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Sara N Bleich, David M Cutler, Alyce S Adams, Rafael Lozano and Christopher J L Murray

BMJ 2007;335;875; originally published online 22 Oct 2007;
doi:10.1136/bmj.39350.617616.BE

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WHAT IS ALREADY KNOWN ON THIS TOPIC

Mortality falls as incomes rise, and this relation holds both between and within countries

Among affluent nations, this relation is tempered as income inequalities increase: the health gains from increases in income are less in more unequal nations

There is some evidence that these effects are more pronounced at different ages

WHAT THIS STUDY ADDS

High inequalities in income are closely associated with higher mortality in both poor and rich nations of the world
This is particularly apparent when the effects are studied by age: worldwide, income inequality is most strongly detrimental to health in young adulthood

We thank colleagues, and two referees, a statistical referee and the editorial committee for many useful points made in reference to an earlier version of this paper. We are solely responsible for the views presented here.

Contributors: See bmj.com.

Funding: RM was funded by the Chief Scientist's Office of the Scottish Executive. DD was supported by a British Academy Research Leave Fellowship while this paper was being written. The opinions are of those of the authors.

Competing interests: All authors are in their 30s and are currently seeking the "bubble reputation" (*As You Like It* 2.7.139-65). However, all have their feet on the ground, having trained in medical geography.

- 1 Ram R. Further examination of the cross-country association between income inequality and population health. *Soc Sci Med* 2006;62:779-91.
- 2 Marmot MG. *The status syndrome: how social standing affects our health and longevity*. London: Bloomsbury, 2004.
- 3 Davey Smith G. *Health inequalities: lifecourse approaches*. Bristol: Policy Press, 2003.
- 4 Lynch J, Smith GD, Hillemeier M, Shaw M, Raghunathan T, Kaplan G. Income inequality, the psychosocial environment, and health: comparisons of wealthy nations. *Lancet* 2001;358:194-200.
- 5 Mclsaac S, Wilkinson RG. Income distribution and cause-specific mortality. *Eur J Public Health* 1997;7:45-53.
- 6 Lopez A, Ahmad O, Guillot M, Inoue M, Ferguson B. *Life tables for 191 countries for 2000: data, methods, results*. Geneva: World Health Organization, 2001. (GPE discussion paper No 40.)
- 7 United Nation Development Programme. Table 14 (Gini index of income inequality). In: *Human development report 2004*. Geneva: UNDP, 2004.

Accepted: 10 August 2007

Impact of insurance and supply of health professionals on coverage of treatment for hypertension in Mexico: population based study

Sara N Bleich,¹ David M Cutler,² Alyce S Adams,³ Rafael Lozano,⁴ Christopher J L Murray⁵

EDITORIAL by Tumwine

¹Johns Hopkins School of Public Health, Baltimore, MD 21205, USA

²Harvard University Faculty of Arts and Sciences, Cambridge, MA

³Harvard Medical School and Harvard Pilgrim Health Care, Boston, MA

⁴Secretaría de Salud, Mexico DF, Mexico

⁵Institute of Health Metrics and Evaluation, University of Washington, Seattle, WA

Correspondence to: S N Bleich sbleich@jhsph.edu

BMJ 2007;335:875-8
doi:10.1136/bmj.39350.617616.BE

This article is an abridged version of a paper that was published on bmj.com on 22 October 2007. Cite this version as: *BMJ* 22 October 2007, doi: 10.1136/bmj.39350.617616.BE (abridged text, in print: *BMJ* 2007;335:875-8).

ABSTRACT

Objective To examine the independent and combined contributions of insurance status and supply of health professionals on coverage of antihypertensive treatment among adults in Mexico.

Design Population based study.

Setting Mexico.

Participants 4032 hypertensive adults (2967 uninsured and 1065 insured): 1065 uninsured adults matched with 1065 adults insured through Seguro Popular, a programme to expand health insurance coverage to uninsured people in Mexico.

Main outcome measures Coverage of antihypertensive treatment and coverage of antihypertensive treatment with control of blood pressure.

Results Rates of treatment for hypertension varied by insurance status and supply of health professionals. Hypertensive adults insured through Seguro Popular had a significantly higher probability of receiving antihypertensive treatment (odds ratio 1.50, 95% confidence interval 1.27 to 1.78) and receiving antihypertensive treatment with control of blood pressure (1.35, 1.00 to 1.82). Greater supply of health professionals in areas with coverage through Seguro Popular was a significant predictor of antihypertensive treatment after adjusting for covariates (1.49, 1.00 to 2.20).

Conclusions Expansion of healthcare coverage to uninsured people in Mexico was associated with greater use of antihypertensive treatment and blood pressure control, particularly in areas with a greater supply of health professionals.

INTRODUCTION

Lack of health insurance is a key obstacle to antihypertensive treatment.¹⁻⁵ Mexico's Seguro Popular programme to extend health insurance to all uninsured people by 2010 has the potential to increase access to treatment for hypertension. The law stipulates that priority for affiliation is to be given to poor households in areas of high deprivation, and to rural areas and indigenous groups.⁶ In addition Seguro Popular was designed to start in communities with health facilities sufficiently equipped to provide the relevant services.⁶

We examined the association between Seguro Popular and coverage of antihypertensive treatment and control of blood pressure among adults. We also explored whether the supply of health professionals (numbers of doctors and nurses per 1000 population) was a mediating or moderating factor between Seguro Popular and antihypertensive treatment and blood pressure control. We hypothesised that Seguro Popular would be a significant predictor of coverage for both, and that the programme would affect the care

of hypertension differentially on the basis of health provider supply.

METHODS

The study population consisted of respondents to the 2005 Mexican national health and nutrition survey⁷ who had hypertension, were aged 20 or more, and were eligible for insurance coverage through Seguro Popular. We considered participants

to be hypertensive if the average of two systolic blood pressure readings was 140 mm Hg or higher or if participants reported taking antihypertensives.^{8,9} We considered participants to be eligible for Seguro Popular if they were uninsured or already affiliated with the scheme. For comparison we included hypertensive people with social security.

We obtained measures of health professional supply (numbers of doctors and nurses) from the 2005 Mexican National Registry of Health Infrastructure.¹⁰ To determine the number of doctors and nurses per 1000 population we obtained the total population numbers for each municipality from the population census (24.7 million households).

Sociodemographic characteristics of study population matched by propensity.* Data from Mexico national health and nutrition survey, 2005.⁷ Values are numbers (percentages) unless stated otherwise

Characteristic	Insured with Seguro Popular (n=1065)	Uninsured (n=1065)	P value (χ^2 test)
Male	390 (36.6)	400 (37.6)	0.654
Female	675 (63.4)	665 (62.4)	
Age (years):			
20-39	178 (16.7)	180 (16.9)	
40-59	461 (43.3)	483 (45.4)	0.725
60-79	371 (34.8)	353 (33.2)	
≥80	55 (5.2)	49 (4.6)	
Permanent income†:			
1st fifth	368 (34.6)	384 (36.1)	
2nd fifth	308 (28.9)	304 (28.5)	0.667
3rd fifth	199 (18.7)	196 (18.4)	
4th fifth	141 (13.2)	123 (11.6)	
5th fifth	49 (4.6)	58 (5.5)	
Marginality index‡:			
1st fifth	331 (31.1)	328 (30.8)	
2nd fifth	407 (38.2)	409 (38.4)	0.981
3rd fifth	203 (19.1)	198 (18.6)	
4th fifth	70 (6.6)	77 (7.2)	
5th fifth	54 (5.1)	53 (5.0)	
Area:			
Urban	534 (50.1)	548 (51.5)	0.544
Rural	531 (49.9)	517 (48.5)	
Region:			
Border	151 (14.2)	136 (12.8)	
North	238 (22.4)	254 (23.9)	0.850
Central	355 (33.3)	352 (33.1)	
Mexico City	15 (1.4)	14 (1.3)	
South	306 (28.7)	309 (29.0)	
Not indigenous	831 (78.0)	832 (78.1)	0.958
Indigenous	234 (22.0)	233 (21.9)	
Non-indigenous language	965 (90.6)	958 (90.0)	0.609
Indigenous language	100 (9.4)	107 (10.1)	
Education:			
None or preschool	267 (25.1)	264 (24.8)	
Primary	644 (60.5)	664 (62.4)	0.695
Secondary	128 (12.0)	116 (10.9)	
Higher	26 (2.4)	21 (2.0)	

*People insured with Seguro Popular were matched to uninsured people using nearest neighbour algorithm. Analytical cohort included 1065 matched pairs. All people insured with Seguro Popular were matched with someone without insurance. Data are unweighted.

†From poorest (1st fifth) to richest (5th fifth).

‡From most marginalised (1st fifth) to least marginalised (5th fifth).

Measures

We used two outcome variables—coverage of anti-hypertensive treatment and coverage of anti-hypertensive treatment with blood pressure control. Participants were considered to have controlled hypertension if they reported taking antihypertensives and their average systolic blood pressure was 120 mm Hg or less (the target recommended by the American Heart Association).⁸ We also included results for blood pressure control less than 140 mm Hg, the standard definition.

The primary independent variables of interest were self reported insurance type (Seguro Popular *v* uninsured) and number of doctors and nurses per 1000 population. In our combined measure for supply of health professionals we included in the primary analysis only doctors classified under general or internal medicine and nurses classified as generalists.

Statistical analysis

Using propensity scores to control for selection bias¹¹ we matched adults insured through Seguro Popular with uninsured adults using a nearest neighbour approach. The cohort included 1065 matched pairs. We used logistic regression to estimate the propensity to have insurance through Seguro Popular. Participants were matched on characteristics that predicted coverage of Seguro Popular: sex, age, income, marginality index, rural area, region, indigenous status, indigenous language, and education.

The marginality index, based on seven characteristics in the community (see bmj.com), includes nine variables. The 2005 marginality index was not available for this analysis.

Using the matched data we carried out a multivariate analysis to estimate the independent effect of insurance status and health professional supply on coverage of antihypertensive treatment and of antihypertensive treatment with blood pressure control. We used multivariate analysis with clustering for the supply side portion of the analysis. We ran the supply side models with and without interaction terms between Seguro Popular and the supply of health professionals to test whether the impact of the programme varied by provider supply.

RESULTS

Overall, 4032 hypertensive adults in the study population were uninsured or had insurance coverage through Seguro Popular. Compared with this population, people with social security were older, had higher incomes, were less marginalised, lived in urban areas, were less indigenous, and were more educated (see bmj.com).

People insured through Seguro Popular were more likely to be young, poor, marginalised, living in rural areas, living in the central region, and less educated than those uninsured. These differences are largely consistent with the roll-out of Seguro Popular, which aimed to prioritise people in the bottom tenths for income, those in highly deprived areas, those living in rural areas, and indigenous populations.⁶ Controlling for the propensity score resulted in statistically significant reductions in these differences (table).

People with social security had a higher probability of receiving antihypertensive treatment (60.3%, 95% confidence interval 60.6% to 65.3%) but the same probability of receiving treatment with blood pressure control as the Seguro Popular population (10.3%, 9.3% to 11.6%; see bmj.com).

Compared with uninsured adults, those insured through Seguro Popular had higher rates of coverage for antihypertensive treatment and for antihypertensive treatment with blood pressure control both before and after adjustment for propensity (see bmj.com). The rates of coverage for both outcomes were similar after adjustment (see bmj.com).

Effect of insurance on coverage of antihypertensive treatment

Insurance through Seguro Popular was positively and significantly associated with antihypertensive treatment. The odds of those insured through Seguro Popular receiving treatment was 50% higher than those uninsured (odds ratio 1.50, 95% confidence interval 1.27 to 1.78).

The magnitude of the effect was slightly smaller for those receiving antihypertensive treatment with blood pressure control. The odds of someone insured through Seguro Popular receiving treatment with blood pressure control was 35% higher than those uninsured (1.35, 1.00 to 1.82). Rates of control among those who received treatment showed a similar effect to Seguro Popular, but it was not significant possibly owing to the small sample size. In addition, Seguro Popular showed a positive and significant effect on controlled hypertension.

Effect of doctor and nursing supply on coverage of antihypertensive treatment

In the model relating supply of health professionals to antihypertensive treatment, after adjusting for insurance type, the odds ratio was not significant (1.04, 0.85 to 1.26). Results did, however, indicate a significant interaction between insurance through Seguro Popular and supply of health professionals. People

insured through Seguro Popular and living in areas with higher supply had significantly higher odds of receiving antihypertensive treatment than those uninsured and living in areas with fewer doctors and nurses (odds ratio 1.49, 1.00 to 2.20).

In the model relating the supply of health professionals to antihypertensive treatment with blood pressure control, after adjusting for insurance type, the odds ratio was not significant (0.81, 0.61 to 1.09). Although the odds ratio was not significant in the model relating the interaction between Seguro Popular and supply of health professionals to coverage of antihypertensive treatment with blood pressure control, the effect size was similar to that for the treatment coverage interaction (odds ratio 1.44, 0.87 to 2.39).

The measure of health professional supply included only doctors classified under general or internal medicine and nurses classified as generalists. Given that other types of physicians and nurses may provide services for hypertension, the effect of all types of health professional supply on the two outcomes showed similar effects (not shown).

DISCUSSION

Our findings suggest that being insured through Seguro Popular—a programme to expand health insurance to all uninsured households in Mexico—was associated with higher rates of antihypertensive treatment and blood pressure control than being uninsured. Furthermore, the programme may be most effective in areas with a high ratio of health professionals to patients.

Similarities and differences exist between our findings and previous research. The rate of antihypertensive treatment in Mexico is comparable to that of the United States (45.7% *v* 58.4%), but the rate of controlled hypertension is significantly lower (8.9% *v* 31.0%).¹² Our results concur with research showing the positive impact of Seguro Popular¹³ as well as studies indicating a strong relation between insurance status and treatment coverage.^{2,5,14}

Seguro Popular was designed to start in communities with health facilities equipped to provide the relevant services. Seguro Popular seemed to be having the biggest impact in these communities. Unlike previous studies our results do not indicate an independent effect of health professional supply on antihypertensive treatment. This could be because variation in supply side factors is insufficient to capture an effect in those areas with high affiliation with Seguro Popular. It is also likely that insurance coverage has a more direct relation to antihypertensive treatment in Mexico than does supply of physicians or nurses. That we found a positive and significant relation between Seguro Popular and the supply of health professionals on coverage of antihypertensive treatment suggests that insurance alone is not sufficient. Rather, Seguro Popular had the biggest impact on coverage of antihypertensive treatment when the clinician to patient ratio was higher.

WHAT IS ALREADY KNOWN ON THIS TOPIC

Coverage of antihypertensive treatment requires affordability and an adequate supply of health professionals

Concerns exist that areas with a low supply of health professionals may experience a reduced impact of Seguro Popular—the programme to expand health insurance to all uninsured households in Mexico—on coverage of antihypertensive treatment

WHAT THIS STUDY ADDS

Seguro Popular is positively and significantly associated with coverage of antihypertensive treatment, particularly in areas with a high supply of health professionals

Strengths and limitations of study

We explored the effect of demand and supply side factors on coverage of antihypertensive treatment. Consideration of health professional supply is important owing to the non-random roll-out of Seguro Popular, which presents challenges to isolating the independent effect of the programme on treatment coverage. Secondly, our study highlights the importance of a high supply of health professionals in areas with Seguro Popular.

The research does, however, have several limitations. Firstly, our analysis was cross sectional, limiting our ability to estimate causal effects. In particular our finding of a clear gradation in rates of treatment and control suggests that Seguro Popular is having a positive effect on health. It could also be the case that insurance status is a marker for people with healthier outcomes. Longitudinal data are necessary to eliminate the possibility of reverse causality. Secondly, we included only doctors classified under general or internal medicine and nurses classified as generalists. It is possible that participants received treatment from other providers. It is also possible that our measure of health professional supply was confounded by broader influences on health. In addition, by combining the number of doctors and number of nurses per 1000 population into one measure, it is difficult to interpret precisely our finding of a significant interaction between supply and insurance status. Thirdly, the impact of Seguro Popular could be smaller because we estimated the effect on the basis of areas where supply of health professionals is relatively high and people insured through Seguro Popular are relatively sicker, owing to the preferential roll-out of the programme. Our analysis provides an estimate of the immediate impact of Seguro Popular, but we may have underestimated this because of our rigorous definition of controlled blood pressure and because of physician migration before data collection in 2005. Recent evidence suggests that the number of doctors and nurses per 1000 population providing health care through Seguro Popular increased from 2001-5.¹³ Fourthly, we cannot generalise the results to the

subgroup of people aged 80 or more because of the small sample size. Finally, it is possible that our estimate of Seguro Popular's impact on antihypertensive treatment captured some of the effect of Mexico's national hypertension programme.

Conclusions

Our findings suggest that Seguro Popular is having a positive impact on the coverage of antihypertensive treatment in Mexico, particularly in those areas with a high concentration of health professionals. Yet coverage rates of treatment with blood pressure control remain low. As Seguro Popular continues to expand, efforts should be made to understand the drivers of uncontrolled hypertension in Mexico.

We thank Michael Law, Emmanuela Gakidou, Goodarz Danaei, Gretchen Stevens, and Majid Ezzati for help with the analysis, and the Secretaría de Salud, who created the datasets used in this study.

Contributors: See bmj.com.

Funding: Harvard Graduate School of Arts and Sciences dissertation completion fellowship.

Competing interests: None declared.

Ethical approval: Not required.

- 1 He J, Muntner P, Roccella EJ, Streiffer RH, Whelton PK. Factors associated with hypertension control in the general population of the United States. *Arch Intern Med* 2002;162(9):1051-8.
- 2 Huttin C, Moeller JE, Stafford RS. Patterns and costs for hypertension treatment in the United States: clinical, lifestyle and socioeconomic predictors from the 1987 National Medical Expenditures Survey. *Clin Drug Investig* 2000;20:181-95.
- 3 Levine DM. Adherence to antihypertensive therapy. In: Izzo JL, Black HR, eds. *Hypertension primer from the Council on High Blood Pressure Research*. Dallas: American Heart Association, 1993:291-3.
- 4 Moy E, Bartman BA, Weir MR. Access to hypertensive care. Effects of income, insurance, and source of care. *Arch Intern Med* 1995;155:1497-502.
- 5 Shea S, Misra D, Ehrlich MH, Field L, Francis CK. Predisposing factors for severe, uncontrolled hypertension in an inner-city minority population. *N Engl J Med* 1992;327:776-81.
- 6 Secretaría de Hacienda y Crédito Público de México. Segunda Resolución de Modificaciones a la Resolución Miscelánea Fiscal para 2003. Diario Oficial de la Federación. www.dof.gob.mx/2003/mayo/dof_15-05-2003.pdf.
- 7 Secretaría de Salud, Instituto Nacional de Salud Pública. Encuesta Nacional de Salud y Nutrición 2005 (ENSANut) 2006.
- 8 Chobanian AV, Bakris GL, Black HR, Cushman WC, Green LA, Izzo JL Jr, et al. Seventh report of the Joint National Committee on Prevention, Detection, Evaluation, and Treatment of High Blood Pressure. *Hypertension* 2007;42:1206-52.
- 9 Whitworth JA, World Health Organization, International Society of Hypertension Writing Group. 2003 World Health Organization (WHO)/International Society of Hypertension (ISH) statement on management of hypertension. *J Hypertens* 2003;21:1983-92.
- 10 Ministry of Health. Subsistema de Información de Equipamiento, Recursos Humanos e Infraestructura para la Atención de la Salud (SINERHIAS) 2005.
- 11 Rosenbaum PR, Rubin DB. Reducing bias in observational studies using subclassification on the propensity score. *J Am Stat Ass* 1984;79:516-24.
- 12 Hajjar I, Kotchen TA. Trends in prevalence, awareness, treatment, and control of hypertension in the United States, 1988-2000. *JAMA* 2003;290:199-206.
- 13 Gakidou E, Lozano R, González-Pier E, Abbott-Klafter J, Barofsky J, Bryson-Cahn C, et al. Assessing the effect of the 2001-06 Mexican health reform: an interim report card. *Lancet* 2006;368:1920-35.
- 14 He J, Whelton PK. Elevated systolic blood pressure and risk of cardiovascular and renal disease: overview of evidence from observational epidemiologic studies and randomized controlled trials. *Am Heart J* 1999;138(3):S211-9.

Accepted: 18 September 2007