When defining workload components, broader activities were split into distinct steps, so that their timing can be better assessed. For example, in defining an intervention such as "providing services for a pregnant woman in the antenatal clinic", the service activities were disaggregated as documentation, taking anthropometric measurements, conducting tests, assisting medical examination, giving tetanus injections, and issuing supplies and further instructions.

A consultative workshop was carried out to further refine the list of interventions and operational guidelines documented during the desk review. A group of MOHs, PHNS, and PHMs participated in this workshop. A list of activities and guidelines prepared were given to participants for the review. They were requested to find out whether any activities are missing, and the guidelines are compatible. Around 37 workload components were identified to be implemented by PHMs during these procedures.

Determination of the total workload

Workload is defined as the total number of various interventions to be implemented by PHMs around the country, annually assuming universal coverage (100%). One Health Tool (OHT) Software (4) was used to assess the annual number of interventions that were based on the respective target populations, population in need and service coverages. We identified the target population and population in need (the percentage of target population eligible for the intervention) for each of the interventions defined in this study based on program guidelines and set the service coverages at 100% to reflect universal coverage. For example, to estimate the number of vaccination visits to be attended by PHMs for under 5 children in the country, we have used the "number of infants surviving the first month", which is generated within OHT based on the country statistics as the target population. The population in need was stipulated as 900% as 9 injection visits are included in the National Immunization Schedule for under 5 children. The coverage was assumed to be 100%. The OHT was used to calculate the annual number of immunization visits by multiplying these parameters. Annual numbers of all types if interventions were calculated in the OHT using appropriate parameters. The final sum of all such interventions was considered as the national workload to be covered by PHMs.

Defining the activity standards for interventions and supporting activities

Activity standard is the time necessary for a well-trained, skilled and motivated PHM to perform a direct patient-oriented intervention to the professional standards in a local field setting. In addition, the time required for support activities and additional activities were determined. Support activities mean the activities conducted by all the PHMs that support the efficient program functions. Number of such activities are not directly based on the number of recipients. For example, one-hour office time used for record keeping, which is used by all PHMs can be considered as a support activity. Additional activities are also activities that are having a facilitative function to service provision but performed by only a selected number of PHMs. For example, clinic preparation was considered an additional activity as it was only performed by the PHMs responsible for a clinic.

Activity standards i.e. the average time required for conducting all types of workload components determined during the previous steps, were assessed using a time motion study. In the time motion study, we observed the performance times of 277 PHMs who were selected using a multi-stage random cluster sampling method, from 16 MOH areas selected from four provincial health directorates in Sri Lanka (5). The parameters used for sample size calculation included the expected population standard deviation of 3 minutes (considering the range of 12 minutes of activity time based on the practical experience of stakeholders), t-distribution, total PHM population size of 6000 and a design effect of 2.

Time taken to perform all interventions by the PHMs was observed by the supervising staff. The performing of interventions was preceded by a brief explanation of the study objectives and on the standard protocols of each intervention by

supervising officers. Average of the performing time was used as the parameter for calculating the standard workload.

Assessing available work time

Available work time was assessed by deducting leave and training days from the annual working time of the PHMs. PHMs are having 7 hours work per day. Half of the casual, vacation leave and annual public holidays were considered as non-working time. Another 2 days per month were excluded as training and monthly conference days. After adjusting for these, 213 days were found to be available as the annual available work time of a PHM.

Use of WISN software to assess the staffing needs

The WISN Software was used to calculate the standard workload of direct patient-oriented service interventions, support and additional activities, and staffing requirements. A standard workload is the number of interventions a single health worker can perform within a year, provided she is only implementing that intervention. The data input required for these calculations included: available working time, annual number of interventions and service standards (average time required) for each intervention.

Data analysis

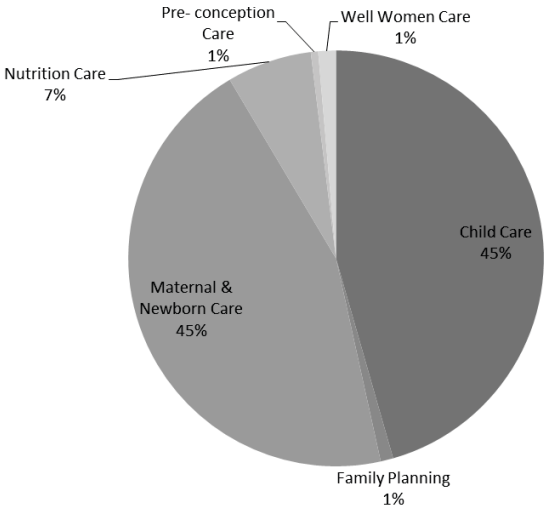
Once these inputs are made, the WISN calculates the standard workload of the intervention. The staffing requirements (full time equivalents-FTE) to perform each of the intervention are calculated by dividing the annual number of interventions to be carried out by the standard workload. The sum of this staffing requirements (for each activity) has to be further adjusted to the staff FTE requirements related to supporting activities and additional activities. WISN calculates the support FTE based on the percentage of total work time available per PHM. This is used for the support activities, which is also known as the Category Allowance Factor (CAF). The FTE calculated for interventions is inflated by a factor of CAF to get the number of PHM FTEs required for service interventions and supporting activities. The FTE required for additional FTE are calculated as additional FTEs required for attending to additional activities. This is also known as Individual Allowance Factor (IAF). The final total staff requirements were calculated by adding IAF to the PHM FTEs required for service interventions and supporting activities. Calculation of the PHM WISN (FTE) can be summarized as follows:

PHM WISN (FTE)= {[(FTE required to perform service interventions) * CAF] + IAF}

Results

The workload of PHMs based on existing guidelines

Figure 1 presents the percentage distribution of PHMs required for performing various interventions related to maternal and new-born care, childcare (child development and other early childcare interventions), nutrition, Immunization, other childcare, family planning, well women care and pre-marital care program areas. These values were derived by finding out the FTE required for performing all the interventions belonging to different program areas and comparing their relative sizes. However, these time requirements do not include supporting and additional activity times.



The analysis of time requirements of various program related interventions indicated that the major share of PHMs' time is utilized by maternal and new-born

(45%) and childcare programs (45%). Exclusively, nutrition activities conducted in the field consumed around 7% of the FTE. Other care services i.e. family planning, well women clinic and pre-conceptional care are attributed to relatively smaller proportion of PHM time.

Staffing needs

WISN analysis found that based on the current program guidelines and assumed 100% coverage of all target populations in need, the country will be requiring 11,622 PHMs. The estimated requirement of 11,612 reflects the staff required for implementing direct patient-oriented interventions, support activities and additional activities.

As there are only 7087 field PHMs in the system, this gives rise to a PHM staff gap of 4525 in relation to the work demand created by the existing programs. The WISN ratio, which is the ratio of existing staff to calculated staff requirement will be around 0.61, indicating a fairly significant staff gap at national level.

Table 1 presents the WISNs by provinces in Sri Lanka. The analysis shows that Western Province is having the largest staffing shortages compared to other provinces. The WISN ratio of Western Province is reported as 0.4, indicating that the province has only 40% of its estimated requirement. The national average of WISN is 0.61, while the Eastern and Uva Provinces seem to have around 80% of their required PHM cadre based on the estimated requirement.

Table 1: Workload indicator staffing needs by provinces

Province	Calculated PHM requirement	WISN ratio	Number needed to be newly employed to meet the demand
Western	3267	0.40	1954
Central	1475	0.72	413
Southern	1414	0.62	531
North Western	1358	0.55	606
North Central	734	0.66	250
Northern	610	0.82	107
Eastern	923	0.85	135
Uva	735	0.82	131
Sabaragamuwa	1096	0.64	398
National	**11612**	**0.61**	**4525**

PHM population ratio based on the calculated requirements

The current national norms for PHM employment require one PHM per 3000 population. However, findings of this study show that at least one PHM is required per 1878 population (21,803,000/11,612) to meet the current service demands.

Discussion

Sri Lanka needs to increase the number of PHMs by 64% to meet the current needs. Unfortunately, whether the current health system is able to train the required number in the short run is a serious concern. On the other hand, with the existing number of field PHMs (n=7087), it would be a near- impossible task to provide the services expected from them.

The total training duration of PHMs is 18 months in Sri Lanka. Basic training of one-year duration is carried out at the Nursing Training schools situated in all provinces of the country. Considering all training schools, the maximum total training capacity is about 800 per batch (6). However, the production of PHM has been around 400 per year over the last six years (7). Even if we totally disregard the retirement and

attrition, it would still take around 11 years to produce the number needed to satisfy the current service needs.

The main limiting factor for the reduced intake of trainees is lack of qualified applicants. At present, to be selected to follow the PHMs course, the candidate should be aged 18-30 years at the time of commencement of the training, all candidates should be unmarried females with a minimum height of 4 feet and 10 inches. They should have passed GCE Advance level Examination in Bio Science Stream, with minimum of 3 simples passes. Candidates should obtain four credit passes and pass in six subjects including English at the GCE Ordinary Level examination in not more than 2 sittings.

It is timely for authorities to change the entry requirements for PHMs, in order to increase the intake of PHMs. The Ministry of Health should take steps to train at least 1000 PHM per year for a foreseeable period until the target amount is met. In order to achieve this objective, the training facility should be expanded, and the recruitment criteria changed. One possible approach would be to select from any stream at GCE Advanced Level examination. In the recent past, this approach had been adopted for certain districts/provinces in an ad hoc manner, through cabinet papers.

Recruitment of applicants from any GCE Advanced Level stream should be expanded to the entire country and continued as a policy. The Ministry of Health is currently discussing this issue with the Public Service Commission in order to change the scheme of requirement (SOR). However, the science stream students may be given first preference.

Conclusions and Recommendations

Over the years, PHMs had been considered as the backbone of the enriched primary care system of the country. However, at present there is a dearth of field PHMs in Sri Lanka. Current service requirement is one PHM for 1878 population. Hence, the country needs to have around 4500 more field PHMs. Therefore, immediate steps should be taken to increase the number of field PHMs in the country in order to provide an optimum primary health care service.

Public Health Implications

This study describes a scientific workload analysis related to field public health midwives (PHMs). It highlights the number of PHMs needed for the country and the current shortage. This would be an eye opener to health planners to explore all possibilities of training more PHMs.

Author Declarations

Competing interests: The authors declare that they have no competing interests.

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