**e- Supplement file A. The steps of the WISN method according to WHO/WISN user’s manual**

1. Identification of priority cadre(s) considering current staffing problems as well as those anticipated in the future

The first step of the WISN method according to WHO/WISN user’s manual is identification of priority cadre(s) considering current staffing problems as well as those anticipated in the future. In line with decision of top management, we included in the study analysts and laboratory technicians from Department for Hygiene and Human Ecology Laboratories and medical doctor’s specialists and laboratory technicians from the Laboratory for Microbiology Laboratories. The total number of employees of these profiles in both laboratories is 99, and the WISN method has been applied to all of them.

2. Estimating available working time (AWT)

The available working time (AWT) is calculated as the number of weeks in a year (5) multiplied by the number of working days a week of a laboratory worker, deducting the number of days for absences including annual leave, public holidays, sick leave and other reasons. The AWT was calculated using the CIPH management’s reports about number of days for annual leave (public holidays, sick leave and other reasons) in accordance to working time directives defined by the Serbian Labor Law30. The AWT presents the average AWT over the 2014-2016 period.

3. Defining workload components and setting activity standards

Workload activities comprise collection, distribution, and preparation of samples, direct and indirect testing, micro-organism cultivation, microscopic and serological examination of the presence of various antigens and antibodies or nucleoid acids, then, reporting clients in accordance with national and international regulations and standards, as well as equipment maintenance, supply and waste management, continuous professional education and innovation, etc (e- Supplement file C). Workload activities are categorized as the *core*, *support* and *additional* activities. Core and support activities are performed by all employees of a specific profile, while certain employees have additional activities. Regular statistics are collected on the core activities. However, information on support and additional activities is not routinely recorded.

Activity standards for core and additional activities (category and individual) were established based on the interview with key respondents and daily records.

Activity standard for core activities is the average time that a health worker needs to perform the activity. For each activity of the support workload component category allowance standards (CAS) is calculated. That is the average real-time of each activity of the support workload component represented as a percentage of the AWT. The total CAS percentage for all support activities was obtained by adding all the percentages together. The Individual allowance standard (IAS) is established for each activity in the group of additional workload components and expressed as unit time that activity requires in one year and is multiplied by the number of persons performing that activity. All IAS are added together in order to calculate the total IAS in a year.

4. Establishing standard workloads

A standard workload need to be determined for each core activity. It is calculated by dividing the AWT by the time standard for particular core activity. Therefore, the standard workload is the amount of work within a core workload component that a worker can perform according to professional standards for one year.

5. Calculating allowance factors

To calculate the total number of FTE laboratory workers needed to perform support activities, the category allowance factor (CAF) is calculated, using the formula in equation 1:

CAF = 1 / [1 – (Total CAS / 100)] (equation 1B)

The individual allowance factor (IAF), which represents the number of FTE laboratory workers required to perform only additional activities, is calculated by dividing the individual allowance standard by the AWT (equation 2).

IAF=IAS/AWT (equation 2B)

6. Determining staff requirements based on WISN

The required number of full-time equivalent (FTE) workers for the core activities (i.e. A) was calculated by dividing the annual workload by the standard workload. The number of FTE laboratory workers required to accomplish core, support and additional activities is obtained when the product of the number of workers need to perform the core activities (A) and the categorical allowance factor (CAF) is summed up by the individual allowance factor (IAF) (equation 3).

WISN = (A \* CAF) +IAS (equation 3B)

7. Analysing and interpreting WISN results

The results obtained from the WISN method are analyzed in two ways. By considering the difference between the current and the required number of workers, a surplus, shortage and balance of health workers are identified, while by considering the ratio of these two numbers, the pressure by the work that the health workers faced is assessed. The ratio of the current and the required number of health workers to 1, indicates that the current number of employees is in balance with the health worker’s workload. A ratio greater than 1 indicates an excessive number of health workers in relation to the workload (none or low workload pressure), and less than 1 that the current number of employees is not sufficient to overcome a certain workload (a moderate pressure or a high pressure).

We estimated the density of laboratory workers per 100,000 inhabitants given that these laboratories were set up to meet public health needs in Belgrade, using the FTE workers and the population number of Belgrade over the 2014-2016 period in a proportion formula. The estimations were done for each category of workforce and laboratory and for every year and than the averages were calculated. For illustration purpose only, a need for 44 analysts and 76 technicians in the City Public Health laboratories of Belgrade with 1.37 milion of population proportionally gives 3.2 analysts and 5.5 technicians per 100,000 inhabitants.