Summary of methods used to assess fairness distribution of hospital-based physician.

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| **No** | **Method** | **Brief Description** | **Advantages** | **Limitation** |
| 1. | Gini coefficient and Lorenz curve | A measure of income distribution across a population, expressed as a number between 0 (perfect equality) and 1 (perfect inequality). Assumption is that there are classes with higher and lower balances. Ordering balances on the horizontal axis and the cumulative sum of these balances gives a Lorenz curve. | 1. Generally regarded as gold standard in economic work. 2. Incorporates all data. 3. Allows direct comparison between units with different size population. 4. Attractive intuitive interpretation. | 1. Requires comprehensive individual level data. 2. Requires more sophisticated computations. 3. Can only reflect the overall difference but not the fairness within the studied population/ region. |
| 2. | Theil Index | Measure of relative inequality in cases where there is no natural ordering among population subgroups. When there is no inequality, Theil index is 0. | 1. Based on the informational entropy calculation. It comes from the fact that the entropy metric is low when all balances are equal, and high, when they are very different. 2. Well reflect the contribution of intra-group gaps and inter-group gaps to the total gap, and is complementary to the Gini coefficient. |  |
| 3. | Concentration Index | A relative measure of inequality that indicates the extent to which a health indicator is concentrated among the disadvantaged or the advantaged.  Given that a population is ranked by increasing socioeconomic status:   * Concentration index has a negative value when the health indicator is concentrated among the disadvantaged. * Concentration index has a positive value when the health indicator is concentrated among the advantaged. * When there is no inequality the concentration index equals 0. |  | 1. The primary limitation of Concentration Index is that it can only be applied if a strict ranking socio-economic variable, like income, is available. 2. Missing income data can bias the value of Concentration Index. |
| 4. | Robin-Hood Index | The portion of the total community income that would have to be redistributed (taken from the richer half of the population and given to the poorer half) for the society to live in perfect equality. Measure of income inequality ranging from 0 (complete equality) to 100 (complete inequality). | Result from Robin Hood index is easier to understand compare with Lorenz curve and Gini coefficient outcome. |  |
| 5. | Spatial autocorrelation analysis | Used geographical mapping to indicate health facilities in studied population. |  | 1. Difficult to determine exact longitude and latitude location of health facilities or physician to be used on map. 2. Need to use complex, costly device to identify exact longitude and latitude of location. |
| 6. | Workload Indicator of Staffing Need (WISN) method | Based on a health worker's workload, with activity (time) standards applied for each workload component. | Traditional ways to determine staffing requirements to set:  (1) Population to staff ratio, (2) Facility based staffing standards. | 1. Not considering both wide local variations in the demand for services. 2. Fail to work what health workers actually do. |
| 7. | Mixed integer linear programming | Often used for system analysis and optimization as it presents a flexible and powerful method for solving large, complex problems such as the case with industrial symbiosis and process integration | 1. Modifications of the mathematical solutions is possible. 2. Can show best use of manpower. | 1. No guarantee of getting integer-valued solutions. 2. Uncertainty and time effects are not considered. 3. Large-scale problems cannot always be solved. |
| 8 | Cohort-component model | The cohort component technique uses the components of demographic change to project population growth. | 1. The model follows the process of demographic change. 2. Is viewed as a more reliable projection method than those that primarily rely on census data or information that reflects population change. 3. It also provides the type of information needed to plan for services to meet the future demands of different segments of the population. | 1. It is highly dependent on reliable birth, death, and migration data. Thus, it may be difficult to collect the information to apply this tool. 2. This model assumes that survival and birth rate and estimates of net migration will remain the same throughout the projection period. 3. Does not consider the non-demographic factors that influence population growth or decline. |