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RESEARCH

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A web-based platform for optimizing healthcare resource allocation and workload management using agile methodology and WISN theory

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Abstract

Background Effective healthcare workforce management is critical for ensuring quality care delivery, particularly in resource-constrained settings. The World Health Organization's (WHO) Workload Indicators of Staffing Need (WISN) methodology provides an evidence-based framework for optimizing staffing levels. However, manual implementation of the WISN methodology is labour-intensive, error-prone, and time-consuming. To address these challenges, the *Platform for Resource Allocation and Optimization for Healthcare Facilities* (PRAYOJN) platform was developed as a web-based tool to automate WISN calculations, streamline data analysis, and improve workforce planning.

Objective To develop and validate a web-based system that automates the WISN methodology for healthcare workforce planning.

Methods The PRAYOJN platform was developed using an agile methodology, structured over five iterative sprints. These sprints incorporated stakeholder feedback to refine system functionalities, ensuring adaptability to real-world healthcare needs. The platform integrates data for principal, supporting, and ancillary tasks to calculate staffing requirements. Key functionalities include automated computation of Available Work Time (AWT), Standard Workload (SW), Category Allowance Factor (CAF), and Individual Allowance Factor (IAF). Alpha testing validated usability and accuracy, while beta testing in a clinical phlebotomy department assessed real-world performance.

Results The platform calculated an ideal staffing requirement of 15.53 Full-Time Equivalent (FTE) for the phlebotomy department, aligning closely with the current staff strength of 15 FTE. Agile development ensured iterative improvements, enhancing user interface (UI) and user experience (UX). Feedback highlighted the platform's user-friendly design, with dynamic visualizations such as pie charts and bar graphs aiding workload interpretation. Users praised its efficiency, adaptability, and role in reducing calculation complexity.

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Conclusion PRAYOJN modernizes and enhances WISN-based workforce planning by automating workload calculations, improving data visualization, and supporting real-time decision-making. Its scalability and intuitive interface position it as a valuable tool for optimizing staffing efficiency across diverse healthcare environments.

Keywords Healthcare workforce optimization, Workload indicators of staffing need (WISN), PRAYOJN platform, Staffing automation, Agile development in healthcare, Workforce planning tool, Healthcare resource allocation

Introduction

Human resources are the cornerstone of any healthcare delivery system, directly influencing the quality, efficiency, and equity of patient care. In resource-constrained settings, healthcare facilities frequently face critical challenges such as workforce shortages, uneven personnel distribution, and staff burnout. These issues are compounded by rising healthcare demands driven by population growth, aging demographics, and increasing disease burdens. Consequently, optimizing staffing and workload distribution is a top priority for healthcare administrators and policymakers to ensure sustainable, high-quality healthcare services [1–3].

A widely adopted framework for assessing staffing needs is the Workload Indicators of Staffing Need (WISN) tool, developed by the World Health Organization (WHO) [4, 5]. The WISN methodology provides an evidence-based approach to calculating the optimal number of healthcare workers required to meet specific workload demands. By integrating data on service utilization, work standards, and human resources, the WISN tool supports informed decision-making in workforce planning across diverse healthcare settings, including hospitals, diagnostic laboratories, and primary care facilities.

Despite its utility, implementing the WISN tool can be labour-intensive and prone to errors, as it requires the manual collection and analysis of large datasets [6, 7]. These challenges are particularly pronounced in diagnostic laboratories, where workloads can fluctuate due to factors such as disease outbreaks, seasonal variations, and advances in diagnostic technologies [8]. To address these complexities, this paper introduces a novel software system designed to automate the WISN calculation process, offering a streamlined, reliable, and dynamic solution for healthcare workforce management. Existing digital adaptations of WISN remain limited in automation, predictive capabilities, and integration with modern workforce analytics. To address these gaps, this study evaluates an automated WISN-based workforce planning system that streamlines data collection, enhances accuracy, and provides real-time staffing insights.

The proposed system leverages advanced computational capabilities to automate data collection, analysis, and reporting, significantly reducing manual effort and enhancing the accuracy of staffing assessments. By identifying workload pressures, bottlenecks, and resource inefficiencies, the system provides actionable insights for administrators to optimize staffing, mitigate staff burnout, and improve operational efficiency. The system's adaptability also allows it to scale beyond diagnostic laboratories to other healthcare settings, such as outpatient clinics and emergency departments. Furthermore, by integrating real-time workload fluctuations and predictive analytics, the platform enhances traditional WISN calculations, making workforce planning more responsive to emerging healthcare challenges.

This software aligns with global efforts to harness digital health technologies for health system strengthening, a priority in achieving universal health coverage and other Sustainable Development Goals [9, 10]. The integration of predictive analytics and machine learning in future iterations could further enhance the system's ability to anticipate staffing needs and respond to emerging healthcare challenges [11, 12].

This paper systematically examines the development, implementation, and evaluation of an web based WISN platform, assessing its effectiveness in optimizing healthcare workforce planning. Findings from this study contribute to the broader discourse on digital health innovations and data-driven staffing models.

Objectives

This study had two key objectives: (a) to develop and test a web based WISN-based system for workforce planning, (b) to evaluate its usability and effectiveness in real-world healthcare settings.

Methodology

We adopted the mHealth Agile Framework [13–15] to guide the systematic development and evaluation of a web-based platform for resource allocation and workload optimization in healthcare facilities, utilizing the Workload Indicators of Staffing Need (WISN) methodology. This study follows a mixed-methods approach, combining quantitative workload calculations with qualitative user feedback to assess the platform's usability and impact on staffing efficiency. The research approach was structured into five iterative Agile development sprints, integrating continuous stakeholder feedback. Alpha testing was conducted in controlled environments to validate system accuracy, while beta testing in real-world healthcare settings evaluated usability and effectiveness.

This approach followed the lifecycle model proposed by Wilson et al. [16] emphasizing iterative development and evaluation. The project spanned six months (April–September 2024), with defined sprints targeting specific goals. The agile methodology's iterative nature ensured that the platform underwent continuous stakeholder feedback and refinement, making it adaptable to the evolving needs of healthcare environments.

A Scrum Team [17] was established to oversee the product development process, consisting of a Product Owner, Scrum Master, and two Product Developers. The overarching Product Goal was defined as: *"Design, development, alpha and beta testing of a resource allocation and optimization platform for healthcare facilities."* The Agile framework ensured iterative refinement based on user feedback, enhancing system adaptability for real-world workforce planning needs. The agile process was executed through successive sprints, each comprising detailed goals, sprint backlogs, and deliverables. These phases systematically addressed the platform's design, functionality, testing, and refinement, as detailed in Table 1.

Agile development of the WISN-based platform

The development of the WISN-based platform followed an iterative approach aligned with the mHealth Agile Framework. The process was divided into five sprints, each addressing specific goals and deliverables, as summarized in Table 1.

Development overview

Sprint 1 focused on problem identification and framework definition. A comprehensive literature review of the WISN methodology, combined with stakeholder interviews, helped identify key fields for data collection and workflows for resource allocation. This phase laid the groundwork for a tailored, user-centric platform.

In Sprint 2, the system architecture was developed, integrating backend workflows for data inputs, calculations, and outputs. Frontend and backend integration were achieved using PHP, HTML5, CSS, and JavaScript to ensure dynamic interactions, visual appeal, and ease of use. Initial testing validated data accuracy, database connections, and output reliability.

Sprint 3 prioritized the creation of a functional prototype, with a strong focus on UI/UX. Stakeholder feedback informed an intuitive interface with clear data visualization. Usability testing with internal staff identified areas for refinement, ensuring the platform delivered a seamless experience tailored to user needs.

Sprint 4 involved beta testing in real-world clinical settings. The platform was deployed in healthcare environments where staff assessed its functionality, feasibility, and operational stability. Feedback from healthcare administrators and frontline staff guided iterative improvements. A operations case study demonstrated the platform's impact on staffing optimization, highlighting improved resource allocation and workload management.

Finally, Sprint 5 addressed feedback from beta testing to refine the platform for large-scale deployment. Usability and operational issues were resolved, and the platform was validated as a robust tool for enhancing staffing efficiency and optimizing resource allocation.

Technologies used

The platform leveraged HTML5 for static interface structure, PHP for backend logic and dynamic data interactions, CSS for styling and user interface customization, and JavaScript for dynamic functionalities like conditional logic and real-time computations. These technologies ensured scalability, responsiveness, and user accessibility.

Understanding the WISN methodology

The Workload Indicators of Staffing Need (WISN) methodology provides a systematic approach to determining the optimal staffing levels required to meet healthcare workload demands.

Available Working Time (AWT)

The first step in WISN involves calculating the total Available Working Time (AWT) for each health worker annually. This accounts for all allowable leaves and excludes break hours.

Table 1 Sprint goals and key activities in the development of the PRAYOJN platform

Sprint	Sprint Goal	Key Activities	Timeline Planned
Sprint 1: Defining the Framework	Problem Identification & Framework Setup	Literature review, stakeholder interviews, identification of data fields and workflows for the WISN methodology.	1 Month and 15 days (April-May)
Sprint 2: Product Development	Development of the WISN-based platform	System design, backend and frontend integration, database structure, and initial testing.	2 Months (May-July)
Sprint 3: Prototype Completion and testing	UI/UX Development and Testing	Interface design, usability testing, and iterative refinements based on feedback.	1 Month (July-August)
Sprint 4: Beta Testing & Refinement	Application testing in a healthcare setting	Real-world deployment, user feedback, operational testing, and operations case study on staffing optimization.	1 Month (August–September)
Sprint 5: Final Application Release	Finalization and evidence of operational impact	Addressing feedback, final adjustments, and preparation for large-scale deployment.	15 Days (September)

$$\begin{aligned} AWT &= (Total\ Workdays\ per\ Year - Allowable\ Leave\ Days) \\ &\times Duty\ Hours\ per\ Day \end{aligned} \tag{1}$$

Where:

- Total Workdays per Year excludes holidays and weekends.
- Allowable Leave Days includes sick leave, annual leave, and other approved absences.
- Duty Hours per Day excludes break hours.

Standard Workload (SW)

The Standard Workload (SW) for each principal task is determined by dividing the annual available work time by the unit time per task:

$$SW = \frac{AWT}{Unit\ Time\ per\ Task} \tag{2}$$

Where:

- Unit Time per Task is the average time required to complete one instance of the task.

Required staff for principal activities (RPA)

The number of staff required for each principal activity is calculated by comparing the actual annual workload of a specific task with the standard workload:

$$RPA = \frac{Actual\ Annual\ Workload}{SW} \tag{3}$$

Where:

- Actual Annual Workload refers to the total number of tasks performed annually for a specific service.

Category Allowance Factor (CAF)

The Category Allowance Factor (CAF) accounts for time spent on supporting activities by all staff in a category. It is derived using the Category Allowance Standard (CAS):

$$CAS = \left(\frac{\substack{Total\ Time\ Spent\ on \\ Supporting\ Activities}}{AWT} \right) \times 100 \tag{4}$$

$$CAF = \frac{1}{1 - (100/CAS)} \tag{5}$$

Where:

- Total Time Spent on Supporting Activities includes activities such as meetings, training sessions, and other non-primary duties.
- Duty Hours per Year = AWT.

Individual Allowance Factor (IAF)

The Individual Allowance Factor (IAF) accounts for time spent on ancillary activities by specific individuals. It is calculated as follows:

$$IAF = \frac{Hours\ Dedicated\ to\ Ancillary\ Activities\ (Yearly)}{AWT} \tag{6}$$

Where:

- Ancillary Activities include activities performed occasionally, such as administrative tasks or one-time special projects.

Total required staff (WISN ideal staff Count)

Finally, the WISN ideal staff count consolidates the outputs of all the above calculations:

$$\begin{aligned} WISN\ Staff\ Count &= (Total\ Staff\ Required\ for \\ &Principal\ Activities \times\ CAF) + IAF \end{aligned} \tag{7}$$

Where:

- Total Staff Required for Principal Activities is the sum of RPA across all tasks.

The WISN methodology combines several layers of calculations to provide a flexible and accurate approach to staffing optimization. By integrating principal activities, support activities, and ancillary activities, it offers healthcare administrators a detailed insight into resource needs. The formulas ensure evidence-based decisions, aligning staffing levels with actual workload demands. This approach can be adapted for any healthcare service cadre, ensuring scalability and adaptability in diverse operational contexts. To assess the accuracy of PRAYOJN's calculations, a comparative analysis was conducted using Excel-based formulas and PRAYOJN's automated computations. The comparison included key WISN workforce planning metrics, with deviations analysed to assess system precision.

Results

The development of the "PRAYOJN" acronym for "*Platform for Resource Allocation and Optimization for Healthcare Facilities*", staffing optimization platform was executed using a structured, iterative process aligned with the Agile Development Lifecycle. Progress was divided into five well-defined sprints, each with specific goals, deliverables, and milestones. This methodology ensured systematic progress while incorporating continuous feedback from stakeholders to refine the platform's functionality and usability.

Framework definition and design

In Sprint 1, the foundation for the platform was established through problem identification and framework design. A comprehensive literature review and stakeholder interviews were conducted to understand the challenges of healthcare resource allocation and the practical application of the WISN methodology. These insights were used to create a tailored framework for optimal staffing calculations, which outlined key data fields and workflows. The framework, illustrated in Fig. 1, mapped the process from input variables, such as work hours and task details, to the computation of staffing requirements using the WISN formula. This sprint provided the blueprint for subsequent development phases.

During Sprint 2, the system architecture was designed and developed. Backend workflows were created to process data inputs, calculate staffing requirements, and generate visual outputs. PHP was employed for backend logic, while JavaScript handled dynamic interactions and real-time computations. Initial testing validated the platform's ability to handle diverse data inputs, ensuring the reliability of calculations. This phase also established seamless integration between frontend and backend components, providing a robust foundation for the platform's core functionalities. The detailed user interface is presented in Fig. 2.

Prototype development and usability testing

In Sprint 3, focus shifted to developing a functional prototype with an emphasis on user interface (UI) and user experience (UX). Stakeholder feedback gathered in the earlier sprints informed the creation of an intuitive interface that prioritized ease of navigation and clear data visualization. Simulated healthcare scenarios were used to test the prototype's usability, enabling developers to identify and address challenges related to input validation, navigation flow, and data visualization. Enhancements included refining error-handling mechanisms, improving navigation logic, and incorporating dynamic visualizations, such as interactive graphs and task breakdowns. By the end of this sprint, the platform was deemed user-friendly and ready for real-world testing. The details of the usability testing are presented in Table 2.

Beta testing and real-world validation

Sprint 4 involved beta testing in clinical settings, specifically in the Phlebotomy department of a large tertiary care hospital in southern India; to evaluate the platform's performance under real-world conditions. An operations case study was conducted to compare staffing levels and workload distribution using the developed platform. he phlebotomy department in this study operates six days a week, handling an average of 510 patients per day with tasks ranging from venipuncture to patient data entry. Staffing optimization was performed using the PRAYOJN tool, which integrates the Workload Indicators of Staffing Need (WISN) methodology to calculate the ideal Full-Time Equivalent (FTE) staff required to achieve operational efficiency while managing workload pressures effectively.

Available Work Time (AWT) using formula

The first step in determining staffing requirements was calculating the Available Work Time (AWT) for each staff member. The department operates six days a week with Sundays off. Factoring in allowable leaves, the total available workdays and work hours were calculated as follows:

$$Total\ Workdays\ per\ Year = 52 \times\ 6 = 312 \tag{8}$$

$$\begin{aligned} Allowable\ Leave\ Days\ &= 30\,(EL) + 12\,(CL) + 2\,(RH) \\ &+10\,(SL) + 12\,(Public\ Holidays) = 66 \end{aligned} \tag{8.1}$$

$$Available\ Workdays = 312 - 66 = 246 \tag{8.2}$$

$$AWT = 246 \times\ 7 = 1722h/year\ per\ staff\ member \tag{8.3}$$

Available Work Time (AWT) using PRAYOJN

The Fig. 3 showcases the Prerequisite Data Inputs interface from the PRAYOJN platform, which is designed to calculate Available Work Hours/Year for healthcare workforce optimization. The user-friendly interface allows users to input key parameters such as the department name (e.g., Phlebotomy), type of employee, annual workdays, daily work hours, and current staff strength in Full-Time Equivalent (FTE). Clear instructions accompany each field, providing examples to guide accurate data entry, such as how to calculate workdays/year by accounting for weekends and leaves or how to define daily work hours excluding breaks. Once the required inputs are provided, the "Calculate Available Work Hours/Year" button dynamically computes the result, which is displayed below the form for easy reference. The interface is simple and intuitive, combining dropdown menus and free-text fields to ensure adaptability across various healthcare departments. Its clarity and efficiency make it accessible even for non-technical users, such as healthcare administrators, enabling quick and accurate calculations with minimal effort.

Workload calculation

The workload in the phlebotomy department was divided into principal activities, supporting activities, and ancillary tasks. The PRAYOJN tool processed these activities to calculate the Standard Workload (SW), Actual Annual Workload, and required staff for each task.

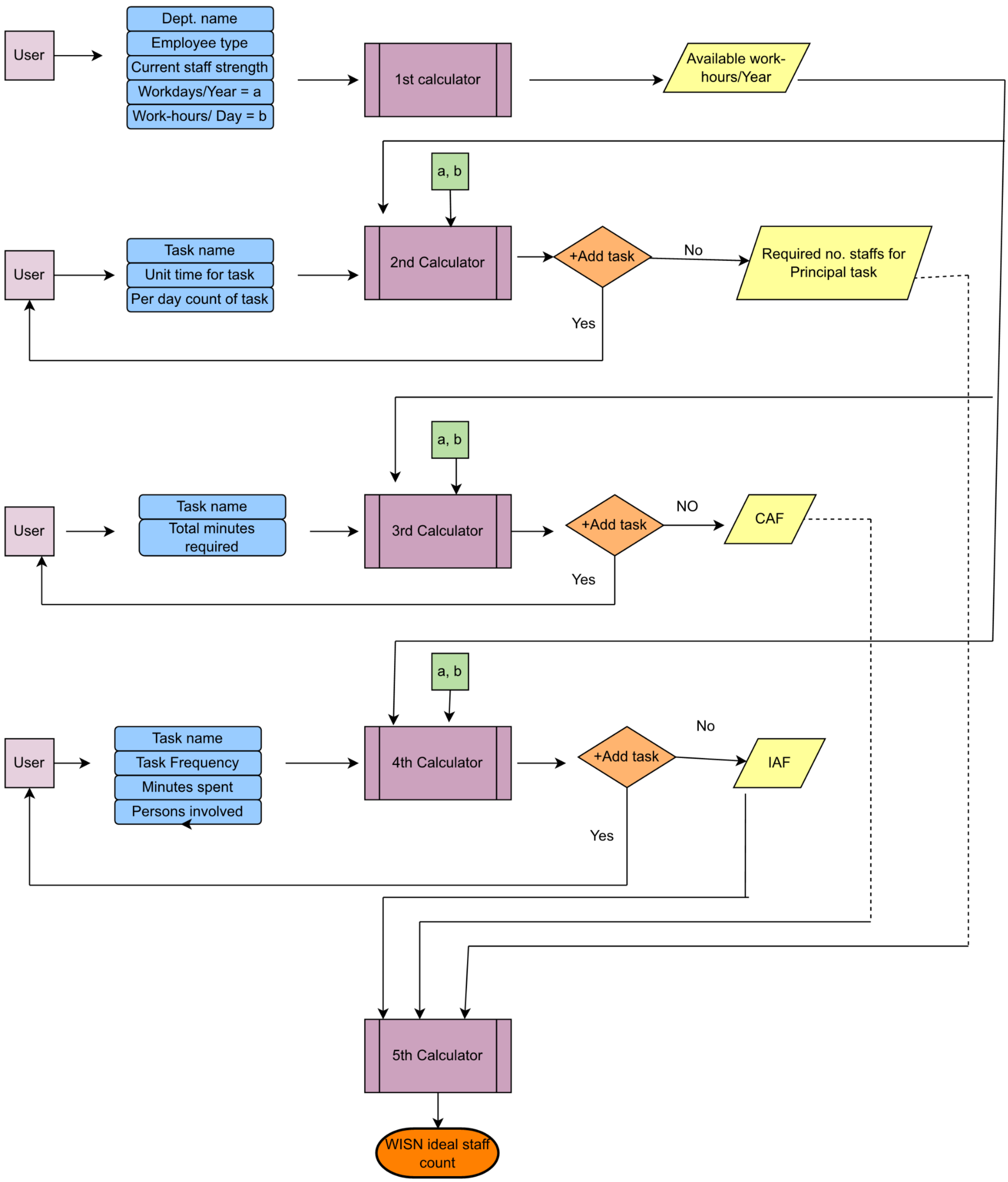
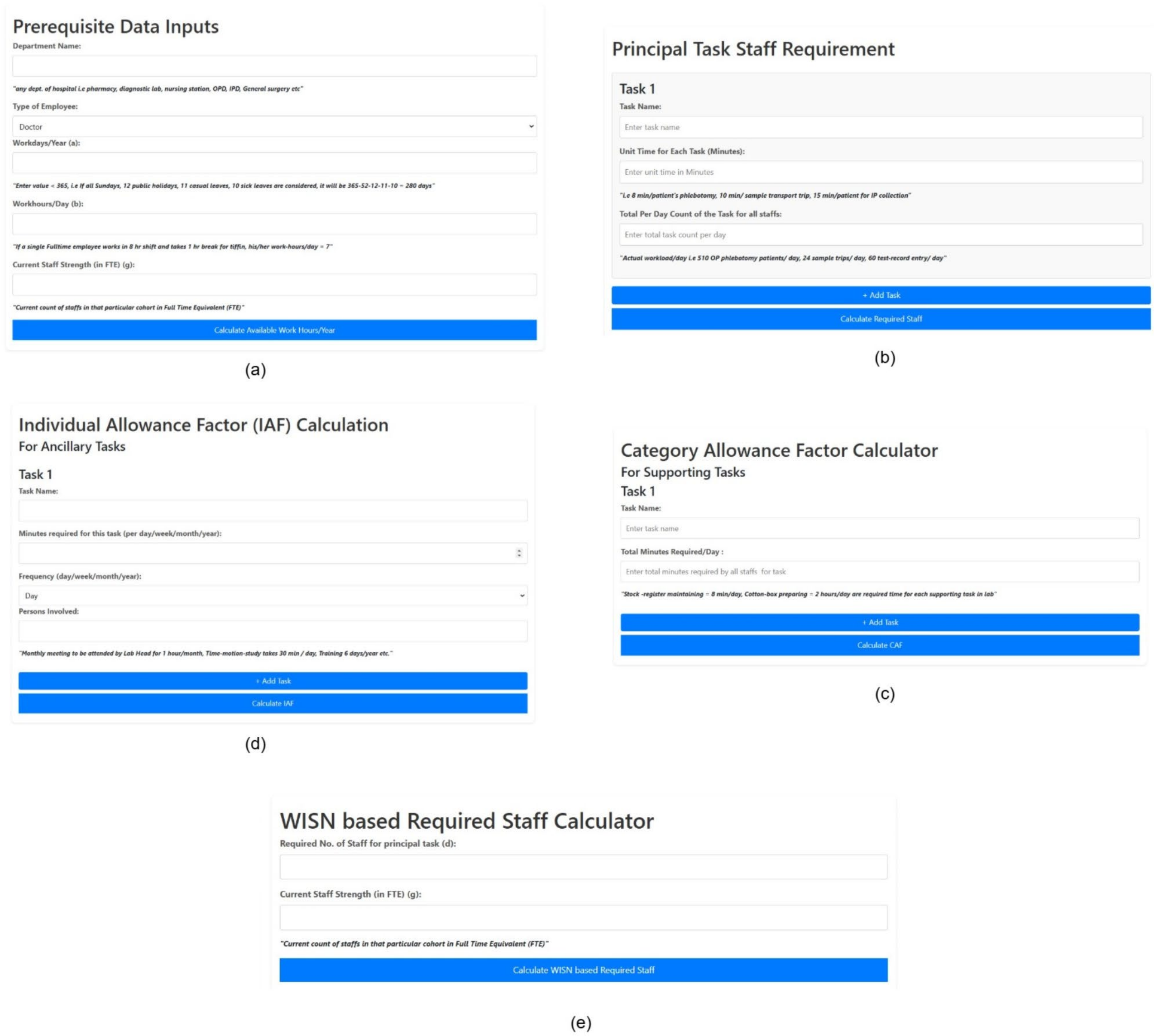


Fig. 1 A tailored data flow diagram for workload and resource allocation calculator

Principal activities using formula

The Phlebotomy Activity involves multiple steps per patient, including greeting and explaining the process (2 min), entering data (3 min), labelling samples (1 min), and performing venipuncture (2 min), adding up to 8 min per patient. Based on the available work time of 1,722 h/year, the Standard Workload (SW) for this activity is calculated as:



a - The "Prerequisite Data Inputs" interface of the PRAYOJN platform allows users to input department-specific data, employee type, workdays, daily work hours, and current staff strength in Full-Time Equivalent (FTE) to calculate Available Work Hours/Year, forming the basis for staffing optimization. The form is intuitive, with instructional hints to guide accurate data entry.

b - The "Principal Task Staff Requirement" interface allows users to input task-specific details, such as task name, unit time per task, and daily task count, to calculate the number of staff required for each task using the WISN methodology

c - The "Category Allowance Factor (CAF) Calculator" interface enables users to input details of supporting tasks, including task name and total minutes required per day, to calculate the CAF for determining time allocated to non-primary activities.

d - The "Individual Allowance Factor (IAF) Calculation" interface allows users to input ancillary task details, including task name, time required, frequency, and number of personnel involved, to calculate the IAF for additional non-routine activities.

e - The "WISN Based Required Staff Calculator" computes the ideal staff requirement by comparing the required number of staff for tasks with the current staff strength in Full-Time Equivalent (FTE).

Fig. 2 The User Interface of the PRAYOJN developed using HTML

Table 2 Summary of respondent feedback, feasibility assessment, and modifications implemented for the PRAYOJN platform

Respondent	Remarks	Feasibility	Modifications done
Respondent 1	Neglecting the peak hours in calculation	Deferred	To be explored separately after final product delivery
Respondent 2	"I find the application appealing and worth working with. The salient of applications is impressive"	Received	NA (Not Applicable)
Respondent 3	1. In case of Multiple key tasks data input is challenging 2. More interactive, using graphs or dashboards. Consider multiple tasks in one department and multiple personnel, variation of service counts, seasonal variations, etc. 3. Should be more interactive and dynamic.	1. Easing out multiple tasks is Feasible 2. More Interactivity is feasible 3. Seasonal variation of patient load feasible but with some alterations 4. Multiple personnel adding is deferred	1. "+ Add task" button enabled 2. Pie-chart, bar -chart displayed 3. Multiplier factor with 10%, 20% increase in patient load is in planning stage 4. To be done later
Respondent 4	Good application for implementation in Hospitals for optimizing staff workflow	Received	NA
Respondent 5	1. WISN, workload calculator and the actual workload is not appropriate. e.g. 1.39 is not the optimum workload but the work of 1.4 people is being done by 1 person, which is far from optimum. 2. Please provide justified workload classification	Feasible	1. Previously, a high workload was defined as a WISN ratio of 1 and a mildly high workload as 0.5. However, this fixed margin often led to misinterpretations, especially when the total Full-Time Equivalent (FTE) count was very high or low. To improve accuracy, the margin has been updated to 30% for the high workload and 15% for mildly high workload, based on the total FTE count. This ensures a more flexible and accurate workload classification, regardless of staffing levels. 2. Workload classification instructions mentioned clearly.
Respondent 6	Prayojn is a user-friendly platform to calculate manpower. It is very useful and helpful HR tool which can optimize the work force.	Received	NA
Respondent 7	1. It is good for one-time calculations. but for repeated use we may require additional information like experience. Suggestion on additional recruitment to normalize can also be calculated. 2. Instructions should be more specific and correct, overall count is not mentioned	1. Feasible but with some alterations 2. Feasible	1. Experience factor as multiplier of total time taken for any activity completion– is in planning stage 2. Instructions rectified

$$SW = \frac{1722\ \times\ 60}{8} = 12{,}915\, patients/year \tag{9}$$

For Difficult Cases, which require additional time (e.g., elderly or newborn patients needing extra care), the time per case is 10 min. The SW for difficult cases is:

$$SW = \frac{1722\ \times\ 6}{1} = 10{,}332\, patients/year \tag{9.1}$$

The Actual Annual Workload is based on daily task counts. For phlebotomy activities, the department handles 510 patients/day over 246 working days, resulting in:

$$510 \times\ 246 = 125{,}460\, patients/year \tag{9.2}$$

For difficult cases, the workload is 10 cases/day over 246 days, which equals:

$$10 \times\ 246 = 2{,}460\, patients\ /year \tag{10}$$

The Required Staff for Principal Activities (RPA) was computed as:

$$PA\ =\ \frac{Actual\ Annual\ Workload}{SW} \tag{10.1}$$

$$PA\ (Total) = \frac{125{,}460}{12{,}915} + \frac{2{,}460}{10{,}332} =\ 9.948\ FTE \tag{10.2}$$

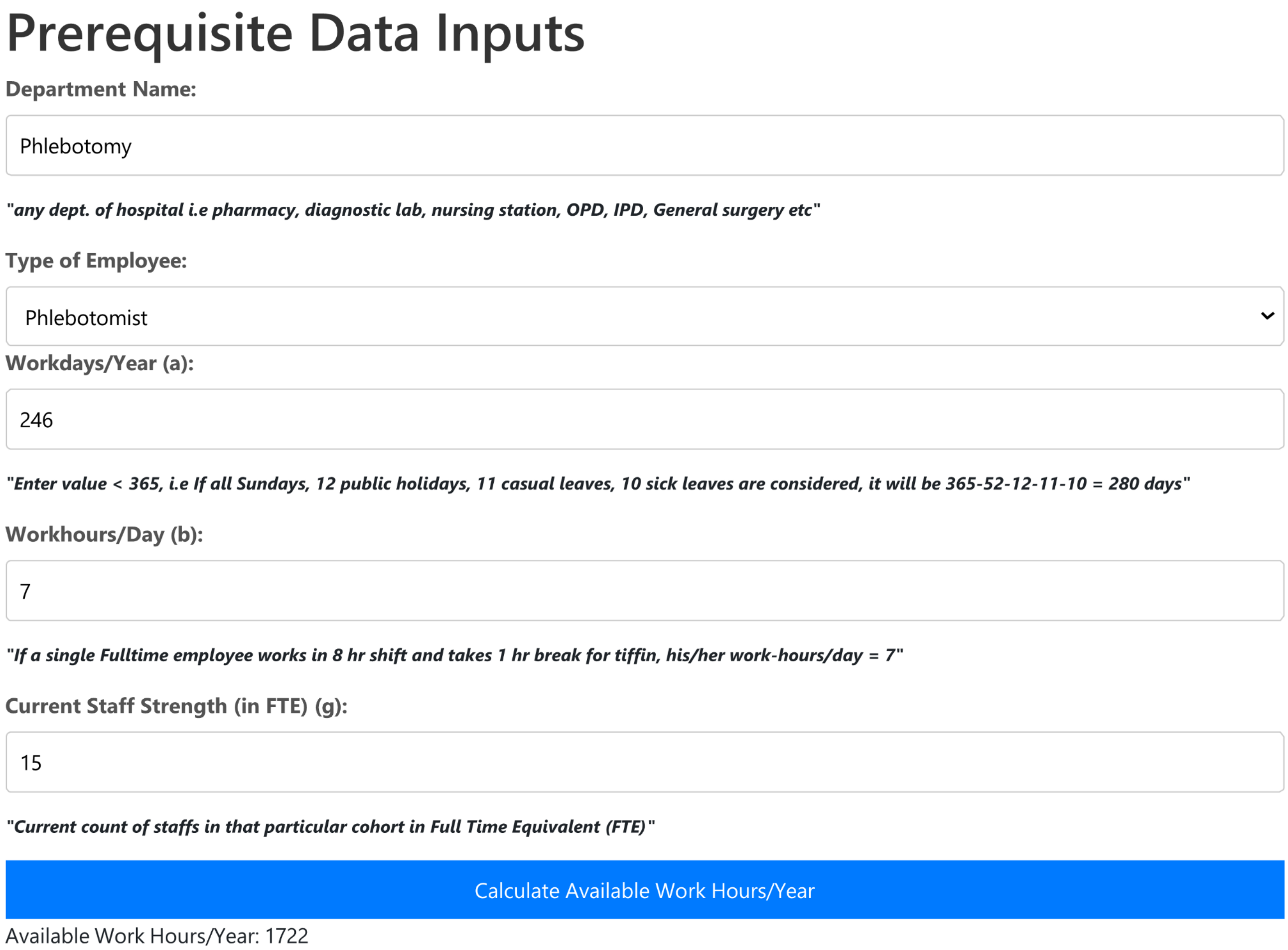


Fig. 3 Prerequisite Data Inputs Interface for Calculating Available Work Hours/Year Using PRAYOJN Platform

Principal activities using PRAYOJN

The Fig. 4 showcases the PRAYOJN Platform, designed to calculate staffing requirements. The platform facilitates the computation of Principal Task Staff Requirements by allowing users to input details such as task names, unit time per task (in minutes), and the total daily task count for all staff. These inputs are used to calculate the number of staff required for each task, with the results dynamically aggregated to provide the total Full-Time Equivalent (FTE) staff needed.

The platform includes features such as the “+ Add Task” button, enabling users to input and manage multiple tasks efficiently. Additionally, the system visually represents the results through a pie chart, highlighting the weighted distribution of tasks and their contribution to the overall staffing requirement. With clear instructions, editable fields, and automated calculations, the user interface is highly intuitive and accessible, ensuring seamless computation of staffing needs even for complex workflows. This design simplifies decision-making and supports efficient workforce planning in healthcare facilities.

Category Allowance Standard (CAS) and Category Allowance Factor (CAF) calculations using formula

The Category Allowance Standard (CAS) measures the time spent by staff on supporting activities that are essential for smooth operations but not directly related to core tasks. In the phlebotomy department, the identified supporting activities include checking the stock of consumables and maintaining the stock register (8 min/day), checking inventories and maintaining the inventory register (8 min/day), preparing cotton boxes (2 h/day, shared between two staff members, or 1 h each), and checking the received status in the Laboratory Information System (LIS) (12 min/day). The LIS activity involves recording one sample per department (e.g., Microbiology, Biochemistry, Clinical Pathology) every 30 min, which totals 12 min/day for 24 trips. Combining all these, the total time spent on supporting activities amounts to 2 h and 28 min, or 2.466 h/day.

The CAS is calculated as the percentage of total working hours allocated to these supporting tasks. Using the formula:

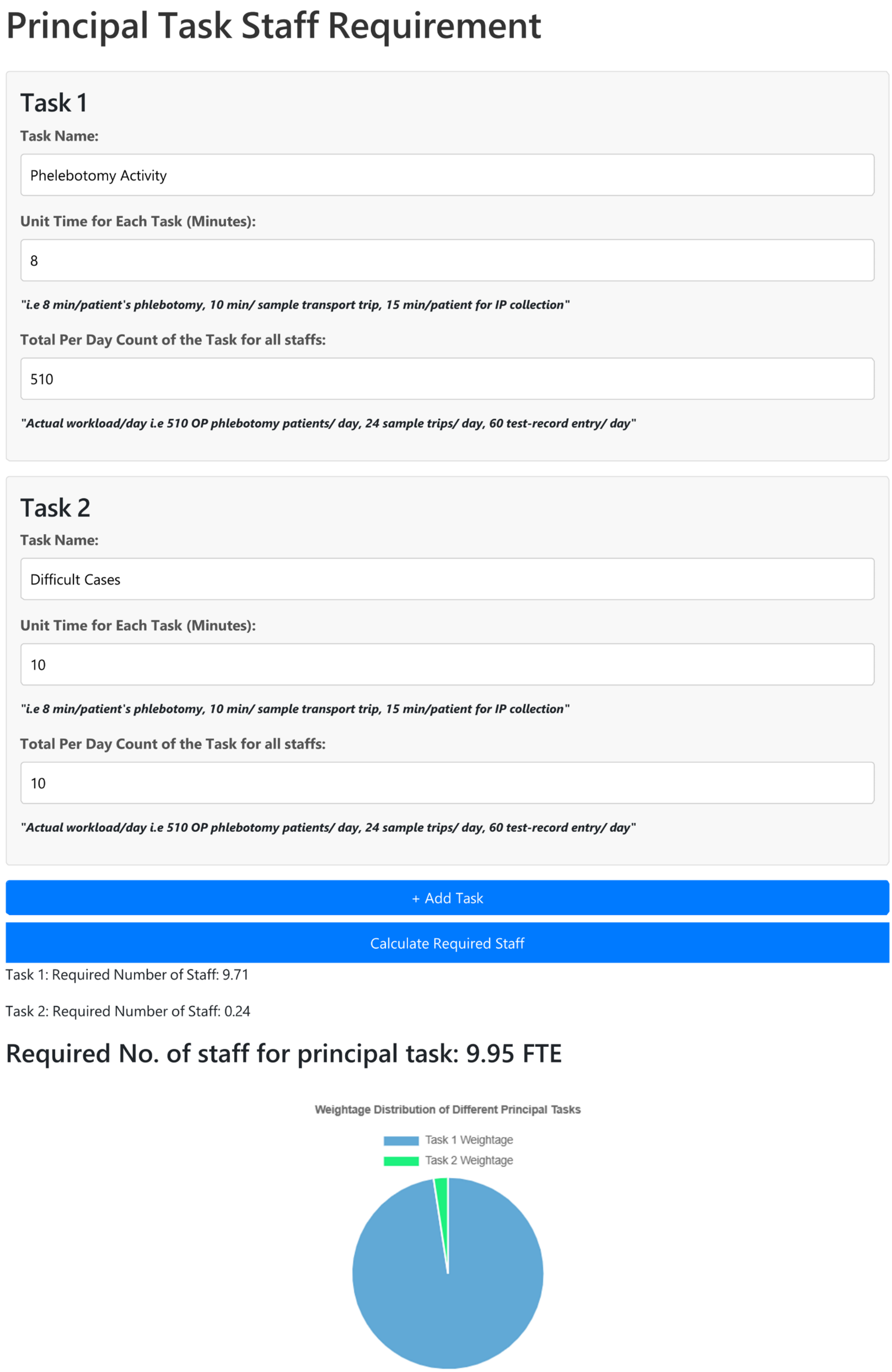


Fig. 4 PRAYOJN Platform Interface for Calculating Principal Task Staff Requirements with Visual Distribution of Task Weightage

$$CAS = \left(\frac{\substack{Total\ Time\ Spent\ on \\ Supporting\ Activities}}{AWT} \right) \times\ 100 \tag{11}$$

$$CAS = \left(\frac{2.466}{7} \right) \times\ 100 = 35.23\% \tag{11.1}$$

This means that 35.23% of staff working hours are devoted to non-primary tasks.

$$CAF = \frac{1}{1 -\ (100/CAS)} \tag{12}$$

$$CAF = \frac{1}{1 -\ 0.3523} =\ 1.5438 \tag{12.1}$$

A CAF value of 1 indicates no workload from supporting activities, while a value above 1 (as in this case) reflects the additional burden these tasks impose on staff. The calculated CAF of 1.5438 signifies that staff spend over a third of their working time on non-primary activities, increasing their overall workload.

Category Allowance Standard (CAS) and Category Allowance Factor (CAF) calculations using PRAYOJN

The Fig. 5 shows the Category Allowance Factor (CAF) Calculator interface of the PRAYOJN platform, which simplifies the calculation of the workload impact of supporting tasks in healthcare operations. Users can input details for each task, including the task name and the total time required per day (in minutes). The interface is designed to handle multiple tasks, with the option to add additional entries using the "+ Add Task" button. Once all tasks are entered, the system dynamically calculates the Category Allowance Standard (CAS), representing the percentage of total work hours spent on supporting tasks, and the CAF, which quantifies the workload burden of these tasks. The results, including the total minutes required for all tasks, CAS, and CAF, are displayed clearly in the "Results" section.

The intuitive layout ensures ease of use, allowing users to input, review, and edit data effortlessly. Each task is listed sequentially, ensuring that no supporting activity is overlooked. The automated calculations eliminate the need for manual efforts, making it accessible even for non-technical users. This interface is highly efficient, enabling healthcare administrators to assess the workload impact of supporting activities quickly and accurately.

Individual Allowance Factor (IAF) calculations using formula

The Individual Allowance Standard accounts for time spent by staff on occasional or ancillary activities that, while not part of their regular duties, still contribute to their overall workload. In this case, two such activities were identified: collecting and restocking consumables from the central store, which takes 30 min/day for 2 staff, and monthly staff training sessions, lasting 30 min/month for all 15 staff. To calculate the Individual Allowance Factor (IAF), the total annual time spent on these activities was determined.

$$IAF = \frac{Total\ Time\ for\ Ancillary\ Activities\ (in\ hours)}{Available\ Work\ Hours\ per\ Year} \tag{13}$$

$$IAF = \frac{((1\ hour\ \times\ 246\ working\ days) + (7.5\ hours\ per\ month \times\ 12\ months)}{1722\ hours\ peryear} \tag{13.1}$$

$$IAF = \frac{336}{17722} = 0.195\ FTE \tag{13.2}$$

Individual Allowance Factor (IAF) calculations using PRAYOJN

The Fig. 6 showcases the Individual Allowance Factor (IAF) Calculation interface of the PRAYOJN platform, which streamlines the computation of the additional workload caused by ancillary tasks. Users can input task-specific details, including the task name, time required per task (in minutes), frequency (daily, weekly, monthly, or yearly), and the number of staff involved. In the example shown, two tasks are entered: "Restocking Consumables," requiring 30 min daily for 2 staff members, and "Time Spent on Staff Training," taking 30 min monthly for 15 staff members. Based on these inputs, the platform automatically calculates the total annual time for all ancillary tasks, converts it into hours, and determines the IAF as a fraction of Full-Time Equivalent (FTE) staff.

The user-friendly interface ensures simplicity and accuracy. Task-specific inputs are customizable, with the option to add multiple tasks using the "+ Add Task" button. Drop-down menus and clearly labeled fields guide users in entering precise details for time, frequency, and personnel. The platform dynamically computes the Total Minutes Required per Year, Total Available Work Hours per Year, and the resulting IAF, displaying the results in a clearly structured "Results" section.

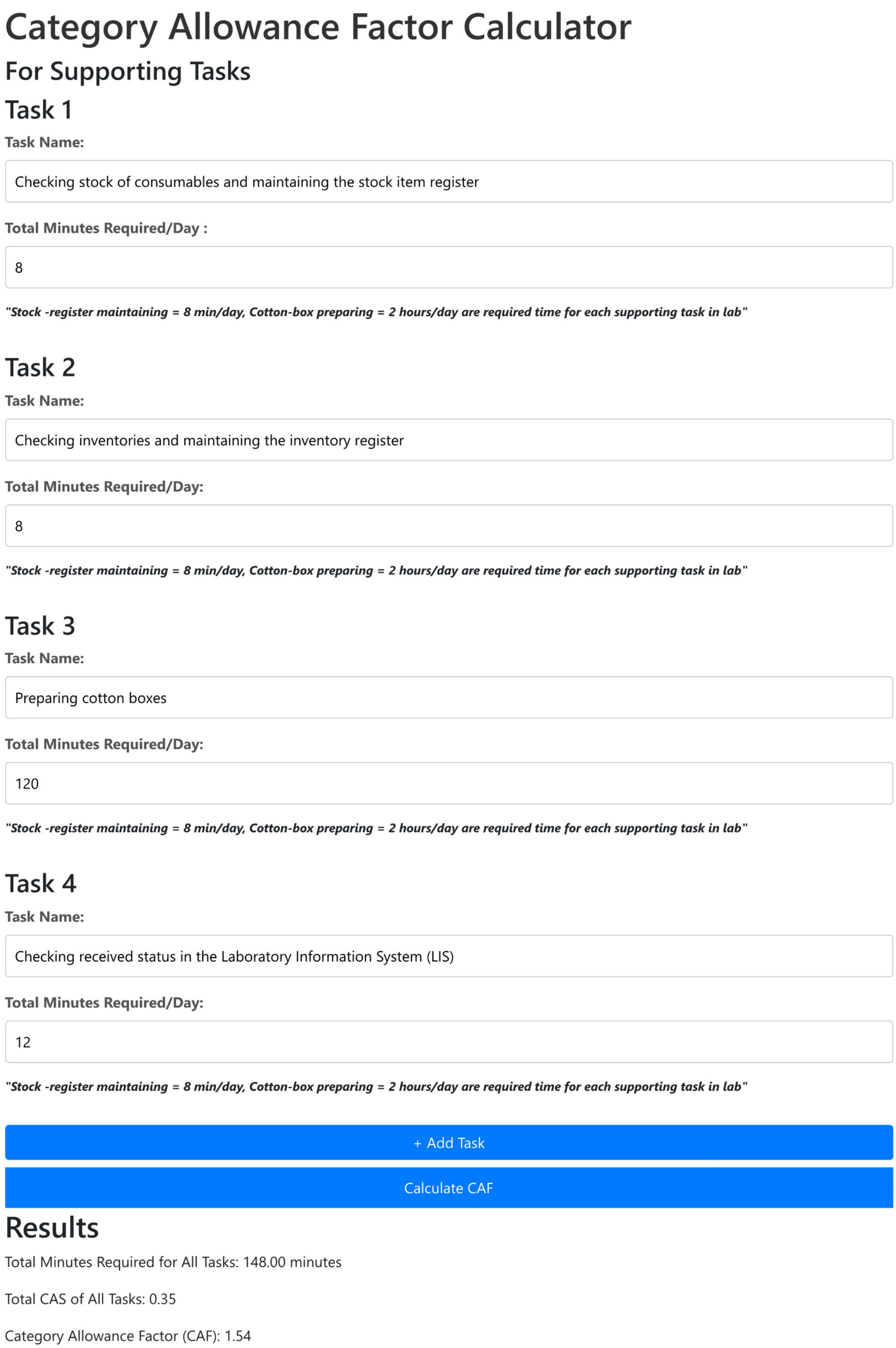


Fig. 5 PRAYOJN Platform Interface for Calculating Category Allowance Standard (CAS) and Category Allowance Factor (CAF) for Supporting Tasks

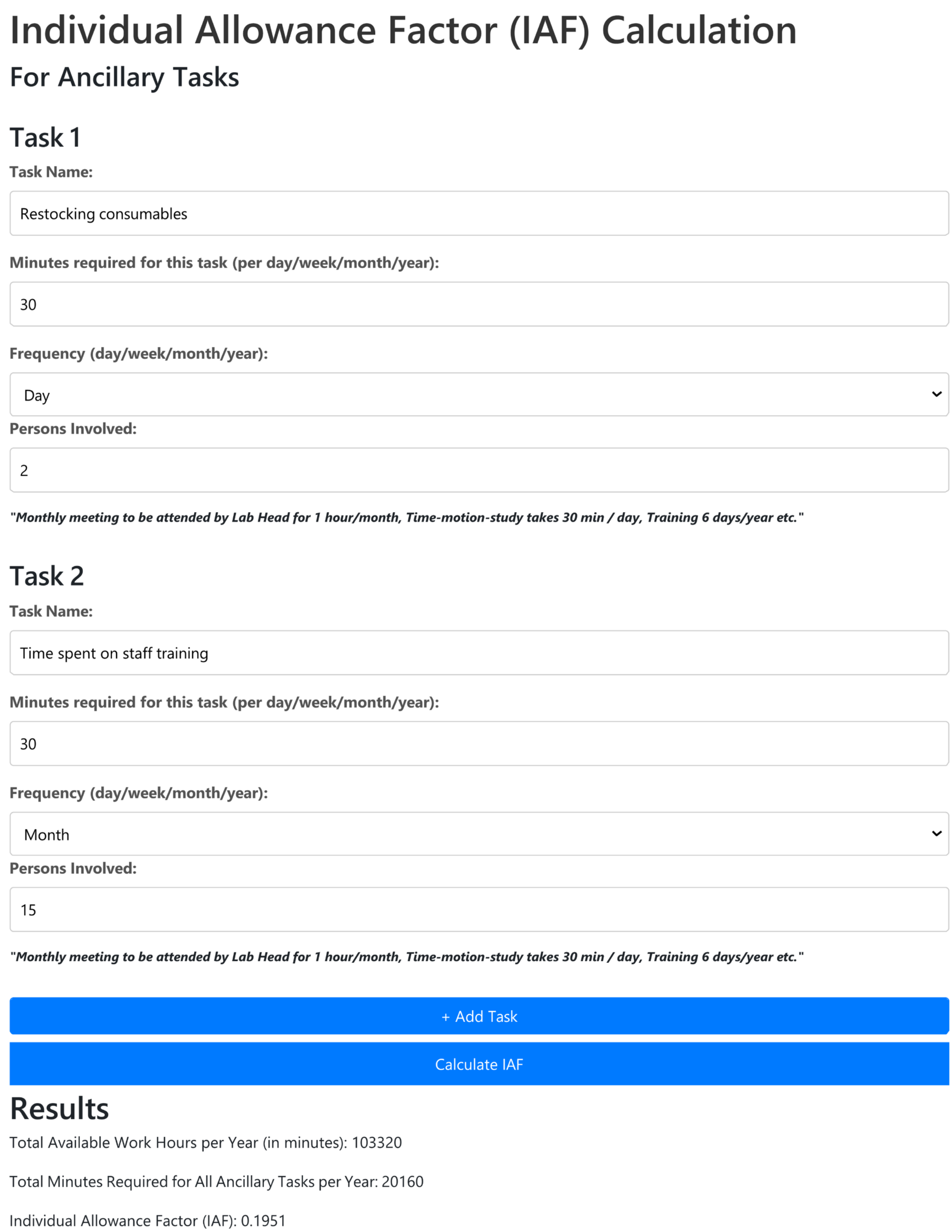


Fig. 6 PRAYOJN Platform Interface for Calculating Individual Allowance Factor (IAF) for Ancillary Tasks

WISN staff requirement calculation using formula

Final WISN Staff requirement is calculated as

$$WISN\ Staff\ Count = \begin{array}{l}(Total\ Staff\ Required\ for\\ Principal\ Activities \times\ CAF) + IAF\end{array} \quad (14)$$

For our case, the Total Staff Required for Principal Activities was calculated as 9.95 FTE, representing the Full-Time Equivalent staff required to perform core activities. The Category Allowance Factor (CAF), which accounts for the workload from supporting activities, was determined to be 1.54, while the Individual Allowance Factor (IAF), representing the time spent on ancillary tasks, was calculated as 0.195 FTE.

$$\begin{aligned} WISN\ Staff\ Requirement &= (9.95\ \times\ 1.54) + 0.195 \\ &= 15.528\ FTE \end{aligned} \quad (14.1)$$

The current staff strength of the Phlebotomy department is 15 Full time employees and the WISN staff requirement suggested number if 15.528 FTE indicating current staff strength is optimal for the current workload.

WISN staff requirement calculation using PRAYOJN

The Fig. 7 showcases the WISN-Based Required Staff Calculator interface of the PRAYOJN platform, which computes the total Full-Time Equivalent (FTE) staff required to handle workloads effectively. Users can input the Required Number of Staff for Principal Tasks (Standard Need) and the Current Staff Strength (in FTE). The system then calculates the WISN-Based Required Staff Count, incorporating adjustments for supporting tasks (via the Category Allowance Factor or CAF) and ancillary tasks (via the Individual Allowance Factor or IAF). In this example, the platform determines a total staff requirement of 15.45 FTE, representing the optimum workforce needed to meet all workload demands.

The results are visually represented through a pie chart and bar graph, showing the contribution of principal, supporting, and ancillary tasks to the overall staffing requirement. This visual breakdown makes it easy to interpret the distribution of workloads across task categories.

The tool also has print option enabling users to print the entire calculations in.pdf format.

Final refinement and deployment

In Sprint 5, the platform was finalized based on feedback from beta testing. Adjustments were made to improve functionality, including recalibrating workload classifications to better align with staffing realities and enhancing the platform's ability to handle dynamic variations in patient load. The platform demonstrated its capacity to optimize staffing levels, manage workload pressures, and adapt to different healthcare environments. These refinements ensured the platform was ready for large-scale deployment, with features that addressed both current needs and potential future requirements, such as the inclusion of experience-based adjustments and seasonal workload forecasting. The live working link for the PRAYOJN tool could be accessed using link - https://iihmrbadmire.netlify.app/.

The user interface is intuitive and simplifies the complex calculation of WISN staff requirements, making it accessible to a wide range of users. Essential values, such as the Standard Need and Current Staff Strength, can be easily entered into clearly labelled fields, ensuring simplicity and accuracy during data input. The platform's "Calculate WISN Based Required Staff" button dynamically computes the optimal staff count, eliminating the need for manual calculations and reducing the chances of errors. Additionally, the results are visually represented through a pie chart and bar graph, providing a clear breakdown of task weightage across principal, supporting, and ancillary tasks. This visual representation enhances understanding and helps users quickly interpret how workloads are distributed. The platform also highlights the final WISN-calculated staff count, allowing administrators to make informed, data-driven decisions for workforce optimization. This user-friendly design ensures that even non-technical users can easily and accurately determine the staffing requirements needed to achieve an optimal workload balance.

Comparison of workforce estimation metrics: Excel vs. PRAYOJN

Table 3 presents comparative analysis between Excel (formula-based calculations) and the PRAYOJN platform demonstrates a high degree of consistency in workforce estimation using the WISN methodology. Across key metrics such as Available Work Time (AWT), Principal Task Requirements, Category Allowance Factor (CAF), Individual Allowance Factor (IAF), and Full-Time Equivalent (FTE) estimation, the deviations remain minimal (< 1%), confirming the reliability and accuracy of PRAYOJN in automating staff calculations.

The FTE estimation showed only a 0.52% deviation between the two methods, indicating that PRAYOJN effectively integrates workload indicators while maintaining computational precision. This reinforces its suitability as a scalable and efficient digital tool for healthcare workforce optimization, reducing manual effort while ensuring data-driven decision-making. The platform's ability to dynamically adjust for task variations, allowances, and operational conditions makes it particularly valuable for hospital administrators and healthcare planners aiming to enhance staffing efficiency.

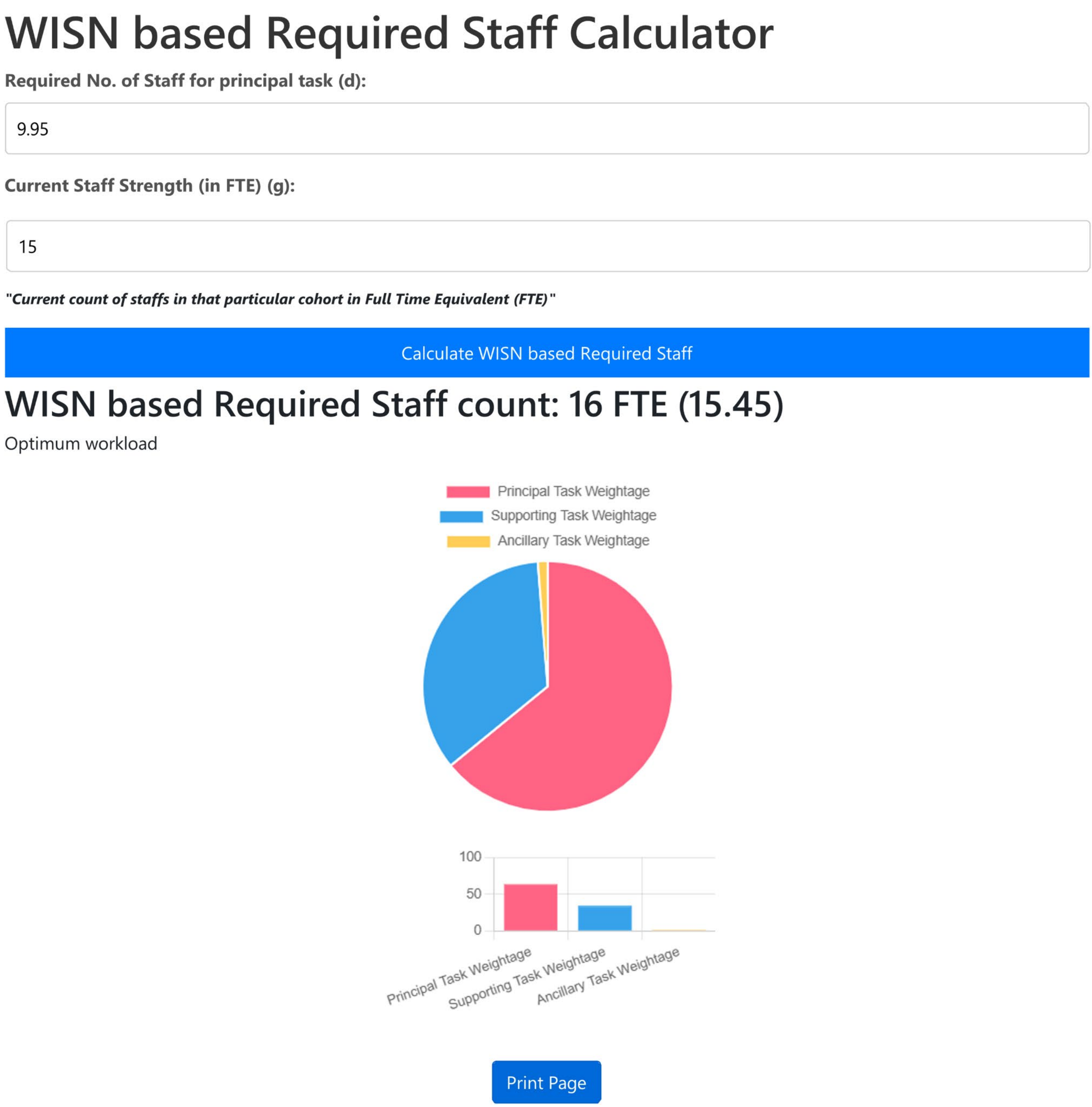


Fig. 7 PRAYOJN Platform Interface for Calculating WISN-Based Staff Requirements with Visual Task Weightage Breakdown

These results validate PRAYOJN's capability to replace traditional manual calculations with an automated, user-friendly interface, ensuring accuracy, scalability, and ease of use in healthcare settings. Future studies could further explore its application across diverse healthcare departments and patient care environments to enhance workforce planning at a larger scale.

Discussion

The WISN methodology has been field test and used across several countries [5], the current study highlights the development and application of the PRAYOJN platform, an innovative tool that digitalises the Workload Indicators of Staffing Need (WISN) process for healthcare workforce optimization. By integrating evidence-based staffing calculations with a user-friendly interface, the platform addresses

Table 3 Comparison of workforce calculation metrics: excel (Formula) vs. PRAYOJN with absolute and percentage deviation

Metric	Units	Excel (Formula)	PRAYOJN	Absolute Deviation	Percentage Deviation
Available Work Time (AWT)	hours	1722	1722	0	0.00
Principal Activities	Full time employees	9.94	9.95	0.01	0.11
Category Allowance Factor (CAF)	Fraction	1.54	1.54	0	0.00
Individual Allowance Factor (IAF)	Fraction	0.195	0.195	0	0.00
FTE Estimation	Full time employees	15.53	15.45	0.05	0.52

critical challenges in resource allocation, particularly in resource-constrained environments. The findings from this implementation, including beta testing in real-world clinical settings, underscore its potential to enhance operational efficiency, reduce workload pressures, and support data-driven decision-making in healthcare facilities.

While WISN remains a widely used tool, its manual implementation is often labour-intensive, prone to data entry errors, and requires significant administrative effort [18–20]. The WHO had released WISN application software tool [21] for recording, analysing, and reporting data related to staffing status and needs at health facilities. However, the software is in.exe format and designed only for windows platform limiting the usage. The WISN software is not currently available for download as the links for download are not accessible. The excerpts from the training module indicate the WISN software offers features such as comprehensive data management, automated calculations, modular workflows, and report generation, allowing users to input, analyse, and report staffing data across various healthcare activities. The software also includes customizable dictionaries for geographic regions and staff categories, supports multiple languages, and provides static tables and graphs to present workload statistics and staffing levels. However, it requires installation and is limited to local use, with a user interface that, while functional, is less modern and visually engaging.

In contrast, the PRAYOJN Platform is a web-based tool that modernizes and enhances the WISN methodology to address its limitations. It provides a more accessible, device-independent interface, eliminating the need for installation. Data entry is streamlined through intuitive, form-based inputs with dropdown menus and dynamic fields, reducing errors and improving usability. The platform integrates advanced visualizations, such as dynamic pie charts and bar graphs, to illustrate workload distribution across principal, supporting, and ancillary tasks. Unlike the WISN software, PRAYOJN fully incorporates Category Allowance Factor (CAF) and Individual Allowance Factor (IAF) calculations, offering a holistic view of staff workload. Developed using modern web technologies, PRAYOJN is highly scalable, adaptable to various healthcare environments, and underwent iterative testing with stakeholders to ensure usability.

Overall, while WISN software provides a foundational framework for staffing optimization, PRAYOJN builds upon it with advanced features, dynamic outputs, and greater flexibility, making it better suited to meet the complex and evolving demands of modern healthcare facilities.

One of the key strengths of the PRAYOJN platform is its intuitive user interface, which enables even non-technical users to compute staffing requirements with ease. Features such as the “Add Task” button, dynamic visualizations, and clearly structured outputs make the platform highly accessible to healthcare administrators. Furthermore, the platform’s adaptability to diverse healthcare environments, from diagnostic laboratories to emergency departments, highlights its scalability. The inclusion of visual tools like pie charts and bar graphs provides an additional layer of clarity, making it easier for stakeholders to interpret and act on the results.

Despite its advantages, the PRAYOJN platform has certain limitations. For example, while the current version provides robust calculations for static workloads, it does not yet incorporate predictive analytics to forecast future staffing needs based on historical trends or emerging challenges. Similarly, the ability to account for variations in staff experience levels or seasonal fluctuations in patient load is limited. These features, however, are planned for future iterations of the platform. The platform’s reliance on accurate input data also underscores the importance of training users in data collection and entry to maximize its effectiveness.

The development of the PRAYOJN platform aligns with global efforts to integrate digital solutions into healthcare workforce management. By automating complex methodologies like WISN, the platform contributes to the digital transformation of healthcare systems, supporting global health priorities such as achieving universal health coverage and strengthening health systems to respond to emerging challenges. The platform’s ability to integrate into existing workflows without requiring significant technical expertise further enhances its utility in resource-limited settings.

Conclusion

The PRAYOJN platform represents a significant advancement in healthcare workforce planning by automating the WISN methodology and providing actionable insights into staffing optimization. Its application in the phlebotomy department demonstrated its accuracy, usability, and potential to improve operational efficiency. While there are opportunities for further enhancement, such as the integration of predictive analytics and dynamic workload adjustments, the platform provides a strong foundation for data-driven decision-making in healthcare facilities. By addressing key challenges in resource allocation, PRAYOJN has the potential to transform workforce planning and contribute to the broader goals of health system strengthening and universal health coverage.

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Availability and requirements of software
Project name: PRAYOJN Platform for Resource Allocation and Optimization for Healthcare Facilities.
Project home page: https://iihmrbadmire.netlify.app/.
Operating system(s): Platform independent.
Programming language: PHP, HTML5, CSS, and JavaScript.
Other requirements: None Specific.
License: GNU general public license (GPL).
Any restrictions to use by non-academics: None Specific.

Authors' contributions
Authors AP and PSK worked on drafting the manuscript, Authors RC and AT worked on software development, testing, data collection and analysis. Authors VSH, AP, SB worked on getting approvals, hosting of the application, reviewing of the data, planning of UI & UX, guidance on technology, specification definitions and analysis planning.

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Data availability
The data that support the findings of this study were obtained on request from the Phlebotomy department of a large tertiary care hospital in southern India, which are included in this published article. Further information regarding the datasets used during the current study are available from the corresponding author on reasonable request.

Declarations

Ethics approval and consent to participate
Since the study was mainly on software designing and the operational study was based on observations and interaction with management team (did not involve human data) the study was exempted from IRB approval by the Institutional Ethical Review Board of the Institute of Health Management Research, Bangalore (IIHMR-B).

Consent for publication
Not applicable.

Competing interests
The authors declare no competing interests.

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References

1. Kruk ME, Gage AD, Arsenault C, Jordan K, Leslie HH, Roder-DeWan S, et al. High-quality health systems in the sustainable development goals era: time for a revolution. Lancet Glob Health. 2018;6:e1196–252.
2. Bhati D, Deogade MS, Kanyal D. Improving patient outcomes through effective hospital administration: a comprehensive review. Cureus 2023;15(10):e47731.
3. Figueroa CA, Harrison R, Chauhan A, Meyer L. Priorities and challenges for health leadership and workforce management globally: a rapid review. BMC Health Serv Res. 2019;19(1):239.
4. Nguyen TTH, Phung HT, Bui ATM. Applying the workload indicators of staffing needs method in nursing health workforce planning: evidences from four hospitals in Vietnam. Hum Resour Health. 2022;19(Suppl 1):124.
5. Asres GD, Gessesse YK. Workload indicators of staffing need (WISN) method for health workforce planning at health facility: A scoping review. Hum Factors Healthc. 2024;6:100078.
6. Namaganda GN, Whitright A, Maniple EB. Lessons learned from implementation of the workload Indicator of staffing need (WISN) methodology: an international Delphi study of expert users. Hum Resour Health. 2022;19(Suppl 1):138.
7. Siyam A, Nair TS, Diallo K, Dussault G. Strengthening the collection, analysis and use of health workforce data and information: A handbook. 1st ed. Geneva: World Health Organization; 2023. p. 1.
8. Nair A, Jawale Y, Dubey SR, Dharmadhikari S, Zadey S. Workforce problems at rural public health-centres in India: a WISN retrospective analysis and national-level modelling study. Hum Resour Health. 2022;19(1):147.
9. Wong BLH, Khurana MP, Smith RD, El-Omrani O, Pold A, Lotfi A, et al. Harnessing the digital potential of the next generation of health professionals. Hum Resour Health. 2021;19(1):50.
10. Kieny MP, Bekedam H, Dovlo D, Fitzgerald J, Habicht J, Harrison G, et al. Strengthening health systems for universal health coverage and sustainable development. Bull World Health Organ. 2017;95(7):537–9.
11. Bhat SS, Srihari VR, Prabhune A, Mallawaram A, Bidrohi AB. Improving Manpower Allocation at Primary Healthcare Facilities: Development and Validation of a Machine Learning Quadratic Model to Strengthen Public Health Service Availability. In: 2024 International Conference on Intelligent and Innovative Technologies in Computing, Electrical and Electronics (IITCEE) [Internet]. Bangalore: IEEE; 2024. pp. 1–6. [cited 2024 Dec 30]. Available from: https://ieeexplore.ieee.org/document/10467473/.
12. Lämmermann L, Hofmann P, Urbach N. Managing artificial intelligence applications in healthcare: promoting information processing among stakeholders. Int J Inf Manag. 2024;75:102728.
13. Liu S, La H, Willms A, Rhodes RE. A No-Code app design platform for mobile health research: development and usability study. JMIR Form Res. 2022;6(8):e38737.
14. Tsangaris E, Edelen M, Means J, Gregorowitsch M, O'Gorman J, Pattanaik R, et al. User-centered design and agile development of a novel mobile health application and clinician dashboard to support the collection and reporting of patient-reported outcomes for breast cancer care. BMJ Surg Interventions Health Technol. 2022;4(1):e000119.
15. Prabhune A, Srihari VR, Sethiya NK, Gauniyal M. Agile fusion: developing eat at right place sentiment analysis tool. IJEECS. 2024;34(1):602.
16. Wilson K, Bell C, Wilson L, Witteman H. Agile research to complement agile development: a proposal for an mHealth research lifecycle. Npj Digit Med. 2018;1(1):46.
17. Schwaber K. Jeff Sutherland. The Definitive Guide to Scrum: The Rules of the Game [Internet]. 2020. p. 14. Available from: https://scrumguides.org/docs/scrumguide/v2020/2020-Scrum-Guide-US.pdf#zoom=100
18. Silva APda, Dal Poz MR. An experience with the use of WISN tool to calculate staffing in a palliative care hospital in Brazil. Hum Resour Health. 2022;19(1):135.
19. Hagopian A, Mohanty MK, Das A, House PJ. Applying who's 'workforce indicators of staffing need' (WISN) method to calculate the health worker requirements for India's maternal and child health service guarantees in Orissa state. Health Policy Plann. 2012;27(1):11–8.
20. Kunjumen T, Okech M, Diallo K, Mcquide P, Zapata T, Campbell J. Global experiences in health workforce policy, planning and management using the workload indicators of staffing need (WISN) method, and way forward. Hum Resour Health. 2022;19(1):152.
21. World Health Organization. Workload indicators of staffing need. Revised 2014. 2010;2.

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