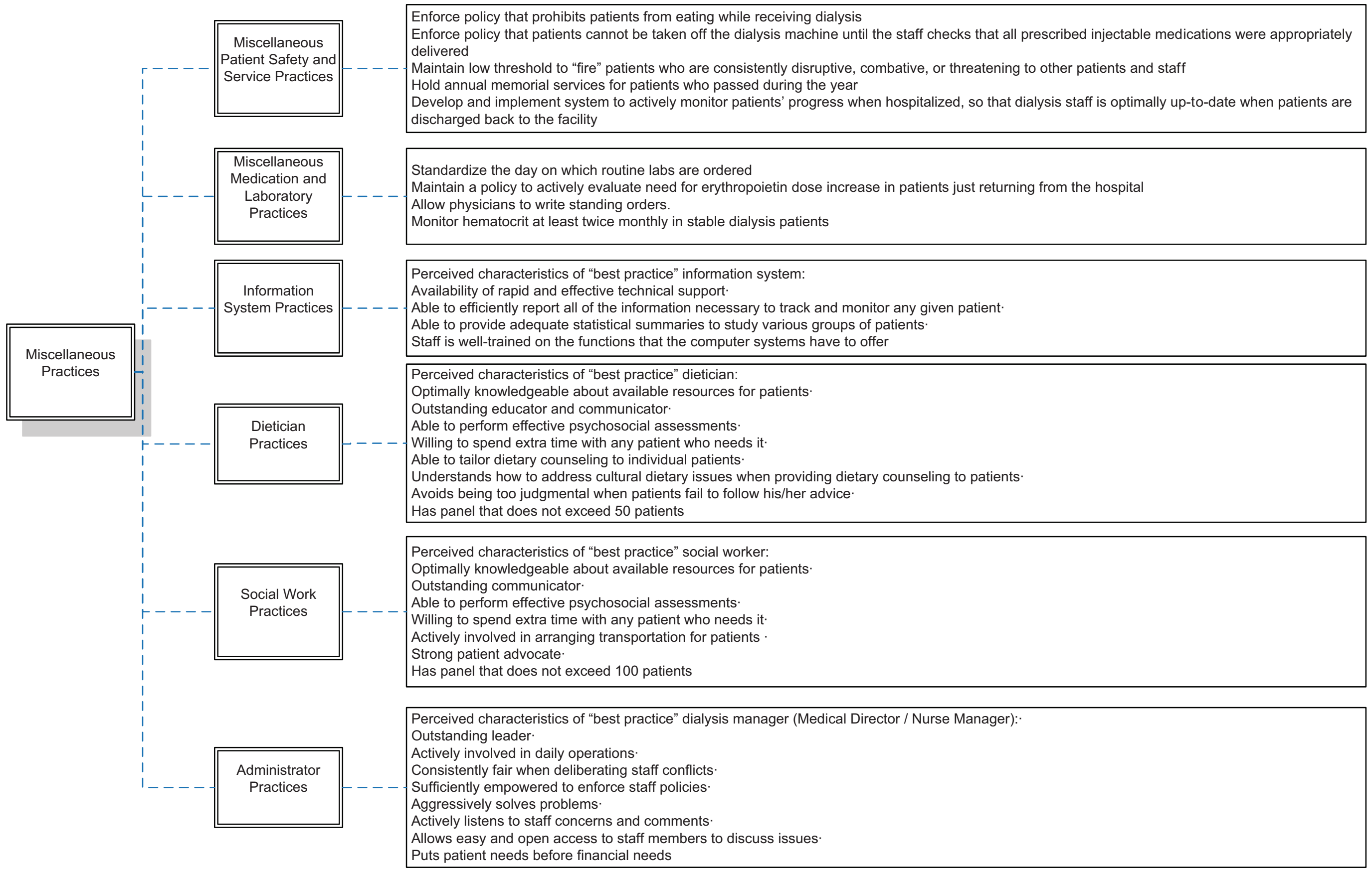
Appendix. Candidate best practices perceived to improve outcomes in dialysis facilities, arranged according to major and minor domains.



Appendix. Continued

incorporate patient-reported data to more optimally predict SMRs and should consider use of hierarchical models to establish how much each level of analysis (*e.g.*, patient, staff, physicians, facility-level) affects overall SMRs. This would require a larger sample size of units.

In conclusion, we found that dialysis facilities with below-expected mortality report that patients in their unit are more highly activated and engaged, physician communication and interpersonal relationships are stronger, dieticians are more resourceful and knowledgeable, and coordination and staff management are superior compared with facilities with above-expected mortality. This suggests that SMR outcomes are enhanced by processes reflecting a coordinated, multidisciplinary environment. Future research should measure the prospective predictive validity of these factors in a larger sample of dialysis facilities.



Appendix. Continued

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Disclosures

None.

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See related editorial, "Processes of Care and Reduced Mortality among Hemodialysis Patients in the United States," on pages 1905–1907.

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