

# Relationship of Medication Use to Health-Related Quality of Life Among a Group of Older American Indians

Jeffrey A. Henderson  
Dedra Buchwald  
Spero M. Manson

*University of Colorado Health Sciences Center*

*This cross-sectional study examines the relationship of polypharmacy to health-related quality of life (HRQoL) among a group of older American Indians. An in-home interview and survey were administered to 63 community-dwelling American Indians aged 50 or older who were taking four or more prescription medications regularly. With the component summary scores from the Medical Outcomes Study Short Form-36 instrument analyzed as dependent variables, only the Physical Component Summary (PCS) score ( $r = .30, p = .02$ ), and not the Mental ( $r = .06, p = .67$ ), was associated with degree of polypharmacy. This association with PCS score remained significant even after controlling for age, sex, and chronic disease score (adjusted  $\beta = -.91, p = .045$ ). This study is the first to describe the relationship between polypharmacy and HRQoL among a group of American Indians, and the results support the need for larger and more comprehensive studies of medication use in this special population.*

**Keywords:** *American Indian aging; prescription drugs; polypharmacy; quality of life; health status*

Polypharmacy is a problem for all patients, but particularly the elderly. According to several recent, prominent studies published by the *Journal of the American Medical Association* and the Institute of Medicine, adverse drug reactions, a key complication of polypharmacy, constitute the fourth to eighth leading causes of death in America (Kohn, Corrigan, & Donaldson, 1999; Lazarou, Pomeranz, & Corey, 1998). Furthermore, it is estimated that

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the complications due to polypharmacy lead to an additional \$1.56 to \$4 billion in direct hospital costs per year in the United States (Bates et al., 1997; Classen, Pestotnik, Evans, Lloyd, & Burke, 1997). Factors shown to be associated with increased medication usage include age (Bjerrum, Sogaard, Hallas, & Kragstrup, 1998; Chen, Dewey, & Avery, 2001; Chrischilles et al., 1992; Jylha, 1994; May, Stewart, Hale, & Marks, 1982; R. B. Stewart, Moore, May, Marks, & Hale, 1991; Whittington, Petersen, Dale, & Dressel, 1981), female gender (Bjerrum et al., 1998; Chen et al., 2001; Chrischilles et al., 1992; Eggen, 1994; May et al., 1982), educational level (Eggen, 1994), self-rated health (Al-Windi, Elmfeldt, & Svardsudd, 2000; Blazer, Hybels, Simonsick, & Hanlon, 2000; Chrischilles et al., 1992; Espino et al., 1998; Fillenbaum et al., 1996; Jylha, 1994; Morse et al., 1994), number of comorbid conditions (Espino et al., 1998; Furu, Straume, & Thelle, 1997; Jylha, 1994), and alcohol use (Espino et al., 1998; Furu et al., 1997).

Although polypharmacy is widely recognized among the general population, no information regarding older American Indians has been published to date. This fact is unfortunate and surprising given the rapid increase in American Indian elders (Indian Health Service, 1996), their high prevalence of type 2 diabetes mellitus and associated complications (Howard et al., 1996), their disproportionate burden of other chronic illnesses (Ferrendelli, 1995), and their active use of both allopathic and traditional herbal remedies (Marbella, Harris, Diehr, & Ignace, 1998).

Although polypharmacy has been extensively investigated, few studies have explored the possible associations of polypharmacy with health-related quality of life (HRQoL; Fincke, Miller, & Spiro, 1998; Hanlon et al., 1996), and then generally in other contexts. With regard to American Indians and Alaska Natives, very few published studies have even explored quality of life in general (Gilliland, Mahler, & Davis, 1998; Gupchup et al., 2001; Johnson, Nowatzki, & Coons, 1996), much less possible associations with polypharmacy.

The objective of this study was to examine the association of HRQoL and polypharmacy and to ascertain the influence of demographic and clinical factors on this relationship.

## **Method**

### *Setting*

This study was conducted in Rapid City, a town of approximately 60,000 residents in western South Dakota. Approximately 25% of the town's

residents are American Indian, principally of Lakota Sioux heritage. Most American Indians in Rapid City receive their health care at the Sioux San Public Health Service Indian Hospital, an Indian Health Service acute care hospital and clinic that provides health care for more than 20,000 American Indians from an approximate 200-mile radius.

### *Sample*

The participants in this study were drawn from a convenience sample of individuals identified by the Sioux San Pharmacy Department as regularly filling four or more prescription medications. Participants were eligible if they were (a) age 50 or older; (b) taking four or more prescription medications regularly; (c) residing in Rapid City; and (d) being seen regularly by a provider specializing in family practice or internal medicine. The first 65 individuals meeting these criteria at the time of Sioux San pharmacy contact were approached about participation, yielding 63 consenting participants, all of whom were American Indian. All participants were fluent in English and were interviewed in their homes by a trained nurse interviewer.

### *Ethics*

The University of Colorado Multiple Institution Review Board and the Aberdeen Area Indian Health Service Institutional Review Board approved this study.

### *Definition of Polypharmacy*

For several reasons, we defined polypharmacy as the regular and concomitant use of four or more prescription medications, irrespective of clinical appropriateness. First, the definition of polypharmacy as a distinct number of different medications is the most commonly used definition reported in the literature (Burns, Nichols, Graney, & Cloar, 1995; Ferrendelli, 1995; Hamdy et al., 1995; Hanlon et al., 1996; Satish, Winograd, Chavez, & Bloch, 1996). Second, a distinct advantage of this definition is that it provides an easily and reliably measured independent variable. Third, four or more prescription medications taken simultaneously is the point at which drug-related morbidity and mortality rise significantly, independent of the rationale for use of any other medication in a given individual's pill-taking regimen (Miller, Zylstra, & Standridge, 2000; Satish et al., 1996; Wachtel, Fulton, & Goldfarg, 1987).

### *Medication Review*

For all prescription and nonprescription medications, the interviewer recorded medication name, dosage, and frequency of use directly from the medication bottles during a home visit. This is widely used procedure common in studies of this nature (Hanlon, Fillenbaum, Schmader, Kuchibhatla, & Horner, 2000; Pitkala, Strandberg, & Tilvis, 2001; Yang, Tomlinson, & Naglie, 2001). All participants were able to provide their medications for direct transcribing of information from the labels.

### *Sociodemographic Variables*

Demographic variables previously associated with increased medication usage were included in the analyses (Chrischilles et al., 1992). Age was separated into four categories based on quartile percentages: 51-57, 58-66, 67-73, and 74-89 years. Education was grouped into two categories: those with 0 to 12 years and 13+ years. Annual income was dichotomized into \$0-9,999 and \$10,000+, and insurance status was dichotomized for those with only Indian Health Service coverage and those with some additional form of coverage (private insurance, Medicaid/Medicare, Department of Veterans Affairs, health maintenance organization, etc.). Participant status for these variables as well as marital status, household income, insurance status, perceived health, and medical history was determined by self-report.

### *Functional Status*

The Medical Outcomes Study Short Form-36 (SF-36) was administered (A. L. Stewart et al., 1989). Responses to self-reported general health were dichotomized into excellent/very good/good versus fair/poor (Hershman, Simonoff, Fishman, Paston, & Aronson, 1995). The broader SF-36 results were analyzed and broken down into their eight discrete domains and both Mental (MCS) and Physical Component Summary (PCS) scores as previously described (Jenkinson, 1998; Ware et al., 1995).

### *Alcohol and Smoking Variables*

Each participant's history of alcohol usage and smoking was ascertained using the measures originally developed by the Strong Heart Study (Welty et al., 1992). Alcohol use was first expressed as a number of drinks per week and then dichotomized into no versus any alcohol usage within the past year. Smoking history was dichotomized into current smokers versus nonsmokers.

### *Comorbid Illnesses*

A chronic disease score was calculated based on self-reported history of arthritis, diabetes mellitus, hypertension, asthma, emphysema, and cancer. Participants were asked if a doctor had ever told them that they had the illness of interest (Welty et al., 1992). The sum of the comorbid illnesses, which in this cohort ranged from 0-5, constituted the chronic disease score.

### *Statistical Analyses*

Statistical analyses were performed using SPSS/PC V 10.0 statistical software (SPSS, 1998). Frequency analyses were first conducted to express the percentage of the study population associated with various factors thought related to medication behavior. Next, one-way ANOVA analyses were performed to compare means of number of drugs taken by study participants according to each posited factor. Finally, a multivariate model with linear regression was designed to explore the possible associations between degree of polypharmacy and HRQoL while controlling for age, sex, and chronic disease score. Age, number of medications (response range 4-19), and chronic disease score (range 0-5) were allowed to enter the model as continuous variables. All tests were two-tailed. The level of significance was set at  $p < .05$ .

## **Results**

### *Response Rate and Characteristics of the Study Population*

Sixty-three out of 65 eligible individuals consented to participate, for a response rate of 97%. The characteristics of the study population and mean number of drugs taken are shown in Table 1. Fifty-nine percent of participants were women. Mean age was  $66.4 \pm 10.0$  years, and mean years of schooling  $12.1 \pm 2.7$ . Thirty-six percent of participants had some post-high school education, and 43% were married or cohabiting. Although not shown, 32% of those younger than 65 years reported they were unemployed; almost half of the study population was hospitalized in the year preceding the baseline exam; 24% of participants reported being hospitalized during the 3 months following the baseline exam.

Nearly 80% of participants were nonsmokers, and 86% were nondrinkers of alcoholic beverages. Income categories are reflected in Table 1, with 62% of participants reporting that their income meets their needs. About 3% of participants rated their health as excellent, 19% as very good, 30% good,

**Table 1. Characteristics of the Study Population ( $n = 63$ ) and Associated Mean Number of Drugs**

<i>Study Variable</i>	<i>%</i>	<i>Mean No. of Drugs Taken</i>	<i>95% CI</i>	<i>p Value</i>
Sex				.777
Male	41.3	9.8	8.33, 11.21	
Female	58.7	10.0	8.85, 11.20	
Age (years)				.308
51-57	23.8	9.7	7.76, 11.57	
58-66	28.6	8.8	6.98, 10.58	
67-73	25.4	10.9	8.74, 13.01	
74-89	22.2	10.6	9.04, 12.10	
Educational status				.005
≤12th grade	63.5	10.9	9.68, 12.02	
>12th grade	36.5	8.3	7.17, 9.44	
Employment status				.059
Working full-time	15.9	7.2	5.15, 9.25	
Working part-time	9.5	10.8	7.98, 13.68	
Unemployed	17.5	10.6	8.55, 12.72	
Retired	57.1	10.3	9.07, 11.54	
Household income ( $n = 60$ )				.110
<\$10,000	32.8	11.0	9.51, 12.4	
\$10,000 to \$20,000	39.3	9.9	8.34, 11.49	
>\$20,000	22.9	8.5	6.53, 10.41	
Smoking status				.178
Current smoker	20.6	11.2	8.88, 13.43	
Nonsmoker	79.4	9.7	8.69, 10.65	
Drinking status				.251
Drinks alcohol	14.3	8.7	5.84, 11.49	
Nondrinker	85.7	10.1	9.18, 10.65	
Perceived health				.028
Excellent/very good/good	52.4	9.0	7.47, 10.26	
Fair/poor	47.6	10.9	9.72, 12.15	
Chronic disease score <sup>a</sup>				.001
0-2 conditions	54.0	8.6	7.47, 9.65	
3-5 conditions	46.1	11.5	10.25, 12.78	

NOTE: CI = confidence interval.

nearly 35% as fair, and nearly 13% as poor. More than 36% reported some recent difficulty rising from a chair or bed, and only 32% reported satisfaction with their present weight; 64% of those dissatisfied wanted to lose weight (data not shown).

### *Medical Conditions*

Table 1 shows the dichotomized variable for chronic disease score. As for the individual illnesses that make up the score, nearly 78% of participants reported hypertension, 64% arthritis, almost 60% adult-onset diabetes, 18% asthma, 8% cancer, and 8% emphysema.

### *Factors Correlated With Increased Use of Drugs*

Increasing use of drugs was correlated with lower educational status, poorer self-reported health and chronic disease score, but not with sex, age, marital status, household income, insurance, or smoking or drinking status, as shown in Table 1. Unemployment and household income both revealed nonsignificant trends. Participants reporting that they were hospitalized in the year preceding the study were taking a mean of  $10.3 \pm 3.1$  medications versus  $9.8 \pm 3.7$  medications for those not hospitalized. Participants living alone reported taking  $10.4 \pm 2.7$  versus  $9.7 \pm 3.8$  drugs for those living with someone; these differences that were not significant (data not shown).

### *Associations of Polypharmacy and HRQoL*

The mean PCS score in this cohort was 36.5, whereas the mean MCS score was 48.0, a pattern (MCS > PCS) usually found in most studies of this type. There is no significant relationship in this cohort between the degree of polypharmacy and the MCS score of the SF-36 instrument, as shown in Figure 1. A significant relationship does exist, however, between the degree of polypharmacy and the PCS score, as displayed in Figure 2. Table 2 reveals the results of the multivariate linear regression analysis. The table shows that degree of polypharmacy remains significantly associated with the PCS score even after controlling for age, sex, and chronic disease score.

## **Discussion**

This study is the first to document characteristics associated with polypharmacy and the association between degree of polypharmacy and HRQoL among older American Indians. This study also confirms the relationships between perceived health, comorbidity, and functional limitations and polypharmacy that have been documented for other community-based populations of elders (Al-Windi et al., 2000; Bardel, Wallander, &

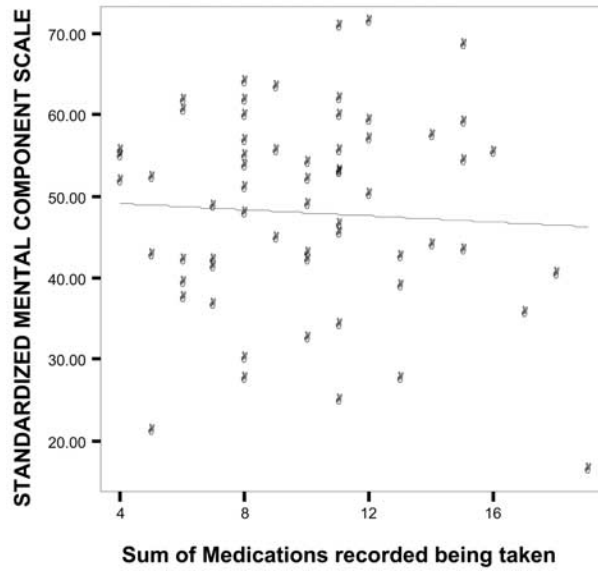


Figure 1. Association of the Number of Medications Being Taken With the Medical Outcomes Study Short Form-36 Mental Health Component Scale Score— $r = .06$  ( $p = .67$ )

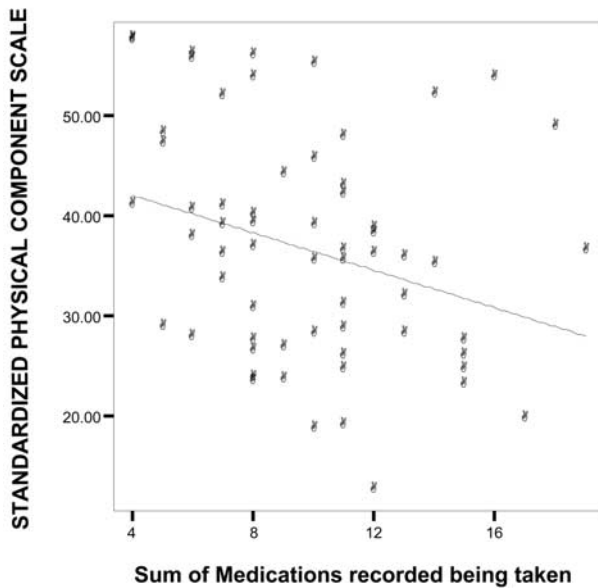


Figure 2. Association of the Number of Medications Being Taken With the Medical Outcomes Study Short Form-36 Physical Health Component Scale Score— $r = .30$  ( $p = .02$ )

**Table 2. Regression Analysis of the Association of Medication Use With the SF-36 Physical Health Component Scale Score Adjusted for Age, Sex, and Chronic Disease Score**

<i>Factor</i>	<i>Adjusted <math>\beta</math></i>	<i>p Value</i>
No. of medications <sup>a</sup>	— .91	.045
Age	.88	.607
Sex	.93	.750
Chronic disease score <sup>b</sup>	— .61	.716

a. Count of the number of medications currently being take (range 4-19).

b. Count of the number of these self-reported chronic diseases: arthritis, diabetes mellitus, hypertension, asthma, emphysema, and cancer (range 0-5).

Svardsudd, 2000; Bjerrum et al., 1998; Chrischilles et al., 1992; Espino et al., 1998; Lassila et al., 1996).

Despite the intuitive relationship between medication use and chronic disease, the degree of polypharmacy remained significantly associated with quality of life even after controlling for six common but significant medical conditions. At least two other studies have revealed self-reported health, a key component of most HRQoL scales, to be significantly associated with medication usage even after controlling for physical conditions (Espino et al., 1998; Woo, Ho, Yuen, & Lau, 1995).

An additional study that examined factors influencing self-reported health revealed a lack of association with physical illness burden (Mulsant, Ganguli, & Seaberg, 1997). This study did, however, show an association with instrumental activities of daily living (IADLs), which, together with activities of daily living (ADLs) are cited as the most sensitive assessments of function in older individuals, as opposed to physical illness burden or a count of conditions (Balducci & Beghe, 2000). The loss of associated function that follows from a given medical condition, rather than the condition itself, likely has the greatest impact on self-reported health (Furner, Rudberg, & Cassel, 1995).

In our study, age was not significantly associated with the number of medications taken and did not affect the relationship between medication use and HRQoL in the multivariate analysis. This could be explained by the small number of study participants and the high prevalence of chronic medical conditions. This last point deserves further mention. One of the reasons why degree of polypharmacy remains significantly associated with PCS (even after adjusting for age and chronic disease score) is likely related to the overwhelming amount of chronic conditions being experienced by this cohort,

including prominent conditions each likely to be treated with multiple prescription medication (e.g., hypertension, diabetes).

Education was significantly associated with mean number of drugs taken in the univariate analysis, whereas employment status, insurance coverage, and income were not significant, though all four of these variables are intercorrelated. These findings are in keeping with the relatively inconsistent findings reported with respect to the relationship of sociodemographic variables on medication use (Chrischilles et al., 1992; Nolan & O'Malley, 1988), particularly the finding of an association between lower educational level and polypharmacy. Notably, a previous study among another American Indian population also found no significant association of education and income with poorer self-reported health, suggesting the need to investigate other social and environmental associations (Cheadle et al., 1994).

With regard to other possible influencing factors on drug-taking and/or quality of life not directly examined in this study, a variety of psychosocial factors—chiefly depressive symptoms—have been shown to be significant (Chrischilles et al., 1992; Mulsant et al., 1997). Though no depression scale was administered to study participants, the MCS score from the SF-36 has been found to correlate well with depression and anxiety (Beusterien, Steinwald, & Ware, 1996; Fossa & Dahl, 2002; Johnson & Coons, 1998; Schneider & Varghese, 1995; Ware et al., 1995), and this study showed no significant relationship between the degree of polypharmacy and the MCS. Depressive symptomatology may relate to poor health or could be associated with an individual's self-perceived health, and therefore correlated with drug-taking behavior. The interplay between perceived health, medication use, and depressive symptoms would be best addressed looking within specific drug class categories, owing to the tendency of certain classes of medication to engender or worsen depressive symptoms (e.g., beta-blockers).

Finally, a few words about the SF-36 summary scores bear mentioning. To our knowledge, this is the first time component summary scores for the SF-36 instrument have ever been presented for an American Indian cohort. It is interesting that the mean PCS score is one of the lowest published, whereas the mean MCS score is only slightly less than the standardized norm (Bauman & Arthur, 1997; Jenkinson, 1998; Ware et al., 1995). The author is involved in initial efforts to explore the psychometric properties of the SF36 instrument when used among older American Indians (Beals et al., in press). Although we have found that the SF36 generally performs adequately in this population, use of the component summary scores, which assume a differentiated physical and mental functioning structure, may be problematic. These findings certainly point out the need for further experience with this

instrument in this special population, including further research exploring its psychometric properties.

This study has several limitations. First is the cross-sectional nature of the design and attendant problems. Another limitation of this study relates to the small sample size, which may have constrained our ability to identify possible associations with education, gender, and age. Also, several potentially important comorbid conditions were not controlled for (e.g., cardiovascular disease, kidney disease). This study did not assess patients' adherence to their medication regimens. Though information was taken directly from pill bottles in the participants' own homes, it is likely that not all medication taken was recorded (particularly over-the-counter and as-needed medication) nor that all medication was being taken in the manner intended when prescribed (Bernstein, Folkman, & Lazarus, 1989; Ostrom, Hammarlund, Christensen, Plein, & Kethley, 1985). These issues need to be addressed in a larger, ideally longitudinal, study. Our working definition of polypharmacy ( $\geq 4$  prescription medications taken concurrently) may be viewed as a limitation by some. Specifically, this definition does not entail such issues as rationale for use, potential or actual adverse events (including drug-drug interactions), nonadherence, or requiring that an even greater number (i.e.,  $\geq 5$  or more) of medications be taken. Finally, the convenience sample design casts doubt on the representativeness of this study; by design, all participants were already taking four or more prescription medications. The many important questions raised by this study would be best studied in a large, longitudinal, population-based design.

These findings highlight medication use issues among older American Indians that clearly warrant further investigation. Because American Indians are generally excluded from all the large population-based epidemiological studies being conducted at present (National Health and Nutrition Examination Survey, National Health Interview Survey, Established Populations for Epidemiological Studies of the Elderly, etc.), separate studies are needed for this special population. The continuing epidemic of diabetes and associated chronic diseases among American Indians, coupled with the growing number of adults reaching elderhood, portends that medication use, including polypharmacy, will become more common along with its associated problems. Finally, this study also found that degree of polypharmacy was significantly associated with the PCS even when controlling for chronic medical conditions. This may be especially important in American Indians (and other indigenous peoples) given their unique cultural heritage and the likelihood that their perceptions of health may differ from those of the general population. Hence, this study suggests that further investigation among older

American Indians regarding quality of life and medication use, especially polypharmacy, should take place.

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*Article accepted*

*Jeffrey A. Henderson, M.D., M.P.H., is a Lakota Sioux internist, epidemiologist, and the founder and president/CEO of the Black Hills Center for American Indian Health (BHCAIH), located in Rapid City, South Dakota. In addition, he is an assistant professor in American Indian and Alaska Native programs at the University of Colorado at Denver Health Sciences Center. The BHCAIH is a community-based, research-intensive organization that works with tribal populations to conduct research and other activities intended to enhance the wellness of American Indian and Alaska Native Tribes, communities, and peoples. Dr. Henderson's own research interests, including polypharmacy and health-related quality of life, include cancer and cardiovascular disease epidemiology, ocular health, clinical trials, and environmental justice.*

*Spero M. Manson, Ph.D. (Pembina Chippewa), a medical anthropologist, is a professor of psychiatry and heads the American Indian and Alaska Native programs at the University of Colorado Health Sciences Center. His program comprises eight centers, each national in scope, that cover the developmental life span in terms of research, training, continuing education, technical assistance, and information dissemination specific to the health of this special population. He has published over 150 articles on the assessment, epidemiology, treatment, and prevention of physical, alcohol, drug, and mental disorders across the developmental life span of Indian and Native people.*

*Debra Buchwald, M.D., is a professor in the Department of Medicine and director of the Center for Clinical and Epidemiological Research at the University of Washington and a professor of psychiatry at the University of Colorado Health Sciences Center. She directs the Regional Native American Community Networks Program, a center focused on community outreach, training, and research on cancer among American Indians and Alaska Natives. Her interests are in the interface between psychosocial and biological aspects of illness, and her recent publications have appeared in The Annals of Internal Medicine and American Journal of Psychiatry.*