

Future Health Manpower Needs in Latin America

JOSEPH A. CAVANAUGH, Ph.D.

THE future requirements for professional health manpower in Latin America will be enormous if acceptable standards for medical care are to be attained. This conclusion is based on the following observations: (a) a present low ratio between population and professional health personnel, (b) the additional manpower needed to keep abreast of a high rate of natural increase within the population, (c) the replacement of professional personnel who migrate to more economically developed areas, and (d) the need for manpower to staff expanded public health programs and treatment facilities.

Need for more manpower applies especially to physicians in all specialties, dentists, professional nurses, and semiprofessional nursing auxiliaries. It also applies to other professionals on the health team such as medical and psychiatric social workers, hospital administrators, biostatisticians, health administrators, health research personnel, technicians, and other related types of personnel.

Reliable statistics on health manpower in Latin America are not generally available. The World Health Organization and the Pan American Health Organization publish some estimates on health manpower which are based on a form sent to health authorities in each country. Their reliability varies from country to country, as only relatively few Latin nations are able to provide accurate information on manpower.

Dr. Cavanaugh is chief of the Mental Health Manpower Studies Unit, Training and Manpower Resources Branch, National Institute of Mental Health, Public Health Service. This article is based on a paper presented at the annual meeting of the Population Association of America, San Francisco, Calif., June 11-13, 1964.

Taking into account the limitations of the data, it is estimated that in Central and South America in 1960 there were about 114,000 physicians, 37,000 graduate nurses, 81,000 auxiliary nurses, 11,000 midwives, 41,000 dentists, and 2,000 sanitary engineers (1). From these available manpower estimates, some notion about the extent of future manpower requirements can be formulated.

Some Conceptual Considerations

For estimating future manpower needs, it is necessary to consider several dimensions which assist in determining and fulfilling those needs. Obviously, two important dimensions are population increase due to natural means and migration and the need for manpower in terms of what additional units are necessary to remove a present deficit. Another dimension is the need for manpower necessary to operate physical medical facilities that undoubtedly will be expanded at an increasing rate in the future.

At the same time, limiting factors are at play which adversely affect the possibility of fulfilling such needs. These include limited facilities for training future potential candidates for advanced professional training, lack of motivation on the part of individuals or communities to take steps to eliminate manpower deficits, and the limited amount of economic support for attracting persons into the professions. Moreover, in most Latin countries, the university-educated manpower pool from which potential professional health personnel may be drawn is comparatively small. Future manpower needs also rely on quality characteristics and level of professional competence as well as quantity expressed in finite numbers or rates per population.

The general conceptual method presented here for estimating future manpower requirements is predicated on the functional relationship of only two dimensions; that is, a population increase and the additional manpower needed to erase a present deficit. This relationship is expressed as

$$y_t = f_t(x)$$

where

y_t = the total number of future units needed at any given point in time, t , and

$x = g_1(t) + g_2(t)$ in which $g_1(t)$ = the total number of units required owing to population increase from $t=0$ to a given point in time, t , and $g_2(t)$ = those units required to erase a present deficit at a given point in time, t .

The total number of future units required at any given time, t , is thus $y_t = f_t[g_1(t) + g_2(t)]$ and is a function of how rapidly the population is increasing and how great or small the present deficit is in order to arrive at a reasonable but arbitrary standard of units per population. Other possible variables affecting the functional relationship are not considered here.

The functional relationships are illustrated geometrically in the chart. The coordinates represent the number of units required according to certain conditions in t number of future years. The line YA represents a constant number of units (that is, physicians, nurses, others) = to Y_0 for all values of t , and the curve YB represents a steadily increasing production of units where r_u (rate of unit increase) is

Conceptual method for estimating future manpower requirements in Latin America

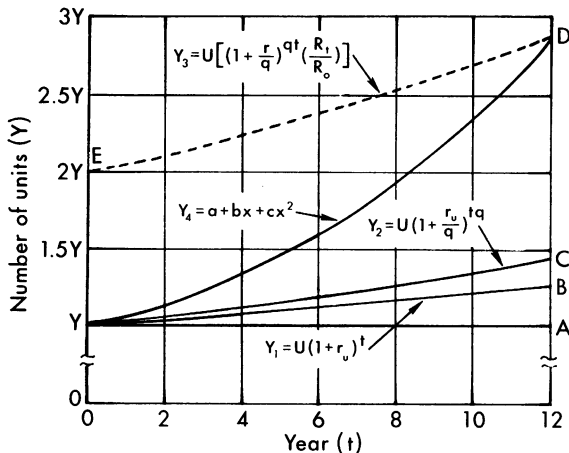


Table 1. Population and estimated rates of increase in Central and South American countries, 1960

Country	Population in 1960 ¹ (thousands)	Estimated annual rate of increase (r)	$(1 + \frac{r}{q})^{qt}$
Total	205, 909		
Argentina	20, 956	0.020	1.2208
Bolivia	3, 454	.025	1.2823
Brazil	70, 175	.025	1.2823
Chile	7, 628	.023	1.2578
Colombia	14, 132	.030	1.3479
Costa Rica	1, 171	.035	1.4166
Cuba	6, 797	.025	1.2823
Dominican Republic	2, 994	.030	1.3479
Ecuador	4, 317	.030	1.3479
El Salvador	2, 612	.035	1.4166
Guatemala	3, 765	.030	1.3479
Haiti	3, 505	(²)	(²)
Honduras	1, 953	.030	1.3479
Mexico	34, 923	.035	1.4166
Nicaragua	1, 477	.032	1.3753
Panama	1, 055	.030	1.3479
Paraguay	1, 768	.025	1.2823
Peru	10, 857	.030	1.3479
Puerto Rico	2, 361	.020	1.2208
Uruguay	2, 827	.015	1.1609
Venezuela	7, 182	.035	1.4166

¹ Reference 1. ² Data unavailable.

arbitrarily given a value of 0.02 and U is the number of units at $t=0$. The curve YC represents the future units required in t years in accordance with a given rate of population increase to maintain a constant ratio of units to population. For illustrative purposes, r_u has been assigned a value of 0.03 because population increase in most Latin countries is at least

this amount, and $\frac{r}{q}$ as $\frac{0.03}{2}$, which describes a 3 percent annual increase in population compounded semiannually where $q=2$.

It can be argued that large populations compound themselves an almost infinite number of times per year and not simply semiannually. Hence some error would exist if q is a very small number. However, it can be shown in the calculus that as q becomes larger and larger, each increment becomes smaller and smaller as $\frac{r}{q}$ approaches a limit; that is, $\lim_{q \rightarrow \infty} S_n = S$ where $S \neq 0$. Also, it can be proved that $\lim_{q \rightarrow \infty} (1 + \frac{r}{q})^q = e$ where e has a limit greater

than 0. Thus the compounding of the population an infinite number of q times increases the number of population units only a relatively small additional amount, making it unnecessary to compound an infinite number of times.

The curve ED indicates the number of units at any t year needed to keep abreast of population increase as indicated by YC and to make up a deficit in the number of units represented by $\frac{R_t}{R_0}$; that is, a ratio expressed in terms of rates of the desired number of units per population at time, t , to the existing number when $t=0$. For the conceptual presentation, this ratio has been arbitrarily given a value of 2; that is, two times the number of units are needed to make up an existing deficit for all values of t .

Finally, the curve YD ($Y_t = a + bt + ct^2$) represents a parabolic curve indicating the number of units which must exist at t years to satisfy the requirement of population increase and a gradual reduction of a deficit at any given t and a complete removal when $t=12$. ($t=12$ is

arbitrarily selected. In practice, complete unit deficit removal will undoubtedly be much greater for the majority of countries with large present deficits.) The numerical value of the constant c depends on the rate a given country is able to increase the necessary units. The curve YD may assume various forms as it approaches $t=12$, depending on how a country is able to increase the number of desired units. For example, the desired increase may be in the form of an ogive, where a country would increase slowly during the first years, more rapidly in the middle years, and then slowly again as it approached the optimum number.

Geometrically, the vertical distances for given t values between the curves show the relative deficiency in units according to the two dimensions, population increase and an existing deficit. For example, at $t=8$ the vertical distance between the curves formed by YB and YC represents the number of units needed between what would be produced if the trend before $t=0$ continues and what units need to be produced to keep up with general population

Table 2. Estimated numbers and rates for physicians needed in 1970 by Central and South American countries

County	Total 1960	Rate per 10,000 population in 1960 (R_{oP})	$U_P \left(1 + \frac{r}{q}\right)^{qt}$ (1970)	$\frac{R_{tP}}{R_{oP}}$	$U_P \left(\frac{R_{tP}}{R_{oP}}\right) - U_P$	Total needed in 1970
Total	116, 193	-----	151, 290	-----	44, 770	196, 060
Argentina	26, 898	13. 0	32, 840	1. 00	0	32, 840
Bolivia	¹ 1, 000	¹ 2. 9	1, 280	2. 45	1, 450	2, 730
Brazil	¹ 30, 000	¹ 4. 3	38, 470	1. 65	19, 500	57, 970
Chile	4, 726	6. 2	5, 940	1. 15	700	6, 640
Colombia	6, 042	¹ 4. 3	8, 140	1. 65	3, 930	12, 070
Costa Rica	458	3. 9	650	1. 82	380	1, 030
Cuba	6, 609	9. 7	8, 470	1. 34	2, 250	10, 720
Dominican Republic	¹ 660	¹ 2. 2	890	3. 23	1, 470	2, 360
Ecuador	¹ 1, 500	¹ 3. 4	2, 020	2. 09	1, 640	3, 660
El Salvador	483	1. 8	680	3. 94	1, 420	2, 100
Guatemala	900	2. 4	1, 210	2. 96	1, 760	2, 970
Haiti ²	-----	-----	-----	-----	-----	-----
Honduras	¹ 410	¹ 2. 1	550	3. 38	980	1, 530
Mexico	20, 227	5. 8	28, 650	1. 22	4, 450	33, 100
Nicaragua	524	3. 5	720	2. 03	540	1, 260
Panama	401	3. 8	540	1. 87	350	890
Paraguay	¹ 990	¹ 5. 6	1, 270	1. 27	270	1, 540
Peru	5, 061	4. 7	6, 820	1. 51	2, 580	9, 400
Puerto Rico	1, 059	4. 6	1, 290	1. 54	570	1, 860
Uruguay	¹ 3, 200	¹ 11. 3	3, 710	1. 15	480	4, 190
Venezuela	5, 045	7. 0	7, 150	1. 01	50	7, 200

¹ Adjusted estimate.

² Data unavailable.

SOURCE: Reference 1.

increase. The vertical distance between curves *YD* and *ED* at $t=8$ represents the additional number needed to satisfy a deficit determined by acceptable standards of supply. The vertical lines between the curves *DE* and *YA* illustrate the total number of additional units needed when $t=0$ for any other value of t .

Estimating Future Manpower Needs

Estimates for the total needed manpower units for a given country or area for any t year may be calculated according to the following equation:

$$y_t = \left[u_x \left(1 + \frac{r}{q} \right)^{qt} \right] + \left[\left(\frac{R_t}{R_0} \right) u_x - u_x \right]$$

where

y_t = estimate of total number of units needed in t years in accordance with population increase and existing manpower deficit when $t=0$

u_x = number of units existing when $t=0$

r = estimated annual rate of population increase

q = number of times population is compounded annually

R_t = rate of units desired per 10,000 population at time, t

R_0 = rate of units per 10,000 population when $t=0$

Tables 1 through 4 present data on population and rates of increase as well as estimates of selected health manpower needs for Latin American countries in 1970. The estimating procedure differs slightly from that explained in the conceptual presentation. The conceptual presentation assumes that $\frac{R_t}{R_0} = 2$ for any t year multiplied by the number of units needed because of population increase, while the actual estimating procedure assumes that $\frac{R_t}{R_0}$ is the desired ratio needed in 1960. That ratio expressed in terms of additional units needed is

Table 3. Estimated numbers and rates for nurses needed in 1970 by Central and South American countries

Country	Total 1960	Rate per 10,000 population in 1960 (R_{0N})	$U_N \left(1 + \frac{r}{q} \right)^{qt}$ (1970)	$\frac{R_{tN}}{R_{0N}}$	$U_N \left(\frac{R_{tN}}{R_{0N}} \right) - U_N$	Total needed in 1970
Total.....	33, 613		45, 650		129, 970	175, 620
Argentina.....	¹ 10, 273	¹ 5. 2	13, 310	1. 6	6, 160	19, 470
Bolivia.....	240	. 7	300	11. 9	2, 620	2, 920
Brazil.....	^{1 2} 4, 144	^{1 2} . 6	5, 730	13. 8	53, 040	58, 770
Chile.....	1, 570	2. 1	1, 970	4. 0	4, 710	6, 680
Columbia.....	999	. 7	1, 350	11. 9	10, 890	12, 240
Costa Rica.....	^{2 3} 700	^{2 3} 6. 0	990	1. 4	280	1, 270
Cuba.....	¹ 2, 876	¹ 4. 5	3, 970	1. 8	2, 300	6, 270
Dominican Republic.....	³ 800	³ 2. 7	1, 080	3. 1	1, 680	2, 760
Ecuador.....	¹ 194	³ . 5	290	16. 6	3, 030	3, 320
El Salvador.....	³ 700	³ 2. 7	990	3. 1	1, 470	2, 460
Guatemala.....	¹ 543	¹ 1. 6	800	5. 2	2, 280	3, 080
Haiti ⁴						
Honduras.....	93	. 5	130	16. 6	1, 450	1, 580
Mexico.....	4, 407	1. 3	6, 240	6. 4	23, 800	30, 040
Nicaragua.....	263	1. 8	360	4. 6	950	1, 310
Panama.....	489	4. 6	660	1. 8	390	1, 050
Paraguay.....	¹ 88	. 5	120	17. 0	1, 410	1, 530
Peru.....	³ 2, 000	³ 1. 8	2, 700	4. 6	7, 200	9, 900
Puerto Rico.....	787	3. 3	960	2. 5	1, 180	2, 140
Uruguay.....	¹ 420	¹ 1. 5	510	5. 5	1, 890	2, 400
Venezuela.....	¹ 2, 027	^{1 3} . 2	3, 190	2. 6	3, 240	6, 430

¹ 1957. ² Includes midwives. ³ Adjusted estimate. ⁴ Data unavailable.

SOURCE: Reference 1.

added to the number of units needed for population increase to arrive at the total number needed for any t year. The calculations of manpower needed to keep abreast of population growth for 1970 were based on population statistics and manpower estimates available for 1960 (or date noted) and projections to 1970 in which $q=4$ and $t=10$. (Where manpower estimates were available only for 1957, $t=13$.)

The annual rate of population growth (r) used for each country was based on an estimated rate of natural increase derived from an adjustment of various indices of increase; that is, (a) the annual rate of increase between the 1950 and 1960 censuses, (b) a ratio between published crude death and birth rates, and (c) the differences between official birth and death rates.

Estimates of an existing deficit of manpower were made by computing a ratio, $\frac{R_t}{R_o}$, between the actual rate of units per population in 1960, R_o , and an arbitrary rate, R_t , which was assumed as acceptable and possibly attainable for

most countries in the future. These rates were selected as follows: one physician for 1,400 persons, one nurse for 1,200 persons, and one dentist for approximately 2,900 persons. However, for Argentina, Cuba, and Uruguay the rate chosen for physicians was 13 per 10,000 population since these countries already approximate this rate, which nearly equals that of the United States. For dentists, Argentina and Uruguay exceeded the rate of 3.5 per 10,000 population in 1960, and a rate of 6 per 10,000 was selected for these two countries. In the United States the 1960 rates per 10,000 population were 13.4 for physicians and 28 for nurses. The 1959 rate for dentists was 5.8 per 10,000 population.

Summary and Conclusion

We have attempted to bring into focus the great need for health manpower in Latin America. A method is presented for calculating estimates of needed manpower, based on the necessity of keeping abreast of a rapid increase in population and gradually reducing a deficit

Table 4. Estimated numbers and rates for dentists needed in 1970 by Central and South American countries

Country	Total 1960	Rate per 10,000 population in 1960 (R_{oD})	$U_D \left(1 + \frac{r}{q}\right)^{qt}$ (1970)	$\frac{R_{tD}}{R_{oD}}$	$U_D \left(\frac{R_{tD}}{R_{oD}}\right) - U_D$	Total needed in 1970
Total.....	41, 002	-----	53, 730	-----	30, 320	83, 190
Argentina.....	¹ 10, 083	15. 1	13, 080	1. 20	2, 020	15, 100
Bolivia.....	500	1. 4	640	2. 50	750	1, 390
Brazil.....	² 16, 000	² 2. 7	20, 520	1. 30	4, 800	25, 320
Chile.....	2, 504	3. 3	3, 150	1. 06	150	3, 300
Colombia.....	1, 719	1. 2	2, 370	2. 90	4, 300	6, 670
Costa Rica.....	146	1. 2	210	2. 90	290	500
Cuba.....	¹² , 100	¹³ . 3	2, 900	1. 06	130	3, 030
Dominican Republic ³	-----	-----	-----	-----	-----	-----
Ecuador.....	500	1. 2	670	2. 90	950	1, 620
El Salvador.....	¹ 161	¹ . 7	250	5. 00	640	890
Guatemala.....	¹ 130	¹ . 4	190	8. 75	900	1, 090
Haiti.....	¹ 52	¹ . 2	(³)	17. 50	860	(³)
Honduras.....	¹ 63	¹ . 4	90	8. 75	490	580
Mexico.....	¹¹ , 601	¹ . 5	2, 520	7. 00	9, 600	12, 120
Nicaragua.....	(³)	. 6	(³)	5. 83	(³)	(³)
Panama.....	88	. 8	120	4. 37	300	420
Paraguay.....	² 300	² 1. 6	380	2. 18	350	730
Peru.....	1, 630	1. 5	2, 200	2. 33	2, 170	4, 370
Puerto Rico.....	² 375	² 1. 6	460	2. 18	440	900
Uruguay.....	¹¹ , 650	¹⁶ . 1	2, 000	1. 00	0	2, 000
Venezuela.....	1, 400	1. 9	1, 980	1. 84	1, 180	3, 160

¹1957. ²Adjusted estimate. ³Data unavailable.

SOURCE: Reference 1.

in existing professional personnel. More accurate calculations require further efforts to provide improved basic statistical data in Latin America.

Other manpower issues in Latin America that are recognized but are not discussed are maldistribution of professional health manpower, especially in urban areas as compared with rural areas, and lack of full utilization of existing manpower. In addition to raw numbers of manpower, specialties within professional disciplines are needed, some specialties far more than others.

Latin countries have suffered loss of manpower especially through migration to more developed countries. Constructive efforts and an intensification of present programs to overcome shortages of professional manpower are clearly indicated. The task is not easy in a world that is suffering acute professional manpower shortages in all fields.

REFERENCE

- (1) Pan American Health Organization: Summary of four-year reports on health conditions in the Americas, 1957-1960. WHO, Geneva, July 1962.

PUBLICATION ANNOUNCEMENTS

Address inquiries to publisher or sponsoring agency.

Health Issues of the Day. Report of symposia of the National League for Nursing 1963 convention. 1963; 55 pages; \$1.50. National League for Nursing, 10 Columbus Circle, New York, N.Y., 10019.

Mental Retardation: A family crisis—the therapeutic role of the physician. Report No. 56. December 1963; 146 pages; 50 cents, discounts for quantity. Group for the Advancement of Psychiatry, 104 East 25th St., New York, N.Y., 10010.

Language Problems After a Stroke. A guide for communication. By Jean C. Peterson and Ann P. Olsen. 1964; 18 pages; 25 cents. Sister Elizabeth Kenny Foundation, 1800 Chicago Ave., Minneapolis, Minn., 55404.

Planned Parenthood. World population, annual report for 1963. By Alan F. Guttmacher, M.D. 1964; 40 pages. Planned Parenthood Federation of America, Inc., 515 Madison Ave., New York, N.Y., 10022.

A Psychiatric Glossary. 1964; 30 pages; \$1. New York Publications Office, American Psychiatric Association, 104 East 25th St., New York, N.Y., 10010.

Scientific and Technical Personnel in Industry, 1961. NSF 63-32. Prepared for the National Science Foundation by the U.S. Department of Labor, Bureau of Labor Statistics. 1964; 84 pages; 55 cents. Superintendent of Documents, U.S. Government Printing Office, Washington, D.C., 20402.

Your Physician Looks at Family Health. 1964; Single copies, free. American College of Physicians, 4200 Pine St., Philadelphia, Pa., 19104.

World Health Organization

WHO publications may be obtained from the Columbia University Press, International Documents Service, 2960 Broadway, New York, N.Y., 10027.

General Practice. Report of a WHO Expert Committee. WHO Technical Report Series No. 267. 1964; 24 pages; 30 cents; Geneva.

Genetics of Vectors and Insecticide Resistance. Report of a WHO Scientific Group. WHO Technical Report Series No. 268. 1964; 40 pages; 60 cents; Geneva.

Promotion of Medical Practitioners' Interest in Preventive Medicine. Twelfth report of the WHO Expert Committee on Professional and

Technical Education of Medical and Auxiliary Personnel. WHO Technical Report Series No. 269. 1964; 22 pages; 30 cents; Geneva.

Rehabilitation of Patients with Cardiovascular Diseases. Report of a WHO Expert Committee. WHO Technical Report Series No. 270. 1964; 46 pages; 60 cents; Geneva.

Atmospheric Pollutants. Report of a WHO Expert Committee. WHO Technical Report Series No. 271. 1964; 18 pages; 30 cents; Geneva.

WHO Expert Committee on Malaria. Tenth report. WHO Technical Report Series No. 272. 1964; 52 pages; 60 cents; Geneva.

WHO Expert Committee on Addiction-Producing Drugs. Thirteenth report. WHO Technical Report Series No. 273. 1964; 20 pages; 30 cents; Geneva.

Collection and Utilization of Statistical Data From Psychiatric Facilities in the United States of America. (Reprinted from Bulletin of the World Health Organization, 1963, 29: 491-510.) By Morton Kramer. 1963; 20 pages; 30 cents; Geneva.

International Digest of Health Legislation. Vol. 15, No. 1. 1964; 205 pages; \$2.75; Geneva.