The Gap in Human Resources to Deliver the Guaranteed Package of Prevention and Health Promotion Services at Urban and Rural Primary Care Facilities in Mexico

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Recommended Citation
References Alcalde-Rabanal, J. E., Nigenda, G., Barnighausen, T., Velasco-Mondragon, H. E., & Darney, B. G. (2017). The gap in human resources to deliver the guaranteed package of prevention and health promotion services at urban and rural primary care facilities in mexico. Human Resources for Health, 15 [Article 49].
The gap in human resources to deliver the guaranteed package of prevention and health promotion services at urban and rural primary care facilities in Mexico

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Abstract

**Background:** The purpose of this study was to estimate the gap between the available and the ideal supply of human resources (physicians, nurses, and health promoters) to deliver the guaranteed package of prevention and health promotion services at urban and rural primary care facilities in Mexico.

**Methods:** We conducted a cross-sectional observational study using a convenience sample. We selected 20 primary health facilities in urban and rural areas in 10 states of Mexico. We calculated the available and the ideal supply of human resources in these facilities using estimates of time available, used, and required to deliver health prevention and promotion services. We performed descriptive statistics and bivariate hypothesis testing using Wilcoxon and Friedman tests. Finally, we conducted a sensitivity analysis to test whether the non-normal distribution of our time variables biased estimation of available and ideal supply of human resources.

**Results:** The comparison between available and ideal supply for urban and rural primary health care facilities reveals a low supply of physicians. On average, primary health care facilities are lacking five physicians when they were estimated with time used and nine if they were estimated with time required ($P < 0.05$). No difference was observed between available and ideal supply of nurses in either urban or rural primary health care facilities. There is a shortage of health promoters in urban primary health facilities ($P < 0.05$).

**Conclusion:** The available supply of physicians and health promoters is lower than the ideal supply to deliver the guaranteed package of prevention and health promotion services. Policies must address the level and distribution of human resources in primary health facilities.

**Keywords:** Health promotion, Preventive health services, Human resources planning, Health manpower, Health workforce, Health personnel, Primary health care, Mexico

**Background**

The availability of sufficient human resources (HR) for delivery of health services is a major global policy concern [1]. The health workforce is the social and technical foundation of any health system [2], and the absence or poor distribution [3] of HR can negatively impact both the delivery of health services and the accomplishment of local or national population health goals [4]. The strengthening of primary health care and health promotion services through sufficient human resources has been identified as a high priority area for health systems in many countries [5]. According to the World Health Organization’s (WHO) recent reports, most developing countries, despite important advancements, are still struggling to find clear guidelines for integration of HR into health systems; however, these countries have been experiencing important transformations in recent decades [6, 7].
The Mexican health system is segmented into social security (employment-based), public (Ministry of Health), and private sectors. The health system has evolved through three generations of reforms, which have motivated various actions and strategies for the strengthening of HR. The first reform, in 1943 [2, 8], highlighted the creation of the social security sub-system and focused primarily on making HR available in hospitals.

The second reform, in the 1980s and 1990s, focused on hiring HR for extending coverage through the decentralization of the public sub-system (Ministry of Health) and strengthening of primary health care (PHC) [4, 8, 9]. At that time, “Oportunidades” (formerly PROGRESA, now PROSPERA), a conditional cash transfer program that began in 1997 [10], was specifically designed to encourage demand for health services at the primary care level. Physicians, nurses, and health promoters were hired by the program to provide services to beneficiaries.

The third reform, in the early 2000s, created Seguro Popular de Salud (SPS) (2003) to allocate new resources to strengthen primary care and health promotion services in the public sub-system. SPS also aimed to transform the existing curative, hospital-centered health care model to a new one more focused on primary care, prevention, and health promotion. This reform meant to hire and allocate personnel for general hospitals and primary health care facilities in rural and urban areas. SPS slowly rolled out across the country covering by 2012 around 57 million Mexicans [11]. It provides a package of 284 primary and secondary care interventions (CAUSES in Spanish) aimed at improving population health, reducing out-of-pocket expenditures, and satisfying client expectations. SPS serves the population outside the formal sector of the economy who are not eligible for social security (employment-based coverage). In each state, the Health Social Protection Regime (REPS in Spanish) was created to take responsibility for pooling together the different sources of financing and allocate them according to SPS managerial guidelines to guarantee the provision of services to beneficiary populations.

Seguro Popular greatly expanded access to health services to the uninsured population [12–15], with the gradual introduction of the CAUSES package, which includes both health promotion and preventive services (PPPS) [14, 16]. CAUSES should operate in all Ministry of Health (public) primary health care facilities. The PPPS has 99 guaranteed activities and was structured to cover the needs of different age groups (Table 1). The massive expansion in demand and access to services following implementation of SPS required additional HR for health in all states in the country. However, the newly contracted health personnel were concentrated in urban areas, due to the lack of an explicit and specific HR distribution policy [14, 17], leaving rural facilities with little HR capacity. Thus, the number of health professionals in primary care facilities has not grown significantly, while at the same time an increasingly larger population is demanding health care.

In order to transform administrative and financial reforms into concrete actions to improve population health status [15, 18] and health service delivery goals, it is critical to have sufficient human resources and to distribute them appropriately [19]. Evidence on the sufficiency of human resources to meet health goals and objectives is scarce. Information on the link between human resources supply and prevention and promotion services is even more sparse. The purpose of this study was to estimate the gap between the available and the ideal supply of human resources to deliver health prevention and promotion services to the Mexican population served by the public sub-system. We hypothesized that the available supply of human resources is insufficient to ensure the delivery of PPPS in rural and urban primary health care facilities in Mexico.

Methods

We conducted a cross-sectional observational study and used a convenience sample considering the following criteria: (a) geographic diversity (North, Center, and South), (b) REPSS juridical status (decentralized, deconcentrated, or integrated), and (c) level of REPSS performance (percentage of the population affiliated to SPS and percentage of population with SPS that use health services). Ten states were included (Morelos, Ciudad de México, Hidalgo, Querétaro, Guerrero, Baja California, Jalisco, Campeche, Zacatecas, and Estado de México). In each state, we selected two primary care facilities (PHFs) that provided a prevention and health promotion package since initiation of SPS in 2003 (Lifeline Program). One rural and one urban PHF was included (we used the classification of urban/rural PHF established by the General Directorate of Health Information). However, Mexico City is completely urban and Jalisco did not have rural primary health facilities that had implemented the package by 2003, so in these states, we included only urban facilities.

Our analysis is guided by the service delivery target model, which is based on demand of health services [20–23] and the availability of human resources to deliver health services. To estimate the demand of preventive and health promotion services, we employed the normative-need approach [24], which relies on an expert opinion about which health services an individual should receive over 1 year (Fig. 1). We focused on all 99 prevention and promotion activities that are included in the guaranteed package for all age groups [16] included in CAUSES and implemented in all primary care facilities (Table 1).
| Table 1 Guaranteed prevention and health promotion package by age group |
|-------------------------------------------------------------|
| **Newborns** | **Children under 9 years** | **Teens 10-19 years** | **Women and men 20-59 years** | **Women and men over 60 years** | **Pre- and postpartum** |
| 1. Risk signs | 1. Weight and height | 1. Tuberculosis risk | 1. Tuberculosis and BK | 1. Visual and hearing problems | 1. Weight and blood pressure |
| 2. Birth conditions | 2. Complete physical examination | 2. Nutritional status | 2. Sexually transmitted diseases and HIV/AIDS | 2. Prostatic disease | 2. Pregnancy confirmation |
| 3. Complete physical examination | 3. Visual acuity | 3. Attention disorders and addictions | 3. Diabetes, hypertension, overweight, obesity, and osteoporosis | 3. Pregnancy risks factors | 3. Pregnancy risks factors |
| 4. Birth defects | 4. Growth and learning disorders | 4. Complete physical examination | 4. Complete vaccination | 4. Perinatal card | 4. Perinatal card |
| 5. Umbilical cord examination | 5. Postural problems | 5. Identification of pregnancy | 5. Tuberculosis risk and BK | 5. Laboratory studies (blood test, syphilis, complete urinalysis, and others) | 5. Laboratory studies (blood test, syphilis, complete urinalysis, and others) |
| 6. Neonatal screening | 6. Family factors of poor prognosis (<5 years) | 6. Detection of sexually transmitted infections and HIV/AIDS | 6. Signs of cognitive impairment and depression | 6. Complete vaccination | 6. Complete vaccination |
| 7. Eye prophylaxis and vitamin K | 7. Complete vaccination schedule | 7. Complete vaccination | 7. Breast examination | 7. Breast examination | 7. Breast examination |
| 8. Vaccination | 8. Micronutrients administration (<5 years) | 8. Reproductive health and contraception | 8. Oral health | 8. Oral health | 8. Oral health |
| 9. Promotion of breastfeeding and early stimulation | 9. Oral health | 9. Sexual and reproductive health | 9. Parental education | 9. Parental education | 9. Parental education |
| 10. Card to follow child | 10. Healthy nutrition | 9. Education for preventing cervical and breast cancer | 10. Care of the newborn | 10. Care of the newborn | 10. Care of the newborn |
| | 11. Early stimulation (<5 years) | 9. Education for preventing cervical and breast cancer | 11. Family planning | 11. Family planning | 11. Family planning |
| | 12. Physical activity and accident prevention | 10. Physical activity, accident prevention, alcohol, and tobacco smoke risk | 12. Health education and treatment to HIV/AIDS | 12. Health education and treatment to HIV/AIDS | 12. Health education and treatment to HIV/AIDS |
| | 13. Individual and family hygiene education | 11. Oral health | | | |
Our operational variables to estimate HR were available and ideal supply, both estimated from time variables.

Available supply (As) was estimated as the average of payable number of hours stipulated in staff labor contracts (physicians, nurses, and health promoters) in primary health facilities in 2009. Ideal supply (Is) was estimated from time used and required to perform health promotion and prevention activities (Table 1). Time used is the time that staff use to deliver health prevention and promotion activities while time required is the time that staff considered suitable to deliver prevention and health promotion activities. To estimate our operational variables, we followed several steps (Table 2):

First, we organized a group of experts all of whom were knowledgeable about prevention and health promotion, having at least 10 years of experience working in primary care facilities and implementing prevention and promotion activities included in the Lifeline Program [16]. The group included two physicians, two nurses, three health promoters, two primary health technicians, two local health coordinators, and one health promotion coordinator at the state level. Experts checked all 99 activities and assigned each one to a single occupational category (physician, nurse, or primary care technician).

Second, available supply was estimated from the number of personnel available (physicians, nurses, and health promoters) at each primary care facility in 2009 (using Ministry of Health official information) [25] multiplied by 200 working days per year and six working hours per day. These figures were added up to obtain the total of annual hours available as a variable of available supply.

Third, we developed an instrument to estimate the time used and the time required. Health workers reported the time used and the time required to perform a single activity from the package of prevention and health promotion. The instrument was piloted in two PHFs in the State of México not included in the study. During the pilot phase, the researchers measured the time used to perform a group of activities (16 of the 99), and then we compared this time with the time reported by health staff. Eighty percent of the time measured to perform activities were very similar to the time reported, and the remaining 20% were not statistically significantly different.

Next, we estimated the ideal supply. Teams working in each of the participating primary care facilities estimated by consensus the amount of time used and time required for performing each of the 99 activities. The age and sex of the individuals were very important, because the package of prevention and health promotion has different annual frequencies and different number of activities whether the subject is a child, adolescent, adult, elderly, man, or woman. Estimation of time used and required by activity according to age and sex was multiplied by the total number of individuals who received care in PHFs in 2009. Then, we added up these figures to obtain the total of annual hours from time used and time required to obtain two variables of ideal supply, one estimated from time used and another from time required. The available and ideal supply estimations were made under the assumption that all personnel at each facility spent all their working time to perform health promotion and prevention services.

Fourth, we calculated available and ideal supply by age groups, personnel type, and rural/urban areas and information is presented using descriptive statistics. To compare similarities and differences, we used median differences (Table 2) as the distribution of data was not normal. The null hypothesis was that the median of available supply is equal to the median of ideal supply (time used and required). We used the Wilcoxon matched-pairs signed-ranks test to compare available supply with ideal supply (available supply with ideal supply estimated from time used or available supply with ideal supply estimated
| Age group                   | Number of prevention and health promotion activities | Total of population attended in PHFs | Median of time used by individual per year (min) | Median of time required by individual per year (min) | Differences |
|-----------------------------|------------------------------------------------------|-------------------------------------|--------------------------------------------------|-----------------------------------------------------|-------------|
|                             |                                                      |                                     | Physician (a1) Nurse (a2) HP (a3)                | Physician (b1) Nurse (b2) HP (b3)                   | a1 − b1     |
| Newborns                    | 10                                                   | 5 601                               | 55.50 24.00 27.00 5.00                          | 9000 41.00 43.50 10.00                              | −34.50      |
| Children under 5 years      | 10                                                   | 41 094                              | 61.50 13.50 33.50 15.50                          | 9400 20.00 46.00 22.50                              | −32.50      |
| Children from 5 to 9 years  | 10                                                   | 24 661                              | 71.00 30.00 20.00 14.00                          | 9450 40.00 30.00 22.50                              | −23.50      |
| Teen from 10 to 19 years    | 10                                                   | 50 508                              | 97.50 60.00 17.50 27.50                          | 13100 77.50 25.00 35.00                             | −33.50      |
| Women from 20 to 59 years   | 11                                                   | 76 839                              | 97.50 40.00 25.00 35.00                          | 16540 57.50 37.50 76.50                             | −67.90      |
| Men from 20 to 59 years     | 11                                                   | 39 459                              | 83.50 37.50 32.50 25.00                          | 15250 51.50 30.00 62.50                             | −69.00      |
| Women and men over 60 years | 10                                                   | 16 591                              | 100.00 52.50 39.50 15.00                          | 16250 70.00 72.50 20.00                             | −62.50      |
| Pregnant women              |                                                      |                                     |                                                  |                                                    |             |
| First visit                 | 10                                                   | 7 610                               | 61.50 46.00 10.00 5.00                            | 8550 67.00 10.00 9.00                               | −24.00      |
| Subsequent visit            | 7                                                    | 5 076                               | 46.50 36.50 10.00 0.00                            | 5850 47.00 10.00 0.00                               | −12.00      |
| Postnatal care              | 10                                                   | 1 483                               | 58.50 27.50 35.00 0.00                            | 9150 37.00 50.00 0.00                               | −33.00      |
| All groups                  | 99                                                   | 268 527                             | 73.00 40.00 25.00 22.00                          | 10500 51.00 35.00 30.00                             | −32.00      |
from time required). Friedman test was used to compare available and ideal supply estimated from used time and ideal supply estimated from time required. Our samples are non-independent (time estimates come from the same teams); these tests account for dependence of the estimates [26]. After, we estimated available and ideal supply into number of human resources (annual hours estimated were divided by 1200 working hours per health worker per year).

Finally, we conducted a sensitivity analysis to test whether the non-normal distribution of our time data biased our estimates of available and ideal supply of human resources. We used the gamma density function (Table 3) because of the non-normal distribution of the variables and tested the following assumptions: (a) asymmetrical distribution, (b) positive asymmetry, (c) no values lower than zero, and (d) the existence of a high degree of variability. We estimated alpha, the peak of the frequency distribution. A smaller alpha value indicates more highly skewed data, with variation so great as to render the median not useful as a method to summarize the distribution. No data were found to have an alpha <1.33, which indicates that our use of the gamma distribution fit our data and the median is a valid way to summarize our data.

Results

Of the 20 PHFs, 60% (12) were located in an urban area and 40% (8) in a rural one. A total of 866 health workers were working on PHFs, 57% (CI 53–60; n = 489) delivered health services and 43% (CI 40–47; n = 377) worked as administrative staff. Of the workers who delivered health services, 45% (CI 41–50; n = 220) were nurses; 36% (32–40; n = 176) physicians; 8% (CI 06–11; n = 39) health promoters; 3% (CI 2–5; n = 15) nutritionists, psychologists, or social workers; and 8% (CI 6–11; n = 39) dentists or medical students in social service. The total population that received care in PHFs in 2009 accounted for 268,527 individuals, 87% (n = 233,618) received care in urban and 13% (n = 34,909) in rural PHFs.

The median of time used to deliver all activities from the guaranteed package of prevention and health promotion per year by individuals across age and gender groups was lower than the median of time required; a difference of –32 min was observed between them (Table 2). In the case of physicians, the median difference between time used and required was –11 min; for nurses, –10 min; and for primary health technicians (PHTs), –8 min. These results show that the time used is lower than the time required to perform prevention and health promotion activities across all age groups and occupational categories.

By age, the largest gaps between time used and time required were observed for women and men from 20 to 59 and women and men over 60 years; the difference was more than 1 h. For newborns, children from 1 to 4 years, teens from 10 to 19 years, and postpartum women, the difference was almost 30 min. Differences lower than 24 min were observed for children of 5–9 years and subsequent queries of pregnant women (Table 2).

The analysis of available and ideal supply by occupational categories using the Friedman chi-square test suggests the distributions (Table 4) of these variables for physicians are statistically different (Friedman P = 0.001). The Wilcoxon test that compared available supply with ideal supply estimated by time used (P = 0.003) and time required (P = 0.002) is statistically significant. Therefore, the negative outcome difference confirms that available supply is lower than ideal supply.

The supply analysis for nurses (Table 4) suggests that available and ideal supply are different (Friedman P = 0.0001), but the Wilcoxon test shows that available and ideal supply estimated by time used (P = 0.252) are not different. Available supply is lower than ideal supply estimated by time required (P = 0.019). No differences were found in nurse supply when analyzed by urban and rural PHFs (P > 0.05).

The supply analysis for health promoters (Table 4) suggests that available supply and ideal supply are different (Friedman P = 0.0167). The Wilcoxon test that compares available with ideal supply estimated by time used (P = 0.0001) and ideal supply estimated by time required (P = 0.0001) shows differences between them. Also, available with ideal supply estimates by time used and required (P = 0.0022) are different in urban PHFs. Therefore, available supply is lower than ideal supply and no differences on HP supply were found in rural PHFs (P > 0.05).

For health workers, the median of available supply across PHFs was 5 physicians, the median of ideal supply estimated by time used was 10.4, and the median estimated by time required was 13.76 physicians (Table 5). Results show that the ideal supply of physicians is greater than the available supply for urban and rural PHFs. However, the gap of physicians is greater for urban PHFs. In the case of the nurses, we did not find any differences between available and ideal supply.

In the case of health promoters, the median of the available supply was “zero”; only in two PHFs were these health workers found. The ideal supply in urban PHFs is
| Variables | Physician Available supply (As) | Physician Ideal supply (Is) | Annual hours estimated time available 2009 (a) | Annual hours estimated time used (a1) | Annual hours estimated time required (a2) | Nurses Available supply (As) | Nurses Ideal supply (Is) | Annual hours estimated time available 2009 (b) | Annual hours estimated time used (b1) | Annual hours estimated time required (b2) | Health promoters Available supply (As) | Health promoters Ideal supply (Is) | Annual hours estimated time available 2009 (c) | Annual hours estimated time used (c1) | Annual hours estimated time required (c2) |
|-----------|-------------------------------|-------------------------------|-----------------------------------------------|--------------------------------------|---------------------------------------------|-------------------------------|-------------------------------|-----------------------------------------------|--------------------------------------|---------------------------------------------|--------------------------------|-------------------------------|-----------------------------------------------|--------------------------------------|---------------------------------------------|
| **Urban PHFs (n = 12)** | | | | | | | | | | | | | | | |
| Total hours | 141 600 | 373 462.6 | 562 069.7 | 220 800 | 231 150.6 | 332 150.6 | 27 600 | 243 449.9 | 406 915.0 | | | | | |
| Median (h) | 12 000 | 22 624.2 | 35 876.9 | 17 400 | 12 654.8 | 21 913.9 | 0 | 16 749.0 | 32 658.9 | | | | | |
| As – Is | −10 624.2 | −23 876.9 | | 4 475.3 | 4 513.9 | | −16 749.0 | −32 658.9 | | | | | | |
| Wilcoxon (P value) | 0.0029 | 0.002 3 | | 0.209 4* | 0.099 5* | | | | | | | | | |
| Friedman (P value) | 0.001 3 | | | | | | | | | | | | | | |
| **Rural PHFs (n = 8)** | | | | | | | | | | | | | | | |
| Total hours | 30 000 | 628 853.6 | 84 632.2 | 38 400 | 40 127.2 | 57 173.1 | 1 200 | 35 627.8 | 52 308.2 | | | | | |
| Median | 1 800 | 4 079.7 | 5 460.1 | 1 200 | 2 173.6 | 3 182.4 | 0 | 2 151.3 | 3 714.2 | | | | | |
| As – Is | −2 279.7 | −3 660.1 | | −973.6 | −1 982.4 | | −2 151.3 | −3 714.2 | | | | | | |
| Wilcoxon (P value) | 0.049 9 | 0.017 3 | | NA | NA | | NA | NA | | | | | | |
| Friedman (P value) | 0.026 2 | | | 0.083 7* | | | | | | | | | | |
| **Total PHFs (n = 20)** | | | | | | | | | | | | | | | |
| Total hours | 171 600 | 436 316.2 | 646 701.9 | 259 200 | 271 545.6 | 389 393.7 | 28 800 | 279 077.7 | 459 223.2 | | | | | |
| Median | 6 000 | 12 478.5 | 16 510.6 | 10 800 | 7 904.6 | 11 321.3 | 0 | 7 220.7 | 9 252 | | | | | |
| As – Is | −6 478.5 | −10 510.6 | | 2 895.4 | −521.3 | | −7 220.7 | −9 252 | | | | | | |
| Wilcoxon (P value) | 0.000 4 | 0.000 1 | | 0.262 7* | 0.018 7 | | 0.000 1 | 0.000 1 | | | | | | |
| Friedman (P value) | 0.000 | | | 0.000 1 | | | | | | | | | | |

* = <0.005
9.96 HP when it was estimated by time used and 27.22 HP when it was estimated by time required. We did not estimate health promoters for rural PHFs because the available supply is the same with the ideal supply (Table 4).

Discussion
Our results show that available supply is lower than ideal supply of HR meaning that the amount of HR available is not enough [27] to deliver preventive and health promotion services. However, the real scenario is likely worse, because this study assumed that health personnel are dedicated exclusively to performing activities to deliver the package of prevention and health promotion services, but in reality, they use only part of their time for this service provision. The gap of physicians in urban and rural PHFs [28] is clear but it is important to highlight that it is far greater in urban areas than in rural ones. The larger gap observed in urban areas compared to rural areas can be explained by a higher demand of services due to population density, the fact that services are available more hours a day (12 in urban areas compared to 6 in rural areas) and over weekends [29], implying a greater demand for HR [30]. This highlights the importance of considering demand for services as well as the volume of the catchment population as a criterion when distributing HR for health.

Internationally, the lack of human resources in primary care facilities has been widely documented [31–34], especially on medical staff and rural areas [35, 36]. The absence of prioritization of policies for prevention and health promotion is one possible explanation for this misdistribution of human resources [37]. Despite the transformation of health service demand, dominated today by

| Table 5 Available and ideal supply expressed on number of doctors and primary health promoters. Mexico, 2009 |
|---------------------------------|-----------------|-----------------|-----------------|-----------------|
| Primary health facilities       | Number of doctors | Ideal supply    | Number of health promoters | Ideal supply    |
|                                | Available supply | Time used | Time required | Available supply | Time used | Time required |
| Urban PHFs                      |                 |            |              |                 |            |              |
| Tapalpa                         | 6.0             | 5.5       | 8.7          | 0.0             | 4.0       | 6.2          |
| Jesus Rosal                     | 11.0            | 60.6      | 108.9        | 0.0             | 37.3      | 65.7         |
| Satellite                       | 2.0             | 3.2       | 4.7          | 0.0             | 1.3       | 2.4          |
| Coapa                           | 10.0            | 11.1      | 16.1         | 0.0             | 6.6       | 8.3          |
| GR. Millan                      | 10.0            | 15.3      | 29.5         | 0.0             | 6.8       | 13.3         |
| Zacatecas                       | 10.0            | 24.8      | 30.3         | 0.0             | 14.0      | 27.1         |
| W. Escalante                    | 10.0            | 24.3      | 36.0         | 0.0             | 17.5      | 27.3         |
| Industrial                      | 13.0            | 43.2      | 48.4         | 0.0             | 25.3      | 35.0         |
| Rena II                         | 3.0             | 4.8       | 6.1          | 0.0             | 3.1       | 6.5          |
| Pedro Escobedo                  | 23.0            | 81.0      | 119.9        | 1.0             | 55.2      | 79.8         |
| Toluca                          | 16.0            | 22.4      | 33.4         | 9.0             | 17.8      | 36.7         |
| San Rafael                      | 4.0             | 13.0      | 26.3         | 13.0            | 13.9      | 30.9         |
| Median                          | 10.0            | 18.9      | 29.9         | 0.0             | 14.0      | 27.2         |
| Rural PHFs                      |                 |            |              |                 |            |              |
| Juanacatlan                     | 2.0             | 9.7       | 11.4         |                |            |              |
| Mineral Chico                   | 3.0             | 6.8       | 10.5         |                |            |              |
| Cuentepec                       | 4.0             | 2.0       | 2.9          |                |            |              |
| Sta Elena                       | 1.0             | 2.1       | 2.2          |                |            |              |
| Koben                           | 1.0             | 1.4       | 2.6          |                |            |              |
| G. Victoria                     | 12.0            | 23.6      | 31.8         |                |            |              |
| R02 Kilometro 30                | 1.0             | 4.3       | 5.2          |                |            |              |
| P. Coyote                       | 1.0             | 2.5       | 3.9          |                |            |              |
| Median                          | 1.5             | 3.4       | 4.6          |                |            |              |
| General median PHF              | 5.0             | 10.4      | 13.8         |                |            |              |
chronic diseases [38, 39], in developed and developing countries, health promotion has not yet been properly included in national and local agendas.

Furthermore, international literature has explained the low availability of physicians in rural areas because of attractive job opportunities outside their home country, the lack of professional development [40, 41], the inequalities in the distribution of health workers [42], and a persistent lack of policy to prioritize the distribution of HR to rural areas [43]. On the other hand, physicians have historically expressed low interest to work in rural areas. For example, in Ayacucho, Peru, physicians are five times more likely to choose an urban area than a rural one [44]. In the United States of America, poor recruitment is likely to be the principal reason for short length of stay in rural areas [45], and in Canada, low salary is the main determinant [46].

Based on this trend, international agencies have called for the strengthening of the primary health care model [40, 47]. This model should be centered in health promotion and preventive services [39–48] and needs not only more [42–49] but also well-trained health personnel and the right skill mix [50] to deliver preventive and health promotion services. Therefore, governments should develop strategies and policies for health personnel retention in PHFs [46, 51, 52], which is one of the biggest challenges of health systems.

In the area where this research was conducted, PHF health promoters were not available. This absence can be explained because hiring of these personnel has remained stagnant in recent years. Those who are retired are being replaced by administrative staff. This situation intensifies the lack of this kind of personnel to deliver prevention and health promotion services in PHFs.

One of the limitations of this study is self-reported time team consensus measurements. We were unable to accurately calculate time to perform prevention and promotion activities and thus chose to assume that 100% of time of health workers was dedicated to such activities. This means that our results are likely biased towards the null (no) difference between available and ideal supply since personnel also devote time to curative and administrative activities on PHFs. The Ministry of Health of Mexico should consider to revise the structure of its databases to provide more accurate data that maybe used for research and policy-making purposes.

**Conclusions**

Based on a conservative analysis, we used data from teams of health care providers and conservative estimates to identify a gap in the current/available and ideal supply of physicians in urban and rural areas, and health promoters in urban areas to deliver a package of prevention and health promotion services. To improve service delivery, several things are needed: (1) an increase of the HR at the PHFs, (2) ensuring complete staff at the PHFs (physicians, nurses, and health promoters), (3) improving their set of skills about prevention and health promotion, and (4) developing policies to retain personnel at PHFs.

**Abbreviations**

- As: Available supply; CAUSES: Package of care interventions; HR: Human resources; Is: Ideal supply; PHC: Primary health care; PHFs: Primary health facilities; PHTs: Primary health technicians; REPSS: Health Social Protection Regime; SPS: Public health insurance (Seguro Popular de Salud); WHD: World Health Organization

**Acknowledgements**

The authors would like to thank the staff of primary health facilities and personnel that participated in this study.

**Funding**

TB was supported by the Alexander von Humboldt Foundation through the Alexander von Humboldt Professor award, funded by the Federal Ministry of Education and Research; the Wellcome Trust; the European Commission; the Clinton Health Access Initiative; and from NICHD of NIH (R01-HD084233), NIA of NIH (P01-AG041710), NIAID of NIH (R01-AI124389 and R01-AI112339) as well as FIC of NIH (D43-TW009775).

**Availability of data and materials**

Data is available for further review on request.

**Authors’ contributions**

JA, GN, and TB contributed to the conceptual design and development of the study, including the development the instruments. EV supported the approach to the data analysis with the leadership of JA on the focus of analysis and interpretation. BD checked the internal coherence to report results. All authors contributed to writing and revising the manuscript, and all authors reviewed and approved the final revised version.

**Ethics approval and consent to participate**

The Ethical Committee of the National Institute of Public Health (Mexico) approved the proposal “Analysis of the HR requirement that take part in delivering health prevention and promotion services within the Popular Health Insurance” with date July 27, 2010.

**Consent for publication**

Not applicable.

**Competing interests**

The authors declare that they have no competing interests.

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