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The Relation of Hypertension to Changes in ADL/IADL Limitations of Mexican American Older Adults

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Hypertension, highly prevalent and often undiagnosed among older Mexican Americans, is associated with greater limitations in activities of daily living (ADLs) and instrumental activities of daily living (IADLs) that can lead to greater dependency for older adults. Using data from the Hispanic Established Populations for Epidemiologic Studies of the Elderly study, the rate of increase in ADL/IADL limitations for a 7-year period was examined for 3,046 older Mexican Americans classified either as reporting hypertension at baseline, first reporting hypertension at subsequent waves, or never reporting hypertension. Latent growth models indicated increased ADL/IADL limitations over time; individuals with hypertension evidenced greater increases than those without hypertension. Age, comorbidities, and depression were positively related to greater ADL/IADL limitations at baseline for all groups; only age was consistently related to ADL/IADL change over time. Development of hypertension may increase the risk of ADL/IADL decline, but early diagnosis and treatment may attenuate this effect.

Key Words: ADLs—Cardiovascular disease—IADLs—Longitudinal change—Minority and diverse populations.

DECLINES in older adults' ability to perform tasks associated with personal care and routine household needs can lead to a loss of independence and decreased quality of life. Liu, Coughlin, and McBride (1991) reported that older adults with greater limitations in activities of daily living (ADLs) are less likely to continue to live independently and utilize assisted-living arrangements earlier. Models of the disablement process (Nagi, 1979; Verbrugge & Jette, 1994) postulate that impairments resulting from pathology (e.g., disease) lead to limitations in physical activities (e.g., walking), which subsequently alter individuals' ability to perform these tasks of daily living. Research is needed to investigate disparities in health risk factors that can result in functional impairment. The current study investigates the impact of hypertension, which is more prevalent among Hispanics, in order to quantify the impact of this risk factor on Mexican American elders' ability to perform ADLs and instrumental activities of daily living (IADLs).

Despite inconsistent terminology in describing the construct that ADLs and IADLs measure (e.g., "disability" by Nagi, 1979; Verbrugge & Jette, 1994; "functional limitations" by Johnson & Wolinsky, 1993; and "functional status" by Liang et al., 2008), the tasks assessed by ADL and IADL measures are relatively consistent in the literature. ADL tasks include basic self-care activities, such as bathing and eating (Katz, Ford, Moskowitz, Jackson, & Jaffe, 1963), and IADL tasks are those activities necessary to run a household, including meal preparation and keeping track of finances (Lawton & Brody, 1969). Previous longitudinal analyses have indicated that ADL/IADL limitations increase with age (e.g., Bowen & Gonzalez, 2008; Kahng, Dunkle, & Jackson, 2004; Liang et al.). Although Spector, Katz, Murphy, and Fulton (1987) suggested that older adults generally become dependent in IADLs before ADLs, loss of basic ADL abilities may have more serious consequences. For example, individuals with greater dependency in ADLs, but not IADLs, have higher mortality rates and greater likelihood of utilizing an assisted-living facility (Liu, Manton, & Aragon, 2000).

Multiple studies support a link between poorer health status and ADL/IADL limitations in the older adult community. In particular, cardiovascular health problems, including hypertension, have been shown to have a more prominent harmful effect on ADL/IADL limitations than do other types of health conditions that may affect older adults (e.g., osteoporosis; Johnson & Wolinsky, 1993). Pinsky and colleagues (1985) found that ever having a hypertension diagnosis was predictive of greater disability status for both men and women. Similar findings by Wu, Huang, Wu, McCrone, and Lai (2007) indicated that hypertension was among one of the highest risk factors for severe disability (defined as two or more ADL limitations) in a sample of community-dwelling older adults. In a literature review by Stuck and colleagues (1999), hypertension was one of the medical conditions most closely associated with functional status decline, with 13 independent studies reporting significant risk of functional status decline for those self-reporting hypertension.

More than half of American adults older than 60 years are estimated to have hypertension (Ostchega, Yoon, Hughes, & Louis, 2008), and this rate rises to three fourths by age 70 (U.S. Department of Health and Human Services, 2008). For Mexican Americans aged 65 years and older, the rate of hypertension reaches approximately 60% (Satish, Stroup-Benham, Espino, Markides, & Goodwin, 1998). Thus, the impact of hypertension on the ADL/IADL limitations

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experienced by older adults may be especially great for older adults in general and for Mexican American older adults in particular. For adults, hypertension is generally defined as a blood pressure more than 140/90 mm Hg (e.g., Hajjar & Kotchen, 2003; Wang & Wang, 2004) and is diagnosed by physicians only after at least two separate blood pressure readings more than this level (Carretero & Oparil, 2000; U.S. Department of Health and Human Services, 2008). If hypertension is left untreated, serious cardiovascular health threats can occur, including heart attacks and strokes, and, as a result, hypertension is associated with increased mortality rates over time (Hajjar & Kotchen).

Despite the potential health complications associated with hypertension and the high prevalence of this condition within the Mexican American community, little research has focused on the links between hypertension and ADL/IADL limitations for Mexican Americans. Kington and Smith (1997) found that chronic diseases, including hypertension, led to greater functional decline for African American and Hispanic older adults than for Whites, but this relationship disappeared when controlling for socioeconomic status. In addition, Mexican Americans older than 65 years are among the groups least likely to achieve hypertension control through medication adherence and lifestyle alterations (Wang & Wang, 2004); for example, approximately 13% of Mexican Americans did not alter their diet or exercise routine, and 31% did not take blood pressure medication. Thus, Mexican Americans could be at substantial risk for decrements in overall well-being due to a hypertension diagnosis.

Stuck and colleagues (1999) called for additional research on the underlying causes of change in functional status decline (defined as a combination of ADL/IADL and physical function limitations) among older adults, such as the impact of chronic diseases like hypertension. Given the lack of research on the effects of hypertension in the Mexican American community, it is important to look at subsequent changes in ADL/IADL limitations in this group. In addition, because hypertension is often a precursor to more serious cardiovascular problems, the timing of if and when an older adult develops hypertension may influence the increase in ADL/IADL limitations. Because hypertension may be comorbid with other chronic health conditions that affect ADL and IADL limitations (e.g., Kington & Smith, 1997; Stuck et al.), the comorbidity of arthritis, diabetes, heart attack, and stroke was examined in the current study as a predictor of ADL/IADL limitations. Other correlates of ADL/IADL limitations were also examined, including depressive symptomatology, acculturation, and demographic characteristics. Past research has indicated that depression is related to greater ADL/IADL limitations (Fifield, Tennen, Reisine, & McQuillan, 1998; Friedman, Lyness, Delavan, Li, & Barker, 2008; Starkstein, Mayberg, Leiguarda, Preziosi, & Robinson, 1992). However, risk for ADL/IADL limitations can be lower with increased physical activity levels (Miller, Rejeski, Reboussin, Ten Have, & Ettinger, 2000). Although physical activity was not directly assessed in the current study, previous studies of Latino samples have found that more acculturated individuals are more likely to report exercising regularly (Cantero, Richardson, Baezconde-Garbanati, & Marks, 1999) and meet recommendations for moderate and vigorous physical activity (Evenson, Sarmiento, & Ayala, 2004) and less likely to report a sedentary lifestyle (Pérez-Stable, Marín, & VanOss Marín, 1994). Finally, reports of ADL limitations have been found to be higher for women, to increase with age, and to be lower for more educated individuals (e.g., Amaducci et al., 1998; Liang et al., 2008; Millán-Calenti et al., 2009).

Thus, the present study examined change over time in ADL and IADL limitations for a group of community-dwelling Mexican American older adults. We hypothesized that significant increases in ADL and IADL limitations would be found over time, given the previous research demonstrating this trend. Furthermore, three groups were compared: those with hypertension at baseline, those with hypertension at a later time point, and those who never had hypertension. We hypothesized that significant differences would be found in the ADL and IADL trajectories based on the timing of development of hypertension such that the two groups with hypertension would experience greater increases in ADL/IADL limitations over time. Finally, we examined demographic variables and other potential correlates of ADL and IADL performance, hypothesizing that more comorbid chronic conditions, more depressive symptoms, lower acculturation, being female, greater age, and less education would be related to greater ADL and IADL limitations.

Methods

Participants

The current study utilized the longitudinal Hispanic Established Populations for Epidemiologic Studies of the Elderly (EPESE) database (Markides, 1999, 2001, 2004; Markides & Ray, 2005), which is archived for secondary data analysis with the Inter-university Consortium for Political and Social Research. The archived database contained variables collected for a sample of 3,050 Mexican Americans aged 65 years or older. The current analysis deleted four participants from the archived database due to the lack of ADL data at any of the time points. The analysis sample (N = 3,046) was an average of 73 years old (SD = 6.8; range = 65–99) and had an average of 4.9 years of education (SD = 3.9; range = 0–20); in addition, it included 1,290 men and 1,756 women. Descriptive statistics for the demographic variables are presented in Table 1.

The Hispanic EPESE used a probability sampling method to obtain a representative sample of noninstitutionalized Mexican American elders from Texas, New Mexico, Colorado, Arizona, and California; an 86% response rate was obtained of those initially contacted to participate in the study. All

Table 1. Descriptive Statistics for All Covariates: Total Sample and HBP Subgroups

Covariate	Total sample (N = 3,046)	Baseline HBP (n = 1,718)	Later HBP (n = 654)	No HBP (n = 674)
Age,[a,b] *M* (*SD*)	73.0 (6.7)	72.8 (6.6)	72.4 (6.2)	74.1 (7.6)
Education (years), *M* (*SD*)	4.9 (3.9)	4.8 (3.8)	4.9 (3.9)	5.0 (4.1)
Sex[c]				
% Female	57.6	61.4	56.0	49.7
Comorbidities,[a,d] *M* (*SD*)	0.9 (0.9)	1.0 (0.9)	0.7 (0.8)	0.7 (0.8)
CES-D, *M* (*SD*)	9.94 (9.59)	10.27 (9.73)	9.67 (9.47)	9.29 (9.32)
English usage, *M* (*SD*)	9.32 (8.76)	9.12 (8.59)	9.36 (8.93)	9.78 (9.02)

Notes: The comorbidities variable reflects the presence of zero to four self-reported health conditions at baseline: arthritis, diabetes, heart attack, and stroke. CES-D = Center for Epidemiological Studies—Depression Scale; HBP = high blood pressure.

[a] Significant Bonferroni comparison for Baseline HBP versus No HBP comparison ($p < .001$).

[b] Significant Bonferroni comparison for Later HBP versus No HBP comparison ($p < .001$).

[c] Significant chi-square value ($p < .001$).

[d] Significant Bonferroni comparison for Baseline HBP versus Later HBP comparison ($p < .001$).

data were collected through face-to-face interviews conducted in the homes of participants with interviewers who were fluent in both Spanish and English; the majority of interviews were conducted in Spanish. The average time to complete the full interview was 1 hr and 45 min. (See Black et al., 2003, for additional information about the Hispanic EPESE methodology.) The first wave of data collection took place between 1993 and 1994 (Wave 1/Baseline). The original sample was contacted again for follow-up interviews in 1995–1996 (Wave 2), 1998–1999 (Wave 3), and 2000–2001 (Wave 4).

Measures

Hypertension status.—Hypertension status was assessed using a combination of: (a) self-reported hypertension ("Has a doctor ever told you that you have high blood pressure?"), (b) self-reported hypertension medications ("Are you currently taking any medication for high blood pressure?"), (c) the average of two systolic blood pressure values, and (d) the average of two diastolic blood pressure values. Participants who answered affirmatively to both of the self-report questions or who self-reported hypertension and had either an average systolic pressure at or more than 140 mm Hg or an average diastolic pressure at or more than 90 mm Hg were classified as having hypertension (Markides, 1999). Using this variable calculated at each of the four waves, participants were then classified into one of the following three groups: those with high blood pressure (HBP) at baseline (i.e., Wave 1), those with HBP at a later time point (i.e., Waves 2, 3, or 4), and those never having HBP. The sample sizes for these three groups were as follows: (a) Baseline HBP (n = 1,718), (b) Later HBP (n = 654), and (c) No HBP (n = 674).

Activities of daily living.—Participants were asked if they needed any assistance with the following seven activities: walking across a small room, bathing, personal grooming, dressing, eating, getting out of bed and into a chair, and toileting (Branch, Katz, Kniepmann, & Papsidero, 1984; Katz et al., 1963). The ADL total score is the total number of areas with limitations as reported by the participant; thus, higher scores indicate greater need for assistance. Descriptive statistics for all measures are given in Table 2.

Instrumental activities of daily living.—The IADL scale assessed limitations in a total of eight areas: using the telephone, traveling alone, shopping, preparing meals, doing light housework, taking medication, keeping track of personal finances, and heavy housework (Lawton & Brody, 1969). Similar to the ADL measure, the total score for IADLs represented the total number of areas for which the participant reported needing assistance (*yes* = 1, *no* = 0),

Table 2. Descriptive Statistics for the ADL and IADL Measures Over Time

	Total Sample	Baseline HBP	Later HBP	No HBP
ADLs				
Wave 1				
M (*SD*)	0.5 (1.6)	0.5 (1.5)	0.4 (1.3)	0.8 (2.0)
N	3,041	1,718	651	672
Wave 2				
M (*SD*)	0.6 (1.7)	0.6 (1.7)	0.5 (1.6)	0.9 (2.1)
N	2,435	1,359	632	444
Wave 3				
M (*SD*)	0.9 (2.0)	1.0 (2.0)	0.9 (2.0)	0.9 (2.0)
N	1,970	1,102	550	318
Wave 4				
M (*SD*)	1.0 (2.0)	1.0 (2.1)	1.0 (2.0)	0.8 (1.8)
N	1,665	914	489	262
IADLs				
Wave 1				
M (*SD*)	1.5 (2.2)	1.5 (2.1)	1.3 (2.0)	1.9 (2.6)
N	3,042	1,715	654	673
Wave 2				
M (*SD*)	1.7 (2.5)	1.7 (2.4)	1.5 (2.3)	2.0 (2.9)
N	2,437	1,360	632	445
Wave 3				
M (*SD*)	2.0 (2.7)	2.1 (2.7)	1.9 (2.8)	1.8 (2.7)
N	1,978	1,104	556	318
Wave 4				
M (*SD*)	2.0 (2.7)	2.0 (2.7)	2.0 (2.8)	1.8 (2.6)
N	1,672	916	491	265

Notes: ADL and IADL values represent number of reported limitations. The possible range for ADLs was 0–7 and for IADLs was 0–8. ADLs = activities of daily living; HBP = high blood pressure; IADLs = instrumental activities of daily living.

with higher total scores indicating greater need for assistance.

Demographic covariates.—Three demographic variables were controlled for in the analyses: sex, age, and education. Participants were asked to specify their sex, age in years, and the highest grade of school completed.

Comorbidity.—Comorbidity was assessed as the number of four health conditions (arthritis, diabetes, heart attack, and stroke) self-reported by participants at baseline.

Depressive symptoms.—Depressive symptoms at baseline were measured by the Center for Epidemiological Studies—Depression Scale (CES-D; Radloff, 1977). The CES-D includes a total of 20 items measured on a 4-point scale (coded 0–3), assessing the presence (e.g., I felt sad) and absence (e.g., I was happy) of specific depressive symptoms over the past week. Possible scores range from 0 to 60.

English language usage.—English language usage has been used previously as a measure of acculturation (Masel, Rudkin, & Peek, 2006). This nine-item scale assessed self-reported competencies in understanding, speaking, and reading English (each coded 0–3); frequency of English usage with children, friends, neighbors, and at family gatherings (each coded 0–4); and use of television and radio programs in English (each coded 0–4). Possible scores range from 0 to 33; greater scores indicate greater English usage at baseline.

Data Analysis

To estimate the rate of change over time in ADLs and IADLs and investigate possible nonlinearity of the curve, latent growth models were used to estimate both linear and quadratic change over time. The linear growth model included an intercept and linear slope to represent, respectively, the average performance at Wave 1 and the average rate of linear change. In the quadratic model, an additional quadratic parameter was estimated to represent the average rate of quadratic change, sometimes described as the rate of acceleration or deceleration of the curve. All factor loadings from the intercept to the four observed data points were fixed to 1; for the linear slope factor, these paths were set to 0, 2, 5, and 7, representing the number of years elapsed since Wave 1. Factor loadings for the quadratic slope were set to 0, 4, 25, and 49. Thus, the mean linear and quadratic slopes are interpreted, respectively, as the average rates of linear and quadratic change for 1 year. Because latent growth modeling was used, the assumption of equal measurement errors was also able to be tested for both models (Willett & Sayer, 1994). Measurement error, loosely conceptualized as the random variance between observed and true scores on a construct, is typically assumed to be independent and homoscedastic (i.e., equal) over time. However, as Sayer and Cumsille (2001) explain, observing heterogeneous error variances over time is typical in developmental research because developmental changes in the construct under study are often accompanied by increases in variance in the construct over time.

Several fit indices assessed model fit. In addition to the chi-square statistic, known to be overly sensitive with large samples such as in the current study, three additional fit indices were also examined: the comparative fit index (CFI), the Tucker–Lewis index (TLI), and the root mean square error of approximation (RMSEA). Values of .95 or better on the CFI and TLI and values of .05 or less on the RMSEA indicated good fit (Hu & Bentler, 1999). Amos 16.0 software (SPSS, Inc., Chicago, IL) (Arbuckle, 2007) was used to estimate the latent growth models; this program uses full information maximum likelihood estimation, which accommodates missing data.

The first step of the analysis estimated two unconditional (i.e., no-predictor) growth models for the total sample (i.e., linear and quadratic models) to investigate the form of the curve and establish base rates of change in the total sample. Next, three multigroup models were estimated to allow parameter estimates to be compared across the three HBP groups (i.e., Baseline HBP, Later HBP, No HBP). The first multigroup model allowed both the intercept and slope of the three HBP groups to be freely estimated. This full model was then compared, using a chi-square difference test, with two restricted models: (a) where intercepts were constrained to equality across the three HBP groups and (b) where slopes were constrained to equality across the three HBP groups. These comparisons tested, respectively, the hypothesis of HBP group differences in baseline ADL and IADL limitations and the hypothesis of HBP group differences in rate of change in ADLs and IADLs for the 7-year period covered by the Hispanic EPESE database. Finally, covariates (i.e., age, sex, education, baseline comorbidities, depressive symptoms, and English language usage) were added to the models to investigate their influence on group differences in ADL and IADL change and their relationship to baseline performance and change over time in ADLs and IADLs.

Results

Growth Models for ADL and IADL Limitations: Total Sample

Using data from the total sample (N = 3,046), linear and quadratic growth models were first estimated for ADLs and IADLs to determine the appropriate form of the trajectories, assuming a homogeneous error structure. As shown in Table 3, both models fit equally well; however, little benefit appeared to be gained by increasing the complexity of the model to include the quadratic term. For ADLs, mean quadratic growth was very small though statistically significant (p = .025), and the variance for the quadratic term could not be estimated and was set to 0. For IADLs, both the mean and variance for quadratic

Table 3. Fit Indices for the Unconditional Linear and Quadratic Growth Models for ADLs and IADLs

Model	χ^2	*df*	CFI	TLI	RMSEA
ADLs					
Linear model	104.41***	8	.96	.95	.06
Quadratic model	99.46***	7[a]	.96	.95	.07
IADLs					
Linear model	82.24***	8	.98	.97	.06
Quadratic model	42.21***	4	.99	.97	.06

Notes: ADLs = activities of daily living; CFI = comparative fit index; IADLs = instrumental activities of daily living; RMSEA = root mean square error of approximation; TLI = Tucker–Lewis index.

[a]The quadratic slope and its covariances with the intercept and the linear slope were fixed to 0 in this model to produce an admissible solution.

***$p < .001$.

growth were nonsignificant ($p = .521$ and $p = .238$, respectively). Thus, the linear model was used in further analyses. Next, the assumption of homogeneous error variances over time was tested (Willett & Sayer, 1994) by comparing linear models with homogeneous (i.e., equal over time) and heteroscedastic (i.e., unequal over time) measurement error structures. Parameter estimates and fit indices for both models are reported in Table 4. The equal error variances model was rejected in favor of the unequal error variances model for both ADLs, $\Delta\chi^2(3) = 82.64$, $p < .001$, and IADLs, $\Delta\chi^2(3) = 58.06$, $p < .001$, indicating that the measurement error variance for these measures was not constant across the four time points.

For both measures, the linear rate of change for the total sample was statistically significant and positive, although relatively small (ADLs: 0.12 per year; IADLs: 0.15 per year). These slopes equate to an average increase of almost one additional ADL limitation ($0.12 \times 7 = .84$) and one IADL limitation ($0.15 \times 7 = 1.05$) during the 7 years between the baseline and Wave 4 assessments. Thus, ADL limitations were estimated to increase from a baseline average of 0.50 to 1.34, and IADL limitations were estimated to increase from a baseline average of 1.53 to 2.58. Significant interindividual variability was observed for ADL and IADL outcomes in both intercept (baseline value) and slope (linear rate of change).

Growth Models for ADL and IADL Limitations: By HBP Group

Given the significant variability in intercepts and slopes observed for both ADLs and IADLs, multiple-group latent growth models were estimated to investigate HBP status (i.e., Baseline HBP, Later HBP, or No HBP) as a possible explanation for this variability. To test for group differences at baseline, the unconstrained intercepts and slopes model was compared with the constrained Intercepts Only model for each of the two outcomes. The chi-square difference tests indicated significant baseline differences between the HBP groups for both ADL, $\Delta\chi^2(2) = 30.837$, $p < .001$, and IADL, $\Delta\chi^2(2) = 24.421$, $p < .001$, limitations. Next, group differences in the linear rate of change were examined by comparing the unconstrained Intercepts and Slopes model with the constrained Slopes Only model for ADLs and IADLs. Significant group differences in slopes were found for ADLs, $\Delta\chi^2(2) = 6.668$, $p = .036$, but not for IADLs, $\Delta\chi^2(2) = 1.536$, $p = .464$. Thus, the best-fitting models were the unconstrained intercepts and slopes model for ADLs and the constrained slopes Only model for IADLs. The model fit statistics for the three models analyzed for ADLs and for IADLs are shown in Table 5, and the parameter

Table 4. Parameter Estimates From the Linear Growth Models for ADLs and IADLs: Total Sample

	ADLs		IADLs	
Parameter	Equal errors model	Unequal errors model	Equal errors model	Unequal errors model
Intercept mean	0.49***	0.50***	1.51***	1.53***
Intercept variance	1.36***	1.63***	3.10***	3.51***
Slope mean	0.13***	0.12***	0.16***	0.15***
Slope variance	0.05***	0.05***	0.06***	0.07***
Intercept–slope correlation	0.25***	0.03	0.30***	0.09
Wave 1 error variance	1.24***	0.81***	2.22***	1.48***
Wave 2 error variance	1.24***	1.22***	2.22***	2.37***
Wave 3 error variance	1.24***	1.66***	2.22***	2.66***
Wave 4 error variance	1.24***	1.13***	2.22***	2.11***
Chi-square	104.41***	21.77**	82.24***	24.18***
df	8	5	8	5
CFI	.96	.99	.98	.99
TLI	.95	.99	.97	.99
RMSEA	.06	.03	.06	.04

Notes: ADLs = activities of daily living; CFI = comparative fit index; IADLs = instrumental activities of daily living; RMSEA = root mean square error of approximation; TLI = Tucker–Lewis index.

**$p < .01$; ***$p < .001$.

Table 5. Fit Indices for the Linear Growth Models for ADLs and IADLs: By HBP Group

Model	χ^2	*df*	CFI	TLI	RMSEA
ADLs					
Unconstrained intercepts and slopes	47.691***	15	.987	.973	.027
Constrained intercepts only	78.528***	17	.975	.955	.034
Constrained slopes only	54.360***	17	.985	.973	.027
IADLs					
Unconstrained intercepts and slopes	32.449**	15	.994	.989	.020
Constrained intercepts only	56.870***	17	.987	.977	.028
Constrained slopes only	33.984**	17	.995	.990	.018

Notes: ADLs = activities of daily living; CFI = comparative fit index; HBP = high blood pressure; IADLs = instrumental activities of daily living; RMSEA = root mean square error of approximation; TLI = Tucker–Lewis index.

**$p < .01$; ***$p < .001$.

Table 6. Parameter Estimates Across HBP Groups for ADLs and IADLs: Best-Fitting Unconditional Models

	ADLs: Unconstrained intercepts and slopes			IADLs: Constrained slopes only		
Parameter	Baseline HBP (n = 1,718)	Later HBP (n = 654)	No HBP (n = 674)	Baseline HBP (n = 1,718)	Later HBP (n = 654)	No HBP (n = 674)
Intercept mean	0.45***	0.33***	0.82***	1.51***	1.25***	1.85***
Intercept variance	1.32***	1.00***	2.83***	3.04***	2.54***	5.64***
Slope mean	0.13***	0.12***	0.08***	0.15***	0.15***	0.15***
Slope Variance	0.05***	0.06***	0.04***	0.08***	0.08***	0.02
Intercept–slope correlation	0.13*	–0.01	0.03	0.07	0.14	0.28
Wave 1 error variance	0.80***	0.62***	1.21***	1.39***	1.64***	1.38***
Wave 2 error variance	1.17***	1.30***	1.17***	2.43***	2.25***	2.47***
Wave 3 error variance	1.80***	1.60***	1.28***	2.66***	2.65***	2.83***
Wave 4 error variance	1.33***	1.08***	0.57***	1.84***	2.05***	3.18***

Notes: ADLs = activities of daily living; HBP = high blood pressure; IADLs = instrumental activities of daily living.
*p < .05; ***p < .001.

estimates for the best-fitting unconditional models are shown in Table 6.

For all three HBP groups, significant increases for 7 years (i.e., slopes) were found for both ADL and IADL limitations, with significant between-group differences in these rates of change for ADLs only. The estimate of change in IADLs was identical to the finding in the total sample. For ADLs, the Later HBP group had the largest slope, indicating the largest increase in ADL limitations after baseline, and the No HBP group had the lowest rate of change. Finally, baseline ADL and IADL limitations were not significantly correlated with ADL or IADL slope, except in the ADL model for the group with hypertension at baseline (r = .13, p < .05).

Controlling for Covariates of ADL and IADL Limitations

In the final models, demographic covariates (age, education, and sex), comorbidities, depressive symptoms, and English language usage were added to the multiple-group latent growth models. Controlling for these covariates, chi-square difference tests again indicated significant differences at baseline between the HBP groups for ADLs (p < .001) and IADLs (p = .012) and in slope (p = .036) for ADLs; a significant difference (p = .043) was now found when IADL slopes were constrained across group. Follow-up model comparisons showed that the IADL slopes for Baseline HBP and Later HBP were significantly greater than the No HBP group's slope. Estimates for the growth parameters from the conditional models are shown in Table 7.

For all three groups, age was significantly related to ADL limitation at baseline (p < .001), IADL limitation at baseline (p < .001), ADL slope (p < .001), and IADL slope (p < .001). Greater age was related to more ADL and IADL limitations at baseline and greater rates of change over time. Education was significantly related to changes in IADL limitations (p = .013) only for Baseline HBP; less education was related to greater rates of change in IADL limitations. Sex was a significant predictor only of IADL impairment at baseline (p = .03) for Baseline HBP; women had higher IADL limitations at baseline than men. The number of comorbidities was a significant predictor of ADL and IADL limitations at baseline (p < .001 for Baseline HBP and No HBP; p = .003 for Later HBP), but was only significantly related to ADL slope in the Baseline HBP group (p = .003) and IADL slope in the No HBP group (p = .030). Greater comorbidities at baseline were related to more baseline ADL and IADL limitations; furthermore, for those with hypertension at baseline, having more comorbid conditions was related to a greater rate of increase in ADL limitations, and for those never reporting hypertension, to greater rate of increase in IADL limitations. Greater depressive symptoms (p < .001) were related to greater ADL and IADL limitations at baseline for all groups and to less change over time in IADLs (p = .030) for the Later HBP group. Greater English language usage was related to fewer ADL and IADL limitations at baseline for the Baseline HBP (p = .002; p < .001) and No HBP (p = .013; p < .001) groups and to lower ADL slopes for the No HBP group (p = .048).

Discussion

The current study utilized latent growth curve modeling to examine changes in ADL/IADL limitations for a sample of Mexican American elders for a 7-year period as well as the relation of hypertension status and other covariates to ADL/IADL trajectories. Investigation of the potential effects of hypertension status on performance of ADL/IADL tasks is particularly important as: (a) hypertension is a known correlate of decline in functioning and negative outcomes (e.g., physical disability, heart attack, stroke) and (b) Hispanic elders, including Mexican Americans, demonstrate an elevated risk for hypertension. This longitudinal analysis adds to the limited research available documenting changes in Mexican American elders' ADL/IADL limitations over time and examines predictors of ADL/IADL limitations that are relevant to this ethnic group.

As hypothesized, the results of the present study indicated that significant increases in ADL and IADL limitations were experienced for the 7 years in which the research

Table 7. Parameter Estimates Across HBP Groups for ADLs and IADLs: Best-Fitting Conditional Models

	ADLs: Unconstrained intercepts and slopes			IADLs: Constrained slopes for baseline and later HBP only		
Parameter	Baseline HBP (n = 1,718)	Later HBP (n = 654)	No HBP (n = 674)	Baseline HBP (n = 1,718)	Later HBP (n = 654)	No HBP (n = 674)
Intercept mean	0.18**	0.19*	0.50***	0.90***	1.09***	1.36***
Intercept variance	1.03***	0.78***	1.85***	1.80***	1.40***	3.05***
Slope mean	0.09***	0.13***	0.04	0.17***	0.17***	0.08**
Slope Variance	0.05***	0.05***	0.03***	0.07***	0.07***	0.01
Intercept-slope correlation	–0.01	–0.13	–0.11	–0.14*	0.03	–0.08
Wave 1 error variance	0.77***	0.59***	1.25***	1.33***	1.56***	1.37***
Wave 2 error variance	1.22***	1.32***	1.13***	2.48***	2.33***	2.44***
Wave 3 error variance	1.80***	1.66***	1.25***	2.64***	2.64***	2.90***
Wave 4 error variance	1.28***	0.99***	0.58***	1.83***	2.04***	3.11***

Notes: ADLs = activities of daily living; HBP = high blood pressure; IADLs = instrumental activities of daily living.
*p < .05; **p < .01; ***p < .001.

was conducted. This finding is in agreement with the literature on this topic, which has shown that ADL/IADL limitations tend to increase over time in older adults (e.g., Liang et al., 2008). More IADL limitations than ADL limitations were observed, supporting previous findings by Spector and colleagues (1987). Also consistent with expectations, differences in the rate of increase in ADL/IADL limitations were observed as a function of hypertension status. Individuals without hypertension demonstrated lower increases over time in the number of ADL and IADL limitations than individuals who met hypertensive criteria. This finding suggests that a hypertension diagnosis may lead to more rapid declines in the ability to perform ADLs in the older adult Mexican American population. These results support previous research (e.g., Hajjar, Lackland, Cupples, & Lipsitz, 2007; Pinsky et al., 1985) showing that hypertensive individuals are more likely to experience difficulties performing ADLs/IADLs than are nonhypertensive individuals.

Examination of the effects of covariates on ADL/IADL trajectories revealed several findings. Consistent with prior research, greater age was related to more ADL and IADL limitations at baseline and greater rates of change over time. Less education was related to greater IADL change for individuals with hypertension at baseline. It is possible that the greater cognitive demands of the IADL tasks (e.g., financial management) combined with the physical toll of hypertension may explain this increased rate of impairment for individuals with less education. This group also had significantly higher comorbidities at baseline than the other two groups, which may have contributed to their greater increases in IADL limitations. Women had higher IADL limitations at baseline compared with men in the group with hypertension at baseline. Sex differences in IADLs may be explained by differences in socioeconomic status, division of labor, and education between men and women, particularly when comparing the current older adult cohort with younger cohorts (Liang et al., 2008). For all three groups, number of comorbidities (i.e., arthritis, diabetes, heart attack, and stroke) was a significant predictor of baseline ADL and IADL limitations. However, the relation of comorbid conditions to change in ADLs/IADLs was fairly limited; having more comorbid conditions was significantly related only to greater increases in ADL limitations for individuals reporting hypertension at baseline and to greater increases in IADL limitations for individuals never reporting hypertension. The finding for the group with hypertension at baseline may reflect an additive effect of having multiple conditions, resulting in possible decreases in physical activity or polypharmacy. The group never reporting hypertension experienced greater attrition at each wave than other groups, which may have resulted in a healthier remaining subsample who did not experience IADL declines until after baseline.

In summary, this study demonstrated significant increases in ADL and IADL limitations for a 7-year period. Greater increases were observed for IADL limitations as opposed to ADL limitations, although the amount differed based on when or if an individual met the criteria for hypertension. Individuals who met these criteria showed higher rates of increase in ADL and IADL limitations than those without hypertension, though for ADLs, these increases were smaller for individuals meeting hypertensive criteria at entry into the study than for individuals meeting hypertensive criteria during the study, when controlling for demographic, health, and psychological covariates. Thus, development of HBP appears to put individuals at risk for functional decline, but earlier diagnosis or treatment may be protective. However, we also found that having a greater number of comorbid conditions (i.e., arthritis, diabetes, heart attack, and stroke) increased the rate of ADL limitations for individuals with hypertension at entry to the study. In comparison, increased comorbidities at baseline were related to greater increases in IADL limitations for individuals not meeting hypertensive criteria during the study.

The present study is limited in several ways. First, it is important to note that the current findings are specific to a Mexican American population of older adults and should not be generalized to all Hispanic individuals or other

ethnic groups. The second caveat relates to the accurate assessment of hypertension, which is a critical issue, particularly among this population. Of those Mexican Americans with hypertension, up to half may be unaware that they have this health condition (Glover, Greenlund, Ayala, & Croft, 2005; Satish, Markides, Zhang, & Goodwin, 1997; Wang & Wang, 2004) and, even among those aware of having hypertension, some individuals may not respond accurately to self-report health measures, such as those utilized in this study (Bush, Miller, Golden, & Hale, 1989). A strength of the current study is the inclusion of both subjective (i.e., self-reported diagnosis and medications) and objective (i.e., actual blood pressure readings) indicators of hypertension; however, a physician's diagnosis was not available. A third issue is that hypertension control was not examined directly in our analyses. Some research indicates that the use of antihypertensive medications can help to prevent or delay subsequent ADL/IADL limitations in older adults (e.g., Elias & Elias, 2007; Hajjar et al., 2007). In addition, Hispanic older adults have been shown to be less likely to achieve control of their condition compared with other groups, often due to lower antihypertensive medication use (Sudano & Baker, 2001; Wang & Wang). Sudano and Baker speculated that Hispanics' lower antihypertensive medications use may be related to limited English proficiency, influencing the level of care they receive and their understanding of physician recommendations. This sample's English proficiency was relatively limited, which may have influenced their level of hypertension control. Finally, we did not have a direct measure of physical activity, but examined acculturation as a correlate of physical activity (Cantero et al., 1999; Evenson et al., 2004; Pérez-Stable et al., 1994). Future research should include variables that assess antihypertension medication use as well as other methods of hypertension control (e.g., lifestyle change) in Hispanic older adults. Other measures that would also be beneficial to include in future studies include a direct measure of physical activity and examination of medical records to determine objectively the length of time for which individuals entering the study with diagnosed hypertension may have had this health condition.

This study contributes to the existing body of literature by examining the relationship between hypertension and ADLs over time in an understudied ethnic minority older adult population. The demonstrated increases over time in ADL and IADL limitations for Mexican Americans are important for public health and social service agencies as well as researchers to consider in light of the growing numbers of older Mexican Americans, whose increased needs for assistance with ADLs as a consequence of hypertension would likely increase demands not only on public resources but also their kin networks (Angel & Angel, 1998). Over-reliance by Hispanic elders on social support networks could lead to increased psychological distress and decreased quality of life for the elders (Cruza-Guet, Spokane, Caskie, Szapocznik, & Brown, 2008). Additional research is needed to compare various ethnic minority groups of older adults with hypertension and the subsequent rates of change in ADL and IADL limitations that they experience over time to better understand health disparities of these groups. Such a study could also compare socioeconomic status and its relationship with functional decline over time (e.g., Kington & Smith, 1997). Future research in this area may also explore additional psychological variables, such as social support, which may influence the relationship between hypertension and changes in ADLs and IADLs over time.

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