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may alkalinize the urine and thus decrease the urinary formaldehyde concentration. This does not appear to account for the large observed difference because most patients with acidic urine pH in the previous study did not have Proteus species. The authors can find no published data to indicate that Escherichia coli and Klebsiella species substantially alkalinize the urine. Third, the two patients in the present study were young adults, while the patients in the previous study were elderly (aged 60 to 76 years). Although no data are available about the effect of age on the generation of formaldehyde from methenamine, it seems unlikely that age was related to the marked differences, as none of the patients in either study had renal dysfunction.

In this study, each of three methenamine regimens resulted in bactericidal formaldehyde concentration. Further long-term clinical studies are needed to demonstrate any therapeutic differences in regimens studied and in patients undergoing intermittent vs continuous urinary catheterization.

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The Relationship of Continuity of Care to Age, Sex, and Race

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Continuity of care has been identified as one of the distinguishing characteristics of good primary care.[1] Family medicine in particular regards continuity of care as a major ideal and seeks to teach and promote continuity in its educational programs.[2] These attempts to foster continuity should be paralleled by efforts to evaluate it, since the determinates of continuity and its influence on health outcomes are largely unknown.[3] A number of authors have sought to measure the overall continuity of care provided by a practice,[4-6] but their results have been difficult to compare because the authors used differing measures of continuity.

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Recently a number of statistical measures of continuity of care have been proposed that should be helpful in studies involving continuity.[7-10] One such measure is the continuity of care (COC) score developed by Bice and Boxerman.[7] This instrument measures continuity of physician care within a group practice and assigns for each patient a numerical value between 0 and 1. A score of 1 results when all visits over a given time period are handled by one physician. If a different physician is seen for every visit, the COC score is 0, and intermediate scores are lowered geometrically each time a new physician provides care for a patient. The COC score is computed as follows:

$$\text{COC} = \frac{\sum_{j=1}^{s} n_j^2 - n}{n\,(n-1)}$$

where n_j = the number of visits to the jth different provider, $j = 1, 2 \ldots 5$; and s = the number of potentially available providers. Because comparison data is scarce for investigators, this study sought to tabulate continuity scores for major demographic subgroups of one practice utilizing the COC score.

Methods

The Department of Family Medicine at the University of North Carolina at Chapel Hill maintains a group teaching practice for residents and faculty. Twenty percent of patients are children under 18 years, 4.8 percent are adults 65 years old and over, 2 percent are on Medicaid, and 21.4 percent are nonwhite. At the Family Practice Center each patient visit is documented on an encounter form, and the data are stored on computer discs for later analysis.

Continuity of care was studied during the regular office hours of the Family Practice Center using the COC score. Utilizing recorded data from each patient visit, this study sought to document the actual rates of continuity of care and the age, race, and sex of patients for the years 1977 through 1981. Because the year 1979 contained a disproportionately large amount of missing information (ie, forms not completed), that year was eliminated from analysis. Data quality for the remaining years was found satisfactory for the purposes of this analysis.

In this study, COC scores during each year were calculated for all patients who made two or more visits to the Family Practice Center that year. COC scores were grouped into four categories: score of 0, scores of .01 to .49, scores of .50 to .99, and scores of 1. These groupings were applied to the COC scores for individual patients in each of the study years (1977, 1978, 1980, 1981) and analyzed according to sex, race, and age group. The chi-square test was utilized to evaluate difference in COC scores for statistical significance.

Results

Overall COC scores for the four study years are tabulated in Table 1.

No consistent relationship was observed between continuity scores and sex or race. There was, however, a weak but statistically significant trend in 1980 and 1981 for women to have higher scores than men.

A stable and significant relationship between age and continuity score was observed in each of the four years. Children show relatively low continuity scores. Adults aged over 55 years, in contrast, show the highest scores. Table 2 lists the individual scores for 1981.

Comment

Continuity of care has been defined in a variety of ways. Most primary care physicians, however, think of continuity as the degree to which a patient sees one physician over a period of time. The COC score provides a measure of this type of continuity within a specific group practice. It does not seek to determine how often patients go elsewhere for care; such information is far more difficult to

Table 1. Distribution of Continuity Scores: 1977, 1978, 1980, 1981 (%)

	Continuity (COC) Score			
Year	0	.01-.49	.50-.99	1
1977	27	34	13	25
1978	24	34	12	31
1980	26	28	10	36
1981	19	18	11	52

Table 2. Continuity Scores by Age: 1981 (%)

	Continuity (COC) Score			
Age (yr)	0	.01-.49	.50-.99	1
0-5	27	24	14	35
6-17	37	16	8	40
18-35	19	18	10	53
36-55	14	19	12	55
56+	10	13	14	63

$\chi^2 = 102.7$, $P = .0001$

obtain. Because the COC score utilizes basic encounter data, this study illustrates a methodology by which group practices with computerized encounter systems can measure the continuity of care they provide.

Most primary care group practices consider continuity of care to be a practice goal, and thus specific data about continuity scores should be useful in several settings. It can provide a yardstick by which one practice may compare itself with other practices. Also, if changes in policies or procedures are instituted by a practice, the COC score will provide a sensitive measure of the concomitant changes in continuity of care. Finally, the COC score provides a means by which the continuity provided to one or more subgroups of patients, such as patients with diabetes or hypertension, can be readily measured and compared with other patients in that practice or elsewhere. This study provides data from one practice on the actual COC scores and on the effects of age, sex, and race on continuity in that practice during a four-year period. While undoubtedly unique to the Chapel Hill Family Practice Center, the data do provide one standard that other practices can use to evaluate the continuity of care they provide.

In addition, the study allows a few observations to be made about continuity of care among certain patient subgroups. Apparently, race and sex are not major determinants of continuity of care in this practice. Physician continuity does, however, bear consistent relationship to the age of patients, with children having the lowest continuity and older adults the highest. Possible explanations for this finding include (1) that visits by children are more frequently for acute problems, which necessitates their being seen as "work-ins" by any available physician, (2) that adults value continuity less for their children than for themselves, with older adults valuing a personal physician most of all, and (3) that the increasing incidence of chronic problems with patient age provides greater need for continuity of treatment.

In conclusion, measurement and interpretation of continuity of care for all patients and for specific subgroups in a family practice can be done using routine encounter data and the continuity of care scale. Using these and other measures of continuity, future research can further elucidate the determinants of continuity and its influence on health care outcomes.

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