

# Estimating of the required midwife in maternity ward in hospital using Workload Indicator of Staffing Need Method

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## Research

**Keywords:** Workload Indicator of Staffing Need, Midwife, Hospital, Workforce

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# Abstract

**Background:** Human resources are considered as a major component of the health sector. The aim of this study was to estimate the number of midwives required in maternity wards in hospitals by using WISN method.

**Methods and Materials:** This cross-sectional descriptive study was conducted in three hospitals affiliated to Mashhad University of Medical Sciences in Iran in 2019. The workload and the standard working time were determined through holding expert meetings; available working time was determined through holding meetings with personnel affairs experts and the actual workload was determined based on information management system and information registries. Microsoft Excel and stata were used to analyze data.

**Results:** 10 factors related to midwives' available working time were identified. Annual available working time for midwives in the studied hospitals was 1378 hours per year. In this study, labor, delivery, recovery and postpartum, recovery after cesarean care and new born cardiopulmonary resuscitation (CPR) were identified as the main activities of midwives. The results have shown that the Centre hospital and the educational hospital faced with 2 and 13 midwives shortage, respectively, while the non-educational hospital had 2 surplus midwives.

**Conclusion:** workforce recruitment has a significant role in the hospitals  
**Keywords:** Workload Indicator of Staffing Need, Midwife, Hospital, Workforce

## Background

Adequate staffing in the hospitals is one of the most important factors that can play a significant role in providing timely and high-quality care. (1). Therefore, estimating the number of workforce required in a hospital is one of the main tasks of HR management that is implemented as part of the HR planning process(2). Lack of attention to HR planning can lead to many problems such as shortage or surplus of workforce, unfair distribution of workforce, inappropriate use of staff, unproductive and unmotivated employees, etc.(3,4). The main task in HR planning is to estimate and determine the number of required workforce. The Workload Indicators of Staffing Need (WISN) method is a human resources management tool that has been developed by WHO. The WISN method is based on a health workforce's workload, with activity time standards applied for each workload component. This method has been tested and verified as a reasonable way for determining how many health workforces of a particular type are required to cope with the workload of a given health facility and assessing the workload pressure of health workforces in that facility. The WISN method is designed in a way that simplifies HR planning process; so the simplicity of this method has made it attractive and comprehensible to users (5). Numerous studies have been conducted to estimate the required workforce in the health sector (6) that indicated the easiness, acceptability and applicability of this method. In Iran, this method has also been used to

estimate the required nursing force in educational hospitals(7), but according to the investigations, no studies have been conducted to estimate the number of required midwives based on the WISN method.

Midwives represent the largest group of health professionals in the health system(8). they are one of the most important staff in a hospital that are trained to care for the pregnant women as a vulnerable group. They also play a significant role in improving maternal and newborn health and providing and promoting high-quality health care and accurate information for patients. According to statistics, more than half a million people die each year from pregnancy and labor complications, and almost all of them (99%) occur in developing countries. Nowadays, maternal health is considered not only as a health indicator, but as a development index and one of the Millennium Development Goals(9). Providing, maintaining and promoting the health of pregnant mothers is one of the national priorities in Iran. Since midwives play an important role in improving maternal health indicators, it is of particular importance to supply enough midwifery workforce in hospitals(10). On the other hand, one of the major themes of the health sector evolution plan that has been implemented by the Ministry of Health and Medical education in eight axes since 2014, was the promotion of natural childbirth plan, which is in line with the Fifth Development Plan of the country to improve maternal health and reduce child mortality. Studies show that the implementation of this program has led to a decrease in cesarean section and an increase in natural childbirth in most Iranian hospitals, indicating an increased demand for natural childbirth in pregnant women which is resulted in increased workload of midwives (11). It should be noted that one of the specific goals of the sector evolution plan was to increase maternal satisfaction(12), which in our country, despite increasing mothers' access to childbirth services as well as the reduction of crude births from 18,000 to 16,000, the pattern of mortality remains unchanged and there seems to be insufficient emphasis on quality of services (13). Certainly, the disproportionate number of midwives in comparison to pregnant mothers reduces the quality of maternity care. Therefore, the purpose of this study was to estimate and determine the number of required midwives by using Workload Indicators of Staffing Need (WISN) method in three hospitals (Centre, Educational and non-educational) affiliated to Mashhad University of Medical Sciences in Iran.

## **Methods**

### **Study Design And Setting**

This descriptive cross-sectional study was performed in three selected hospitals affiliated to Mashhad University of Medical Sciences in 2019. The study setting, Ghaem Hospital as a Centre Hospital, has 980 active beds that accommodates the obstetrician-gynecologist's patients in the northeast of the country using the most advanced equipment and the most skilled medical staff. The Specialized Gynecology and Obstetrics Hospital Umm al-Banin had 136 active beds has been selected as a teaching hospital and Shariati Hospital with 155 active beds has been selected as a non-teaching hospital.

### **Study Population**

The study population consisted of all full-time midwives working in the studied hospitals.

## Data Collection Tools

In this study, the Workload Indicators of Staffing Need (WISN) method has been used for estimating the required workforce.

## Data Collection

Holding experts working groups and observation methods were used to determine the components of workload (main, supportive and additional activities) as well as initial standard time. work study was used to verify the standard time of the main activities and was performed by three trained midwives. To eliminate the time factor, work study was performed three days a week (Saturday, Monday, and Tuesday) in three different shifts; it was repeated three times for each main activity. To determine the available working time, we have interviewed with aware experts such as midwifery experts, staffing personnel in the selected hospitals and HR planning expert in the MUMS, and studying the rules and regulations related to the midwives attendance in the hospitals (i.e. rule of productivity promotion and administrative code of employment of non-academic Staff), as well as checking the personnel system information. management Information system and information registries were used to determine the actual workload.

To ensure the validity and reliability of the results, since experienced midwives are fully aware of the activities and duties of midwifery, it was decided to interview with the experienced midwives (with at least ten years of working experience) during the expert working groups meetings. In this case inclusion criteria were: 1) at least ten years of useful working experience in the maternity ward and 2) interesting in participating in the study. Based on the above criteria, the expert working group meetings consisted of 10 midwives (three midwives of selected hospitals, three midwives of Vice-chancellery of Treatment, three experienced midwives from each hospital selected by the head of the university midwifery department, and one experienced midwife who is a faculty member as a facilitator and a research fellow).

Before meetings, in order to introduce the process to the members a workshop had organized by the corresponding author and all questions and ambiguities were answered.

## The WISN Method

The WHO's WISN was used to compute the midwives excesses or shortages at the hospitals. This method consists of 7 steps(6):

1) Estimating the available working time, which is the period of time that is available for a healthcare provider within a year. The available working time is calculated as follows:

$$AWT = [A - (B + C + D + E)] \times F$$

Where A is the total number of working day in a year, B is the number of holidays per year, C is the number of annual paid leaves, D is the number of sick leaves, E is the other times that is taken off because of different reasons such as vacations and F is the total working hours per a normal day.

2) Identifying the workload components which include main, supportive and additional activities. These activities form an employee's working hours per a day. The main activities are the activities performed by all the employees of the department and for which there are annual statistics. Supportive activities are performed by all employees but there are no specific statistics for them, and additional activities are performed by a certain number of employees and there are no annual statistics for them.

3) Defining activity standards, which is the whole time that a trained, skilled and motivated employee spend on performing an activity based on the professional standards. There are two types of activity standards: the service standard and the allowance standard.

Service standards are a set of occupational health care activities that are expressed in two ways. The first is the "time unit", which is the average time an employee needs to perform the activity. The second is the "work rate", which is the average number of activities performed over a specific period of time.

There are generally two allowance standards. The category allowance standard for supportive activities which is set by all members of a business group. The individual allowance standard is the amount of time that a certain number of members of a business group spend on additional activities.

4) Calculating workload standard, which represents the number of healthcare working units for primary care that each employee can perform annually. The standard workload is set for each workload component. To calculate the standard workload, it is assumed that a health workforce dedicates all of his annual working time to a workload component.

The formula for calculating the standard workload depends on whether the service standard is expressed as a unit of time or in terms of work rates. When the service standard is expressed as a unit of time, the standard workload is calculated as follow:

Standard workload = AWT in a year divided by unit time

When the service standard is expressed in terms of work rates, the standard workload is:

Standard workload = AWT in a year multiplied by rate of working

It is very important that the available work time, activity time unit and work rate are expressed in the same time units.

5) Calculating the allowance factors. There are two types of allowance standards for workload components that the annual statistics of them is not regularly available. Category allowance standards are designed for activities performed by all members of the target group and individual allowance standards designed for those activities performed by specific members of the target group. To calculate supportive and additional activities, allowance standards must be transformed into allowance factors. These factors are then used in the WISN method to calculate the total number of human resources required.

The category allowance factor is calculated as follows:

$$\text{CAF} = 1 / [1 - (\text{Total CAS} / 100)]$$

The individual allowance factor indicates how many full-time staff (or how much time a member of a particular occupational group) are needed to cover additional activities of a specific occupational groups. To calculate the individual allowance factor, the total annual allowance standard is divided by the available working time. At this point, it is important to make sure that both unit times are the same.

$$\text{IAF} = \text{Total IAS} / \text{AWT}$$

6) Determining the required staff based on the workload indicator. At this point, last year's facility service statistics that we want to calculate its required staff is needed. This data is required for any healthcare activity that has a standard workload defined. The number of human resources required for each of the three workload groups is calculated separately.

7) Analyzing the WISN results. At this point, first the difference between the number of available workforce and the number of required workforce is considered, then the ratio of these two values is examined.

## **Data analysis**

Excel software was used to analyze the data collected from the WISN process and one-sample T-test and STATA software (version 19) were used to determine the relationship between the work study data and the activities standard.

According to the WISN method, the results were interpreted using two terms differences and ratios. The difference indicates the amount of surplus or shortage of midwifery staff and the ratio, which is calculated as the number of actual midwifery staff divided by the number of required midwifery staff, indicates the midwives' working pressure.

## **Results**

In general, 10 variables were identified and analyzed to calculate the midwives' available working time (Table1). The values of identified variables were obtained by referring to the hospital personnel information system (by permission from the hospital management). According to the findings, the average available working time of midwives in all three hospitals was 1378 hours.

## **Workload Components**

Workload components for main, supportive, and additional activities were obtained through four expert working group meetings. In addition, two expert working group meetings were held to identify standard time for main activities and standard time for supportive and additional activities. The average meeting time was 2 hours. In order to verify the standard time of the main activities, work study was performed 27

times for each activity. The results of one sample t test showed that there was no significant difference between the mean time taken from the work study and the specified time in the expert working group meetings ( $p > 0.05$ ); hence the standard times specified at the expert working group meetings were chosen as the definitive standard times.

Table 1  
Calculating midwives' available working time

Item	Variable	Description	Calculation
1	Number of days of the year	365 days per year	365
2	Number of Fridays	52 days per year	$365 - 52 = 313$
3	Number of public holidays	An average of 24 public holidays per year	$313 - 24 = 289$
4	Annual leaves	An average of 20 days a year for each midwife	$289 - 20 = 269$
5	Sick leaves	An average of 3 days a year for each midwife	$269 - 3 = 266$
6	Maternity leave	An average of 5 days a year for each midwife	$266 - 5 = 261$
	Converting working days to working hours	Coefficient of working days at 7.33 hours	$261 \times 7.33 = 1913$
7	Training course	An average of 80 hours per year for each midwife	$1913 - 80 = 1833$
8	Mandatory overtime	40 hours a month equals 480 hours a year	$1833 + 480 = 2313$
9	the Productivity Improvement Act	A deduction of 4 h per week according to Sect. 2 of the Productivity Improvement Act ( $4 \times 52 = 208$ ) and Adjustment of the working hours available under the third section of the Productivity Improvement Act (1.5 times calculated of the nights and official holidays = 0.77 Adjustment coefficient)	$2313 - 208 = 2105$ $2105 \times 0.77 = 1621$
10	Allowed unemployment	15% deduction of working time for allowed unemployment (rest and personal affairs, fatigue, and delays during work)	$1621 \times 0.85 = 1378$

### The Main Activities And Standard Time For Each Activity

Labor and delivery care, recovery and postpartum, recovery after cesarean, and newborn cardiopulmonary resuscitation were identified as the main activities of midwives. The standard time for each of the main activities is shown in Table 2.

Table 2

Main activities and standard time for each of the midwives' main activities in the hospital maternity ward

<b>Activity</b>	<b>Hospital</b>	<b>Standard Time</b>
Labor Care	Centre	325 minutes for each patient
	Educational	270 minutes for each patient
	Non-educational	220 minutes for each patient
Delivery Care	All 3 Hospitals	90 minutes for each patient
Recovery and Postpartum Care	All 3 Hospitals	80 minutes for each patient
Recovery after cesarean	All 3 Hospitals	60 minutes for each patient
New born cardiopulmonary resuscitation (CPR)	All 3 Hospitals	15 minutes for each patient

### **Standard Time Of Supportive And Additional Activities**

Supportive and additional activities with the required standard time for performing each activity are shown in Table 3.



Table 3

Supportive and additional activities along with standard time for each hospital

Workload Components	Working Time		
	Centre Hospital	Educational Hospital	Non-educational Hospital
Supportive Activities			
Doing administrative tasks	1 hour per month	1 hour per month	1 hour per month
Peer Training	2 hour per month	2 hour per month	2 hour per month
Students Training	4 hour per month	4 hour per month	-
Reporting	1 hour per month	1 hour per month	1 hour per month
Attending Meetings	1 hour per month	1 hour per month	1 hour per month
Accountability to patients and their families	5 hour per month	5 hour per month	5 hour per month
Patient Training	5 hour per month	5 hour per month	5 hour per month
Ward/Patient Delivery	0.5 hour a day	0.5 hour a day	0.5 hour a day
Additional Activities			
Delivery of Drugs and Misoprostol	30 minutes a day	30 minutes a day	30 minutes a day
Emergency Trolley Control	45 minutes a day	45 minutes a day	45 minutes a day
Control of pharmaceutical shelves, refrigerated medicines and wards' equipment	30 minutes a day	30 minutes a day	30 minutes a day
Collection of birth certificates and delivery to the local register	1 hour a day	1 hour a day	1 hour a day
Prenatal clinic	6 hours a day	6 hours a day	6 hours a day

Workload Components	Working Time		
	Centre Hospital	Educational Hospital	Non-educational Hospital
Conduct childbirth preparation classes	18 hours per week	18 hours per week	18 hours per week
Teaching Breastfeeding to Mothers	6 hours a day	6 hours a day	6 hours a day
High-risk mothers interface	18 hours a day	12 hours a day	6 hours a day

### Determining The Number Of Required Midwives

The number of midwives needed for the centre, educational and medical hospitals is shown in Tables 4–6, respectively. These tables show all the steps outlined in the WISN method. The number of midwives needed for the centre, educational and medical hospitals was 59, 60 and 18, respectively, which according to the available number of midwives, the centre and educational hospitals needed 2 and 13 midwives, respectively, while the medical hospital had 2 surplus midwives. So according to the current number of midwives, the working pressure in the centre, educational and medical hospitals was 0.96, 0.78 and 1.1.

Table 4

Determination of required midwives at Centre hospital (GHaem hospital)

<b>Centre hospital (available working time = 1378 hours per year)</b>			
Main Activity	Annual Workload	Standard Workload	Number of required midwives
Labor Care	7593	254	29
Delivery Care	2221	919	2.4
Recovery and Postpartum Care	2221	1034	2.1
Recovery after cesarean	2461	1378	1.8
New born cardiopulmonary resuscitation (CPR)	1058	5512	0.2
A) Number of required midwives			42.1
Supportive Activities		Category allowance standard (real working time)	Category allowance standard (Percentage of real working time)
Doing administrative tasks		1 hour per month	0.87
Peer Training		2 hours per month	1.74
Students Training		4 hours per month	3.48
Reporting		1 hour per month	0.87
Attending Meetings		1 hour per month	0.87
Accountability to patients and their families		5 hours per month	4.35
Patient Training		5 hours per month	4.35
Patient Delivery		1.5 hours a day	5.9
Sum of percentages of category allowance standard			22.43
B) Category allowance factor			≈ 1.28
Additional Activities		Individual allowance standard (real working time per each person)	Individual allowance standard
Delivery of Drugs and Misoprostol		30 minutes a day	0.13
Emergency Trolley Control		45 minutes a day	0.19

<b>Centre hospital (available working time = 1378 hours per year)</b>		
Control of pharmaceutical shelves, refrigerated medicines and wards' equipment	30 minutes a day	0.13
Collection of birth certificates and delivery to the local register	1 hour a day	0.26
Prenatal clinic	6 hours a day	1.59
Conduct childbirth preparation classes	18 hours per week	0.68
Teaching Breastfeeding to Mothers	6 hours a day	1.59
High-risk mothers interface	18 hours per week	0.68
C) Individual allowance factor (sum of annual individual allowance standards divided by standard working time)		5.25
Number of required midwives		59
Number of available midwives		57
Shortage or Surplus		-2
Working Pressure		0.96

Table 5

Determination of required midwives at educational hospital (Um albaninHospital)

<b>Educational hospital (available working time = 1378 hours per year)</b>			
Main Activity	Annual Workload	Standard Workload	Number of required midwives
Labor Care	6944	254	27
Delivery Care	5949	919	7
Recovery and Postpartum Care	5949	1034	6
Recovery after cesarean	3557	1378	3
New born cardiopulmonary resuscitation (CPR)	501	5512	0.1
A) Number of required midwives			43.1
Supportive Activities		Category allowance standard (real working time)	Category allowance standard (Percentage of real working time)
Doing administrative tasks		1 hour per month	0.87
Peer Training		2 hours per month	1.74
Students Training		4 hours per month	3.48
Reporting		1 hour per month	0.87
Attending Meetings		1 hour per month	0.87
Accountability to patients and their families		5 hours per month	4.35
Patient Training		5 hours per month	4.35
Patient Delivery		1.5 hours a day	5.9
Sum of percentages of category allowance standard			22.35
B) Category allowance factor			≈ 1.28
Additional Activities		Individual allowance standard (real working time per each person)	Individual allowance standard
Delivery of Drugs and Misoprostol		30 minutes a day	0.13
Emergency Trolley Control		45 minutes a day	0.2

<b>Educational hospital (available working time = 1378 hours per year)</b>		
Control of pharmaceutical shelves, refrigerated medicines and wards' equipment	30 minutes a day	0.13
Collection of birth certificates and delivery to the local register	1 hour a day	0.26
Prenatal clinic	6 hours a day	1.6
Conduct childbirth preparation classes	18 hours per week	0.69
Teaching Breastfeeding to Mothers	6 hours a day	1.6
High-risk mothers interface	12 hours per week	0.45
C) Individual allowance factor (sum of annual individual allowance standards divided by standard working time)		5.06
Number of required midwives		60
Number of available midwives		47
Shortage or Surplus		-13
Working Pressure		0.78

Table 6  
Determination of required midwives at medical hospital (Shariati Hospital)

<b>Medical hospital (available working time = 1378 hours per year)</b>			
Main Activity	Annual Workload	Standard Workload	Number of required midwives
Labor Care	1722	254	6.78
Delivery Care	1418	919	1.54
Recovery and Postpartum Care	1418	1034	1.37
Recovery after cesarean	936	1378	0.68
New born cardiopulmonary resuscitation (CPR)	5	5512	0.00
A) Number of required midwives			10.37
Supportive Activities		Category allowance standard (real working time)	Category allowance standard (Percentage of real working time)
Doing administrative tasks		1 hour per month	0.87
Peer Training		2 hours per month	1.74
Students Training		4 hours per month	3.49
Reporting		1 hour per month	0.87
Attending Meetings		1 hour per month	0.87
Accountability to patients and their families		5 hours per month	4.35
Patient Training		5 hours per month	4.35
Patient Delivery		1.5 hours a day	5.9
Sum of percentages of category allowance standard			29.44
B) Category allowance factor			≈ 1.28
Additional Activities		Individual allowance standard (real working time per each person)	Individual allowance standard
Delivery of Drugs and Misoprostol		30 minutes a day	0.13
Emergency Trolley Control		45 minutes a day	0.2

<b>Medical hospital (available working time = 1378 hours per year)</b>		
Control of pharmaceutical shelves, refrigerated medicines and wards' equipment	30 minutes a day	0.13
Collection of birth certificates and delivery to the local register	1 hour a day	0.26
Prenatal clinic	6 hours a day	1.59
Conduct childbirth preparation classes	18 hours per week	0.68
Teaching Breastfeeding to Mothers	6 hours a day	1.59
High-risk mothers interface	6 hours per week	0.23
C) Individual allowance factor (sum of annual individual allowance standards divided by standard working time)		4.81
Number of required midwives		18
Number of available midwives		20
Shortage or Surplus		2
Working Pressure		1.1

## Discussion

The purpose of this study was to estimate the number of midwives needed to respond to the care needs of pregnant women referred to maternity ward of three selected hospitals in Mashhad University of Medical Sciences and compare it with the current situation. In this study, the workload indicator of staffing need (WISN) was used.

In Iran, midwives in the maternity ward are mainly responsible for providing care to pregnant mothers in the labor, recovery and postpartum and recovery after cesarean sections and assisting specialist physicians during the delivery phase. In this study labor, recovery and postpartum and recovery after cesarean care were identified as the main activities. The childbirth process, according to Friedman's definition, is divided into labor, delivery and recovery and postpartum stages, which caring for these steps is one of the primary responsibilities of midwives (14). Due to the importance of controlling vital signs and bleeding, recovery after cesarean care was also added to main care.

Antarou Ly study aimed at determining the delivery care capacity of educational hospitals in Burkina Faso identified labor, delivery, cesarean and recovery after cesarean care as part of the activities of nurses and midwives working in the gynecology and maternity ward (15).



According to the calculations, the midwives' annual available working time was 1378 hours, which was different from similar studies in other countries. Govule et al. in their study, which determined the health care staff needed at a public hospital in Uganda, calculated physicians, nurses, and midwives available working time, in 1624, 1680, and 1688 hours, respectively (16). Another study was conducted at the Lacor Hospital in India estimated the available working time of nurses and midwives to be 1815.5 and to assist nurses to be 1844 hours (17). Shivam et al. conducted a study in West Bengal, India, which estimated the available working time for nurses to be 1680 hours (18). Bonfim et al. estimated the available working time for nurses at 1672 hours in their study in Brazil(19). The differences in annual available working time in different studies appear to be due to the specific circumstances of each country in the variables affecting the available working time, such as the number of national holidays, the number of days off, the existence of rules and regulations reducing the working time. In Iran, for example, the existence of a productivity improvement act has led to a reduction in working time for nurses and midwives, or the radiation protection law has led to a reduction in the working time of radiologists.

In this study, the results of one-sample t-test showed that there was no significant difference between the standard time announced by the midwifery experts in the expert working group meetings and the average time taken by the work study ( $P > 0.05$ ). Peter Ship believes that if the composition of the staff at the expert working group meeting is carefully determined, the difference between the standard time announced by the experts and the average time taken by the work study will be very negligible (20).

The results showed that there was a discrepancy between the number of midwives required by the WISN method and the number of midwives available in all three hospitals studied. In other words, the present study showed that the center, educational and medical hospitals needed 59, 60, and 18 midwives in their maternity wards, but due to the current situation in these hospitals, the center and educational hospitals have been hit by staff shortage (2, 13 midwives, respectively) while the medical hospital has 2 midwifery surpluses. In other words, the working pressure in the three hospitals studied was 0.96, 0.78 and 1.1 for the center, educational and medical hospitals, respectively.

Workforce shortage in different parts of the hospital and health system has been reported in numerous studies and in different countries (21–23). Shortage of skilled and trained staff leads to failure in the process of patient care in various departments, which in turn leads to increased working pressure and eventually results in decreasing the whole time that staff spend on each activity in comparison with the country standard time activity. This may reflect the fact that the quality of care provided is less than the accepted standards.

Working pressure on staff can affect the quality of patient care and the quality of communication with colleagues and can lead to job stress, burnout, and issues such as turnover and absenteeism. It is often stated that health staff in large cities are usually overestimated (15), but the findings of our study show that the central and educational hospitals in Mashhad that usually have acute patients are facing with workforce shortage.

## **Limitations**

Similar to other studies related to WISN, the results relied on statistical data from previous years; so this method calculates the number of human resources that should have been supplied last year. This is usually not a serious concern, as the workload of healthcare facilities changes relatively slowly and in line with demographic and economic conditions changes. Another limitation of the study is the dependence of results and calculations of WISN method on the accuracy of annual statistics. In order to manage this limitation statics of the main activities were obtained from surveying the current registries as well as the hospital information system. Another limitation of this study was that informal midwifery staffs, including midwifery students, were also assisted in the process of providing care in the maternity wards of the center and educational hospitals that due to the insignificance of these services and the lack of impact on the study results, were ignored.

## **Conclusion**

The results of this study showed that the center and educational hospitals providing maternity and midwifery cares to pregnant women in north-east of Iran have a shortage of midwifery staff. Since one of the simplest ways to cover for a shortage of labor is to increase overtime, this shortage can cause working pressure, job stress, burnout and dissatisfaction in midwifery staff, and on the other hand, reduce the quality of provided care to pregnant women. In addition, unbalanced working pressure between health facilities in a city increases the demand for transitions from facilities with high-pressure to facilities with low-pressure, which in turn worsens existing conditions. Therefore, it is suggested that decision makers and human resources planners, using WISN method to determine the number of workforce needed and distribute it fairly among medical centers.

## **Abbreviations**

MUMS

Mashhad University of Medical Sciences

WHO

World Health Organization

WISN

Workload Indicators of Staffing Needs

AWT

Available Working Time

## **Declarations**

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## **Availability of data and materials**

The datasets supporting our conclusions are provided in the manuscript.

## **Authors' contributions**

ED contributed to the manuscript's conceptualization, drafting the paper's background, and results. SST participated in all phases of the WISN work, contributed to the manuscript's conceptualization and drafting the paper's method and discussion and conclusion. All authors read and approved the final manuscript.

## **Ethics approval and consent to participate**

This study received ethical approval from the Ethics Committee on Research (IR.MUMS.REC.1398.055), Mashhad, Iran. All study participants read the information sheet and agreed to participate in the study voluntarily.

## **Consent for publication**

All authors have approved the manuscript for submission.

## **Competing interests**

The authors declare that they have no competing interests.

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