Dissertation Internship Training

At

Wrig Nano systems Private Limited

(February 27- May 27, 2023)

A Report on

Digital hemoglobinometers as point-of-care haemoglobin testing devices in Bhopal division of Madhya Pradesh: A Knowledge Assement Study

By

Dr Nancy Modi

Enroll No. PG/21/063

Under Guidance of Dr Rohini Ruhil

PGDM (Hospital & Health Management)

2021-2023

International Institute of Health Management Research

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NEW Delhi

(COMPLETION OF DISSERTATION FROM RESPECTIVE ORGANIZATION)

This certificate is awarded to

NAME: Dr. Nancy Modi

In recognition of having successfully completed his/her internship in the department of

TITLE: Business - Sales

And has successfully completed his/her project on

TITLE OF PROJECT: Digital haemoglobinometers as point of care testing devices in Bhopal division of Madhya Pradesh

DATE: 27/02/2023 to 27/02/2023

ORGANIZATION: Wrig Nanosystems Private Limited (TrueHb Hemometer)

She comes across as a committed, sincere & diligent person who has a strong drive and Zeal for learning.

We wish her all the best for future endeavour's.

Management Representative

Swanki Mathur

TO WHOMESOEVER IT MAY CONCERN

This is to certify that **Dr Nancy Modi** student of PGDHM (Hospital and Healthcare Management) from International Institute of Health Management and Research- Delhi has undergone internship training under **Wrig Nanosystems Private Ltd** from **27-02-2023** to **27-05-2023**.

The candidate has successfully carried out the internship tenure and completed the projects assigned to her during her training. She has been sincere, scientific, and analytical in her approach to her study.

The internship is in fulfilment of the course requirement.

I wish her success in all the future endeavours.

Dr Sumesh Kumar
Associate Dean (Academic and student affairs)
IIHMR, New Delhi

Rohini 22-06-23

Dr Rohini Ruhil
Mentor
IIHMR, New Delhi

Certificate of Approval

The following dissertation titled **"Digital hemoglobinometers as point-of-care haemoglobin testing devices in Bhopal division of Madhya Pradesh"** is hereby approved as a certified study in management carried out and presented in a manner satisfactorily to warrant its acceptance as a prerequisite for the award of **PGDM (Hospital & Health Management)** for which it has been submitted. It is understood that by this approval the undersigned do not necessarily endorse or approve any statement made, opinion expressed or conclusion drawn therein but approve the dissertation only for the purpose it is submitted.

Dissertation Examination Committee for evaluation of dissertation.

Name	**Signature**
Sidharth Sekhar Mishra	Sidharth Sekhar Mishra
Rupsa Banerjee	

Certificate from Dissertation Advisory Committee

This is to certify that **Dr. Nancy Modi**, a Post-Graduate student of the **PGDM (Hospital & Health Management) at IIHMR- Delhi** has worked under our guidance and supervision. She is submitting this dissertation titled **"DIGITAL HEMOGLOBINOMETERS AS POINT-OF-CARE HAEMOGLOBIN TESTING DEVICES IN BHOPAL DIVISION OF MADHYA PRADESH: A KNOWLEDGE ASSESSMENT STUDY"** in partial fulfilment of the requirements for the award of the PGDM (Hospital & Health Management).

This dissertation has the requisite standard and to the best of our knowledge, no part of it has been reproduced from any other dissertation, monograph, report, or book.

Institute Mentor Name,

Dr. Rohini Ruhil

Signature: Rohini 19/06/23

Organization: IIHMR Delhi

INTERNATIONAL INSTITUTE OF HEALTH MANAGEMENT RESEARCH, NEW DELHI

CERTIFICATE BY SCHOLAR

This is to certify that the dissertation titled Study on Digital hemoglobinometers as point-of-care haemoglobin testing devices in Bhopal division of Madhya Pradesh: A Knowledge Assessment Study and submitted by Dr Nancy Modi Enrolment No. PG/21/063 under the supervision of Dr. Rohini Ruhil for award of PGDM (Hospital & Health Management) of the Institute carried out during the period from 27th February to 27th May, embodies my original work and has not formed the basis for the award of any degree, diploma associate ship, fellowship, titles in this or any other Institute or other similar institution of higher learning.

Nancy

Signature

Wrig Nanosystems Private Limited

FEEDBACK FORM

Name of the student: Dr. Nancy Modi

Name of the organization in which dissertation has been completed:

Wrig Nano systems Private Limited (TrueHb Hemometer)

Area of dissertation: Business (sales)

Attendance: 100% satisfactory

Objectives achieved: Yes- overall good performance.

Deliverables / strengths: She possesses a keen eye for observation, exhibits good learning abilities, and effectively communicates thoughts and ideas. She is confident, hard work, and have leadership qualities, constantly driven to expand her knowledge and skills.

Suggestions for improvement: NA

Suggestions for institute (course curriculum, industry interactions, placement, alumni): Satisfactory

Signature of the office-in- charge/organization mentor(dissertation)

Date: 14/06/2023

Place: Himachal Pradesh (Parwanoo)

Wrig Nanosystems Private Limited

TO WHOMSOEVER IT MAY CONCERN

Wrig Nano systems Private Limited incorporated on 05 Nov 2009 with ISO 13485:2016 and Manufacturing License as per MDR 2017. The Corporate is engaged in the business of manufacturing of medical equipment. Company manufactures device named as TrueHb haemoglobinometer is an accurate home-use haemoglobin measuring device that you can use at your home at your convenience. Was awarded by the Government of India(GOI) as the "Indian Medical Device Company of the Year" in the year 202.

TrueHb fits into your palm to provide point of care testing. It leverages our powerful and innovative nano- bioelectronic technology to give lab standard results in less than a minute. Seamless services and product qualitymakes True Hb a reliable tool for diagnostics and cure. An option instead of a lab - Intelligent self-calibration sensors and algorithms Test strips with lot-to-lot reproducibility and intelligent batch code algorithms. Date and time storage for more than 1000 results An answer to complexities Capillary, venous or arterial whole blood sample. Easy record maintenance using mobile application.

This is to certify that Dr Nancy Modi, student of PGDHM, from IIHMR university Delhi, has completed 03 months of internship in the department of business-Sales. From 27th February 2023 to 27th May 2023. She has completed study on “Digital haemoglobinometers as point of care testing devices in Bhopal division of MadhyaPradesh”

During her tenure with organization Dr Nancy Modi was found to be hardworking, sincere, self-disciplined, andconscientious worker. During this period her performance was good.

We wish her all the best for her future endeavour.

WRIG NANOSYSTEMS (P) LTD.

HEAD IN-CHARGE /ORGANISATION MENTOR (DISSERTATION)

DATE: 14/06/2023

Acknowledgement

I would like to express my profound gratitude to Mr. Ambar Srivastava and Mr. Babul Mody, who provided me with the exceptional opportunity to undertake my internship at Wrig Nano Systems Private Limited and included me in their project. Their faith in my abilities and their willingness to mentor and guide me throughout the internship period has been invaluable.I am truly appreciative of Mr. Gourav Khajuria and Mr. Abhishek Anand for their constant support, valuable guidance, and insightful inputs. Their expertise and knowledge have contributed significantly to my professional growth, and I am grateful for their dedication in helping me navigate through the challenges of the project.

Furthermore, I would like to extend my gratitude to the senior management of Wrig Nano Systems Private Limited for their trust and granting me full access to all the resources within the organization. This access has allowed me to explore and learn from a wide range of experiences, contributing to my overall development during the dissertation. I would also like to acknowledge and thank the entire staff at Wrig Nano Systems Private Limited for their sincere cooperation and support throughout my entire internship period. Their willingness to share their expertise and collaborate has greatly enriched my learning experience.

In addition, I am deeply grateful to my professor, Dr. Rohini Ruhil, and my internal mentor at IIHMR (Indian Institute of Health Management Research) for their continuous assistance and unwavering support. Their guidance and feedback have been instrumental in shaping my approach and enhancing my understanding of the subject matter.

Last but not least, I would like to express my immense gratitude to almighty God for providing me with the strength, perseverance, and opportunities to undertake this internship. I am also grateful to my family and friends for their unwavering support, encouragement, and belief in my abilities throughout this journey. Their presence and constant motivation have been invaluable in helping me overcome challenges and achieve success.

Overall, I am deeply thankful to each individual and entity mentioned above for their significant contributions to my internship experience. Their support, guidance, and belief in my potential have played a pivotal role in shaping my professional growth and will always be cherished.

Contents

Abbreviations and Keywords:

AMB: Anaemia Mukt Bharat

HW: Health Worker

HB : Haemoglobin

POCT: Point of care testing

M.P: Madhya Pradesh

WHO: World Health Organization

GOI: Government of India

ANM: Auxiliary Nurse and Midwife

AWW: Anganwadi worker

ASHA: Accredited Social Health Activist

MPW: Multipurpose worker

LOA: Limits of agreement

HWC: Health and Wellness centre

PHC: Primary Health Care

NHM : National Health Mission

JSSK: Janani shishu suraksha karyakaram

RBSK: Rashtriya bal swasthya karyakram

HWC : Health and wellness centre

ICMR: Indian Council of Medical Research

Executive summary Title:

"Digital hemoglobinometers as point-of-care haemoglobin testing devices in Bhopal division of Madhya Pradesh "

Background: Anaemia is a serious global public health problem, particularly affecting young children and pregnant women. According to the World Health Organization (WHO), 42% of children under 5 years of age and 40% of pregnant women worldwide are anaemic. This condition, characterized by a deficiency in red blood cells or reduced oxygen-carrying capacity, leads to symptoms such as weakness, fatigue, dizziness, and shortness of breath. Addressing anaemia requires interventions that target the root causes, including poverty, illiteracy, and gender norms, through initiatives focusing on disease control, water, sanitation, hygiene, and reproductive health. [1] Anaemia contributes to the high maternal mortality rate and the prevalence of low-birth weight babies. [2]In India, the Anaemia Mukt Bharat (AMB) strategy was implemented in 2018 to combat anaemia in vulnerable populations. The strategy follows a comprehensive 6X6X6 approach, aiming to reduce anaemia prevalence through six beneficiary groups, six interventions, and six institutional mechanisms. [3] Efforts to diagnose and treat anaemia at the primary care level, such as point-of-care testing using digital hemoglobinometers, play a crucial role in reducing the burden of anaemia, particularly in resource-limited settings where laboratory services are not readily available.[4].

Objective: To assess knowledge and utilization of digital haemoglobinometer as point of care testing devices by healthcare workers under anaemia mukt Bharat program

Methodology: Cross sectional research in the Bhopal division of Madhya Pradesh. The study will utilize primary data collected over a three-month period, from February 27th, 2023, to May 27th, 2023, as well as existing feedback obtained from healthcare workers through an online Google form. The analysis will be based on the primary data collected, and no direct interviews will be conducted. The study will be focused on the Bhopal division of Madhya Pradesh, and the data will be of a primary nature.

Findings: The findings suggest that HW have knowledge about the Anaemia Mukt Bharat (AMB) program and are also familiar with the use of digital hemoglobinometers. However, for the effective utilization of these devices, it is crucial to provide appropriate training and support. Furthermore, refresher training should be offered to address troubleshooting, regular maintenance, and updates, thereby ensuring successful usage. Notably, the introduction of digital hemoglobinometers has been observed to save time for both patients and healthcare workers.

Conclusion of the Study The anticipated result of the study is that the introduction of digital hemoglobinometers has facilitated the early detection of anaemia due to their portability and use in outreach areas. This, in turn, contributes to the reduction of the overall burden of anaemia. The study also highlights the healthcare workers' knowledge and awareness of using these devices, as well as the challenges they face during their usage. The proposed solution to address these challenges is to provide refresher training to healthcare workers, ensuring their proficiency in operating the digital hemoglobinometers.

Background

Anaemia is a serious global public health problem that particularly affects young children and pregnant women. WHO estimates that 42% of children less than 5 years of age and 40% of pregnant women worldwide are anaemic . It is a condition where there are either too few red blood cells or the ability of the blood to transfer oxygen to the body's tissues is reduced. This causes symptoms including weakness, exhaustion, light-headedness, and shortness of breath. Changes in behaviour and society Communication techniques are employed to alter eating habits. The main causes of anaemia, such as poverty, illiteracy, and gender norms, are addressed by interventions that focus on topics like disease control, water, sanitation, and hygiene, reproductive health. [1]

Anaemia contributes to the high maternal mortality rate and the prevalence of low-birth weight babies. Previous research has shown that anaemia has a negative impact on adolescents' cognitive function and mental health. Anaemia also reduces adolescent learning capacity, academic performance, school attendance, and work performance.[2]

The Anaemia Mukt Bharat (AMB) strategy was introduced by the Indian government in 2018, with the aim of reducing anaemia in vulnerable age groups like women, children, and adolescents using a life cycle approach and providing preventive and curative mechanisms. The strategy is implemented through a 6X6X6 strategy, which includes six target beneficiaries, six interventions, and six institutional mechanisms for all stakeholders. The prevalence of anaemia among six groups as per the National Family Health Survey 5 (2019-21), is 25.0 percent in men (15-49 years) and 57.0 percent in women (15-49 years), 31.1 percent in adolescent boys (15-19 years), 59.1 percent in adolescent girls,52.2 percent in pregnant women (15-49 years) and 67.1 percent in children (6-59 months).The prevalence of anaemia in M.P is 72.7 percent in children (6-59 months), 54.7 percent in Non-pregnant women age 15-49 years , 52.9 percent in Pregnant women age 15-49 years, 54.7 percent in All women age 15-49 years, 58.1 percent in Adolescent girls age 15-19 years and 30.5 percent in Adolescent boys age 15-19 years [3]

Anaemia Mukt Bharat (AMB) strategy was launched in 2018, to deal with the high burden of anaemia in the country. Haemoglobin (Hb) estimation is used to diagnose anaemia. Any intervention to treat anaemia is largely based on the level of Hb. Assessment of palmar, nail bed and tongue pallor is a traditional method for the detection of anaemia.[4]

Point-of-care testing (POCT) of anaemia using digital hemoglobinometers and treatment is one of the primary interventions under Anaemia Mukt Bharat. When compared to other POCTs, digital hemoglobinometers have the following advantages: (i) no or minimal subjectivity in Hb estimation; (ii) rapid turnover time (within a few seconds) and requirement of less blood sample (one drop of capillary blood sample); (iii) portable and operable in a wide range of temperatures; (iv) Hb values with one decimal place will be displayed in the device monitor; (v) availability of control solution at low, normal, and high ranges; (vi) recommended by the WHO and ICMR (India) for Hb estimation in primary health-care and community settings; and nonrequirement of sophisticated laboratory or trained laboratory technicians;(vii) features to enable tech health intervention and real-time data capture[4,5]. Any technique of checking a patient's anaemia at the primary care level should be affordable, easy to use, durable enough for field usage, not reliant on batteries or energy, and relatively accurate. [6]

It should also utilise a minimal amount of ingredients that need to be replaced frequently and produce effects right away. Diagnosis of anaemia in children using accurate technologies and providing adequate treatment is essential to reduce the burden of anaemia. Point-of-care testing (POCT) devices is a potential option for estimation of haemoglobin in peripheral and field settings were the haematology analyser and laboratory services are not available.[7,8] Wrig - TrueHb ,Acon - MissionHb , Microgene -Diaspect, Microgene - Accusure Hb, Biosense - HbChek ,Hemocue - Hb301, Sensacore – Hemospark, Aditya Clinical - Dolphin are different digital haemoglobinometer devices for detection of anaemia have been developed [3,5,7]

.

Introduction

About Wrig Nano Systems Private Limited

Established in the year of 2009, Wrig Nanosystems Private Limited with its office registered in Himachal Pradesh . The leading manufacturer of True Hb Hemoglobin Meter Kit, TrueHb Hemoglobin Meter and much more. Founder & MD, Mr. Ambar Srivastava (CEO), whose continual backing and direction have been led to accomplishment for attaining exponential development in the current market. Wrig Nanosystems Private Limited " is a rapidly growing medical device company focused on cutting-edge bioelectronics-based medical diagnostics. Have developed a handheld. Haemoglobin meter (TrueHb) and attained market leadership in the Hemoglobins space in India in less than five years. Was awarded by the Government of India (GOI) as the "Indian Medical Device Company of the Year" in the year 2021. A series of new globally advanced technologies in the pipeline and are progressing toward becoming a global giant in personalised diagnostics. We are funded by several institutional and HNI investors and are handsomely profitable. We are re-investing in growth aggressively and expanding our horizons into international markets.

About TrueHB

The True Hb Hemometer is intended to be used for the quantitative measurement of haemoglobin. The True Hb Haemoglobin Monitoring System is intended for use outside the body (in vitro diagnostic use) by healthcare professionals and individuals. It indicates the wellness and development of babies among pregnant women. On the other hand, Among Diabetic and Hypertension patients, lessening of Hb(< 12 in females and <13 in males) is associated with a likely determinant of chronic kidney disease.

What is True HB?

The True Hb Hemometer System is based on the principle of reflectance photometry. When a drop of blood is applied to the strip. It disperses within the hydrophilic mesh. The haemoglobin is extracted out from the RBC and, with the help of reagents present in the strip, is converted into a complex. The optical reflectance is measured which is inversely proportional to the concentration of haemoglobin in the blood sample. This corresponds to the total haemoglobin present in blood. True Hb is an accurate home-use haemoglobin measuring device that you can use at your home at your convenience. True Hb requires just one drop of blood and displays the result in less than a minute.

What are provided in the combo?

- True Hb Meter
- True Hb control strips
- Lancing Device
- Lancets
- True Hb User manual
- Feather Touch User Manual

- Warranty card

True Hb Hemometer Strips

The True Hb Hemometer Strips are thin plastic strips which contain chemical reagents that perform our advanced nano-biochemistry. The total haemoglobin level in a blood sample is found using the True Hb Hemometer Strips on the True Hb Hemometer.

Core Values

- Integrity – We stay honest to ourselves and the team in terms of our strengths, weaknesses, purpose and passion. We as a team believe in commitment, transparency and respect.
- Passion – We believe in productive passion; it motivates and gives an energy boost to our passionate team and helps assist a big cause.
- Perseverance – We remain focused on our purpose; perseverance and consistency are our strengths.
- Creativity – We have the ability to solve an unsolved problem in a new and better way.
- Belief- We have the self-belief that drives us to creatively pursue our passion and purpose belief that drives us to push ourselves beyond our limits.
- Equal respect, irrespective of roles, responsibilities, authority, background, etc.
- Intra and inter-team trust and transparency
- In data they trust! An individual having the highest amount of data, not the highest year of experience wins the discussion.
- Hardworking, inspiring environment
- Each day is enriching and evolutionary in terms of knowledge.

Use cases:

- Pregnancy
- Diabetes, Hypertension & Chronic Kidney Disease
- Anaemia
- GI Bleeding
- Menorrhagia
- Post Menopausal bleeding

User Manual & Technical specification

- True Hb Haemoglobin Monitoring System includes True Hb Hemometer, True Hb Strips (pack of 10, 25,50), User manuals Cable & Charger, Warranty Card, Safety Lancets, Feedback Form
- It is intended for use outside the body (in vitro diagnostic use) by healthcare professionals only.
- Intended User Population :Adults – above16 years; Children – Above 6 months.

- Test principle is based on the principle of reflectance photometry (A drop of blood is applied on the strip. It disperses within the hydrophilic mesh)
- The TrueHb Hemometer must be used with True Hb Strips only.
- Purpose for conducting this test is for :
    - Detection of anaemia
    - Clinical diagnosis and therapeutic interventions
    - Track disease progression
    - Blood loss and efficacy of the therapies involved to restore the Hb levels to normal.
    - Changes involved before and after operations or blood transfusions.
    - Screening of the blood donors to ensure that the Hb content of the donor meets the minimum required Hb for donating blood.
- Normal Haemoglobin Level:
    - Adult Males 13.5-18 g/dL
    - Adult Females 12-16 g/dL
- Samples can be taken from the forearm, upper arm, hand, thigh, calf, or fingers.
- In the event of unexpected Haemoglobin results:
    - Check the expiry date of True Hb Strips.
    - Repeat the test again If problem persists,
    - Discontinue using the True Hb strips and contact the nearest distributor or contact us on toll free number.

- **Warnings :**
    - Use blood sample from the tip of your fingers (Third drop of the blood for the test).
    - Severe dehydration and excessive water loss may cause falsely elevated results.
    - Keep out of children's reach.
    - Do not use it for treating or managing any disease condition.
    - Avoid donating blood in case his/her haemoglobin level is under 12g/dl.
    - Do not use damaged Strips, used fresh strips in case of damages, torn or bent strips.

- **About True Hb Haemoglobin Monitoring System**
    - Display Screen: Displays your test results, date, and time etc.
    - Right, Left, Up and Down Buttons: To move among displayed items.
    - ON/OFF Select button: This button turns the True Hb Hemometer on and off and selects the highlighted item.
    - Test Strip slot: For inserting the test strip.
    - Mini-USB charging port: For charging the battery.
    - Display Indications:
        - Batch code: Indicates the code number of test strip.
        - Battery Symbol: Indicates the battery level.
        - Strip Symbol: Indicates when to insert test strip.
        - Blood Drop Symbol: This symbol appears when the True Hb Hemometeris ready for you to apply blood drop.
        - Test Result Area: Shows the haemoglobin level
        - Measurement Units: Indicates the units for the test result (g/dL)

- Memory: Indicates a test result is being recalled from memory

- **Performing the test**
  - Before calling the patient put on powder-free gloves and keep alcohol swabs or gauze pads ready for use.
  - For maximum and neutral blood flow the patient's fingers or puncture site should be kept straight, and not be bent.
  - Take following precautions to get the right sample: Enabling natural blood flow within the patient's body make the patient sit comfortably on the chair, A young child should be seated in the guardian's lap .
  - Turn ON and charge the True Hb Hemometer it undergoes an auto check and auto- calibration after which the battery level,
  - Strip's Batch code are displayed ,Accept the batch code by pressing the button.
  - When device flash 'strip' symbol on the display, Insert a fresh test-strip.
  - Do not allow fingers/ foreign objects to come in contact with the white test area of the test-strip
  - Immediately after inserting the fresh test strip the display would flash the (Blood) symbol.
  - Prick a body surface, and drop the third hanging drop of blood from on the white test area (Ring or middle finger of left hand should be preferred as the puncture site)
  - Ensure that there is sufficient blood (a minimum of 10µl) to completely cover the white coloured test area
  - The True Hb Hemometer will automatically start sample evaluation and display Within a minute the test result will be displayed (Up to 1000 test result stored)
  - Remove the used test strip and dispose it as per local regulations.

- **Do's and Don'ts**

  - The True Hb Hemometer should be cleaned after each use, remove any excess /residual blood by using non fiber cloth dampened with mild disinfectant.
  - Clean the optical lens regularly by removing the black bottom part of True Hb Hemometer
  - Make sure you do not scratch the optical lens' surface as damaging the lens may lead to inconsistent results.
  - Store your True Hb Hemometer and Strips, and other items in your carrying case after each use in a cool, dry place between 5 to 55 ˚C.
  - Clean your hands properly before performing the test.
  - Check the expiration date of the True Hb Strips .
  - Keep the True Hb Hemometer dry and avoid exposing it to extreme temperatures.
  - Don't refrigerate or freeze the True Hb Hemometer & Strips.
  - Do not bend, cut, deform, or alter True Hb Strips, don't remove strip while the test is running.

- **Specifications**
    - Assay method: Reflectance Photometry
    - Automatic shutoff: Yes
    - Battery life :500 Cycles
    - Display: LCD
    - Measurement units :(g/dL)
    - Memory :1000 blood sample test
    - Operating Relative Humidity: 5% to 95%
    - Operating temperature: 5-55˚C
    - Power Source : One 3.7-volt Lithium rechargeable battery
    - Result Range: 0 to 24 g/dL Sample Capillary or Venous whole blood
    - Storage Conditions: 2˚C to 30℃
    - Testing Time :20 to 59 Sec
    - Blood Volume 10 - 12 µl
    - Weight: 60 grams
    - Dimension : 133*59*10
    - Accuracy : <3% CV
    - Bluetooth and USB connectivity

- **In case of Troubleshooting**
    - True Hb Hemometer does not turn ON : Charge the True Hb Hemometer
    - True Hb Hemometer doesn't charge/ The display is damaged/ Defective True Hb Hemometer: Call customer support.
- **Benefits**
    - Eliminates the hassle of sending blood sample to lab and waiting time.
    - Provide appropriate care by accessing patient test results at point of care.
    - Early identification of asymptomatic condition leading to better patient outcomes

MANAGERIAL DUTIES AND TASKS PERFORMED

During my internship in Bhopal District, Madhya Pradesh, I was assigned as a Management Trainee for the "Anaemia Mukt Bharat program in Districts of Madhya Pradesh." This program aims to reduce the prevalence of anaemia and effectively screen for anaemia in all age groups by utilizing the Wrig Nano Systems device called "True Hb haemoglobinometer" in Health and Wellness Centres (HWC), Primary Health Centres (PHC), Community Health Centres (CHC), and Urban Primary Health Centres (UPHC).

My duties during the internship included:

1. Collaborating with relevant stakeholders at the National Health Mission (NHM) of Madhya Pradesh, such as Janani Shishu Suraksha Karyakaram (JSSK), Rashtriya Bal Swasthya Karyakram (RBSK), and Health and Wellness Centres (HWC), to improve screening efforts in the district.

2. Providing technical and managerial support to the districts, particularly in addressing complaints related to operating and replacing the True Hb haemoglobinometer.

3. Developing and reviewing micro plans for the effective implementation and usage of the digital Hb meter.

4. Strengthening capacity building and providing training to end users, including ASHA workers, Community Health Officers (CHO), and Auxiliary Nurse Midwives (ANM) in various districts of Madhya Pradesh.

5. Liaising with Chief Medical and Health Officers (CHMO), District Program Managers (DPM), and distributors in the district of Madhya Pradesh, and effectively addressing the challenges encountered in the field through subsequent meetings.

6. Conducting product demonstrations of the HB meter in both government and private hospitals with the aim of showcasing its capabilities and generating sales leads.

REFLECTIVE LEARNING

The internship period provided me with valuable learning opportunities and a practical understanding of public health. I gained insights into various aspects of the AMB program, including:

- Developing a foundational understanding of the AMB Program, including its current beneficiaries and the implementation of the 6*6*6 strategy.
- Collaborating with distributors to ensure effective utilization of the Hb meter.
- Conducting field visits and engaging in meetings with officials at the district and block levels.
- Facilitating trainings that enhanced my technical knowledge and practical skills related to anaemia and hand on training of digital haemoglobinometer.
- Developing problem-solving abilities and fostering teamwork to effectively accomplish tasks.
- Engaging in meetings with diverse stakeholders, which improved my communication skills.
- Learning how to navigate the intricacies of working with government entities and addressing challenges during service execution.


TRUEHb
HEMOMETER
For in vitro diagnostic use only
For Hemoglobin Measurement
Quantitative measurement of hemoglobin
1 Test Strip
1 Blood Drop
1 Minute reading
0 - 24g/dl
041
07/2021
06/2023
CE


Batch Code
427
FOR USE ONLY WITH GENUINE
TRUEHb
HEMOMETER
04/2022
03/2024
Made in India
Not to be sold or stored loose

Review of literature

Point-of-care testing using invasive and non-invasive hemoglobinometers Reliable and valid method for estimation of haemoglobin among children 6-59 months was published by Ramaswamy G, Vohra K, Yadav K, Kaur R, Rai T, Jaiswal A, et al. During November 2019 to January 2020, research participants were recruited from the paediatric outpatient department in Haryana, India. Using capillary blood samples, the haemoglobin levels of the research participants were calculated using invasive digital hemoglobinometers (DHs) and Sahli's hemoglobinometer. The children's finger or toe was used to measure the children's haemoglobin levels during non-invasive DH. Hematology analyzer estimates of venous blood haemoglobin were compared to the haemoglobin levels detected in POCTs.

In January 2019, Yadav K, Kant S, Ramaswamy G, Ahamed F, and Vohra K conducted a hospital-based, cross-sectional study in Haryana, India. The study focused on pregnant women attending antenatal clinics at a selected primary health center and subdivisional hospital. The objective was to assess the haemoglobin (Hb) levels of the pregnant women using digital hemoglobinometers and haematology analyzers. Capillary blood samples were collected and analyzed using both devices.To ensure the accuracy and reliability of the digital hemoglobinometers, they underwent testing for bias, limits of agreement (LOA), and validity against a haematology analyzer. This validation study aimed to determine the suitability of digital hemoglobinometers as point-of-care testing devices for estimating haemoglobin levels, specifically in the context of India. The study findings would provide valuable insights into the performance of digital hemoglobinometers in comparison to the gold standard haematology analyzer. This information would be significant for healthcare professionals and policymakers in determining the feasibility and reliability of using digital hemoglobinometers as point-of-care testing devices for haemoglobin estimation in antenatal care clinics.

In a research study conducted by Wangaskar SA, Sahu SK, Majella MG, and Rajaa S, the aim was to determine the prevalence of anaemia and assess compliance with the weekly iron-folic acid supplementation program among adolescents in selected urban schools in Puducherry, India. To gather data, a cross-sectional analytical study design was employed, and information was collected using a semi-structured, self-administered questionnaire that had been pretested for reliability. The participants' haemoglobin levels were measured using a digital haemoglobinometer. The researchers also recorded details regarding the consumption of iron and albendazole tablets. The anaemia status of the participants was evaluated based on the guidelines set by the World Health Organization (WHO). By conducting this study, the researchers sought to obtain a comprehensive understanding of anaemia prevalence among adolescents and assess their compliance with the iron-folic acid supplementation program in an urban setting in Puducherry.

Sutapa Bandyopadhyay Neogi and Himanshu Negandhi conducted a prospective study to evaluate the diagnostic accuracy of three different devices for screening patients with anaemia. The devices included a haemoglobin colour strip (HCS-HLL), a digital haemoglobinometer (TrueHb), and a non-invasive device (TouchHb). The research was conducted at four medical

colleges in India.The study included adult patients (above 18 years) who provided their consent and were undergoing routine investigations. Each patient underwent the reference test, as well as at least one of the index tests using the three devices. The outcome assessors were blinded to the results of the reference test during the evaluation of the index tests.
To determine the diagnostic accuracy, the WHO cut-offs for anaemia were used. The study aimed to assess the sensitivity, specificity, positive predictive value, negative predictive value, and overall accuracy of each device in identifying patients with anaemia.

By conducting this study, the researchers aimed to provide valuable insights into the performance and reliability of these devices in screening for anaemia. The findings would contribute to the understanding of their diagnostic accuracy and their potential for use in clinical settings. This information could be instrumental in guiding healthcare professionals in choosing appropriate screening tools for anaemia and improving patient care outcomes.

Toppo M, Pal DK, and Gour D conducted a hospital-based cross-sectional study comparing a Digital Hemoglobinometer with an automated hematology analyzer for hemoglobin estimation among pregnant women in selected district hospitals of Madhya Pradesh. The study lasted for six months, from April to September 2017, in five High Priority Districts. A total of 260 prenatal women were included from each district. The research aimed to assess the performance and user-friendliness of the Digital Hemoglobinometer in accurately estimating haemoglobin levels. The findings would contribute to understanding its effectiveness as a point-of-care testing device in routine antenatal care. The study results would guide healthcare providers and policymakers in decision-making regarding the adoption and implementation of the Digital Hemoglobinometer in district hospitals of Madhya Pradesh.

Sharma U and Yadav N conducted a study focusing on the prevalence and risk factors of anaemia and zinc deficiency among 4-6-year-old children in Allahabad District, Uttar Pradesh. The study aimed to investigate the undernutrition status and micronutrient levels, specifically iron and zinc, among children in the district. The research design involved assessing the nutritional and micronutrient status of children aged 4 to 6 years in Allahabad. The study findings would provide insights into the prevalence of anaemia and zinc deficiency, as well as identify potential risk factors associated with these conditions among young children in the district. The results of this study would contribute to understanding the nutritional needs and challenges faced by children in Allahabad, helping to inform interventions and strategies to improve their health and well-being.

RATIONALE

The rationale of this study is to address the limited number of studies conducted in India regarding the use of digital haemoglobinometers in government healthcare facilities across various districts of Madhya Pradesh (M.P.). The objective is to explore the experiences of healthcare workers and stakeholders who have utilized these digital devices for screening anaemia.

Traditional methods were being employed for anaemia screening, but they are time-consuming and may lack accuracy. By shifting efforts towards the use of digital haemoglobinometers, faster and more precise screening can be achieved. This will enable early interventions for anaemia, which is crucial for improving patient outcomes.

If the issue of early detection is not effectively addressed, it is anticipated to have a significant impact on the population. Therefore, it is essential to implement point-of-care testing (POCT) using digital haemoglobinometers as a necessary intervention to alleviate the burden of anaemia.

By conducting this study and gaining insights from healthcare workers and stakeholders, it is expected to contribute to the advancement of anaemia screening practices in government facilities in Bhopal zone of M.P. The findings will provide valuable information to support the adoption and implementation of digital haemoglobinometers, leading to improved quality of life for patients across all age groups.

Additionally, conducting this study will fill a critical research gap in the Indian context by focusing specifically on the experiences of healthcare workers and stakeholders using digital haemoglobinometers in government facilities in various in Bhopal zone of M.P. By understanding their perspectives, challenges, and successes with these devices, valuable insights can be gained regarding their feasibility, usability, and effectiveness in real-world settings. This research will not only contribute to the existing body of knowledge on digital haemoglobinometers but also provide evidence-based recommendations for their widespread adoption and integration into routine anaemia screening programs. Ultimately, this study aims to promote early detection of anaemia, facilitate prompt interventions, and improve the overall quality of life for individuals affected by this condition in in Bhopal zone of M.P and potentially serve as a model for other regions in India facing similar challenges.

Research Question

Does the utilization of a digital haemoglobin meter act as a point-of-care testing (POCT) device For early detection of anaemia?

The introduction of digital haemoglobinometers has proven to be beneficial in the detection of anaemia in inaccessible areas. These portable devices have revolutionized the screening process by providing quick results within seconds. This speed is crucial in remote and underserved regions where access to healthcare facilities may be limited. By enabling early detection of anaemia, these devices facilitate prompt intervention and treatment, preventing further complications associated with the condition. Their portability allows healthcare providers to reach out to communities that were previously difficult to access, ensuring that even individuals in remote areas receive timely screening and appropriate care. Overall, the digital haemoglobinometers have significantly contributed to improving the identification and management of anaemia in inaccessible regions, ultimately enhancing public health outcomes.

To answer this research question, the following sub-questions could be considered:

How will knowledge and awareness of digital haemoglobin meter help in detection of anaemia?

Does a digital haemoglobin meter help in the early detection of anaemia?

What are the advantages of using a digital haemoglobin meter for anaemia screening?

Can a digital haemoglobin meter provide quick results for anaemia screening saving doctor and patient time?

Does the utilization of a digital haemoglobin meter improve the timely treatment of anaemia?

This study will utilize a quantitative approach, incorporating data collection and analysis methods, to gather information from healthcare providers. The study findings will have significant implications for the development of a framework that explores the utilization of digital haemoglobinometers as POCT devices in Bhopal division, Madhya Pradesh. Moreover, the evaluation will help identify existing gaps to enhance the future utilization of Hb meters for more effective screening and management of anaemia in the region.

Objectives

- To assess knowledge and utilization of digital haemoglobinometer as point of care testing devices by healthcare workers under anaemia mukt Bharat program
- To spread awareness regarding use of digital haemoglobinometer among health care workers in accordance with 6X6X6 strategy by anaemia mukt Bharat

Methodology

This study aims to conduct cross-sectional research in the Bhopal division of Madhya Pradesh, examining the current state of healthcare and gathering insights from healthcare workers. The primary data collected over a three-month period, supplemented by existing feedback obtained through an online Google form, ensuring a comprehensive analysis. Additionally, the study will solely rely on primary data, emphasizing the importance of first-hand information for accurate findings.

- **Study design- Cross sectional study**

  The study design employed for this research was cross-sectional, enabling the collection of data at a single point in time thus provides a snapshot of the current state. This design proved suitable for assessing the knowledge and awareness of HW regarding the effective utilization of digital haemoglobinometers. By utilizing this technology, valuable time can be saved for both patients and healthcare workers, particularly in inaccessible areas. Ultimately, this promotes enhanced screening and treatment of anaemia, leading to improved healthcare outcomes.

- **Study setting- Bhopal division of MP**

  The study will be conducted in Bhopal division of MP

  Districts includes Bhopal, Vidisha, Raisen , Rajgarh, Sehore, Narmadapuram, Harda, Betul

- **Study duration- 3 Months**

  The entire study is for a period of 3 month and data collection span was for a period of 3 months.

- **Study population- Healthcare workers**

  CHO, ASHA, ANM, MPW

- **Selection criteria**-
  - Inclusion criteria- Healthcare workers involved in anaemia screening in the Bhopal division of Madhya Pradesh include professionals such as CHO, ANM, ASHA, and MPW, who are present at HWC and PHC facilities, actively engaged in conducting tests, interpreting results,

providing counselling, and implementing appropriate interventions or referrals.

- Exclusion criteria- Healthcare workers who refuse to provide consent for participation will be excluded from the study, HW outside the geographical scope of Bhopal division in the state of Madhya Pradesh, India

- **Sampling Technique : Convenience sampling**

Was employed in this study, as the available samples were conveniently accessible. The survey was conducted online through the distribution of a google forms questionnaire to the target population, allowing for an efficient and convenient data collection process.

- **Sample size** : For this study was calculated using the formula n = (Z^2 * p * q) / d^2, where n represents the sample size, Z is the standard normal deviate (for an alpha level of 5%, Z is 1.96), p is the population proportion (assumed to be 50%), q is (1 - p), and d is the margin of error (taken as 10%).; n= $(1.96)^2*0.5*0.5/(0.1)^2$

By applying this formula, the calculated sample size was 96.04. However, the actual sample collected for this study consisted of 301 participants.

- **Data Collection: Tools and Technique : Primary data**

Is collected by using pre-structured questionnaire, online survey form., The questionnaire or online survey form serves as a means to capture valuable insights regarding the users' familiarity with digital haemoglobinometers. It also aims to uncover any challenges or issues encountered during their interactions with the device. By analysing this data, researchers can gain a comprehensive understanding of user experiences and identify potential areas for improvement in the usability and functionality of digital haemoglobinometers. The survey included a combination of close-ended, open-ended, and semi-open-ended questions to gather insights on various aspects, such as information sharing, communication, device performance, user acceptability, and the challenges faced by the healthcare workers during the utilization of the haemoglobinometer.

- **Data analysis : Data is analysed through Microsoft Excel 365.Version 2112.**

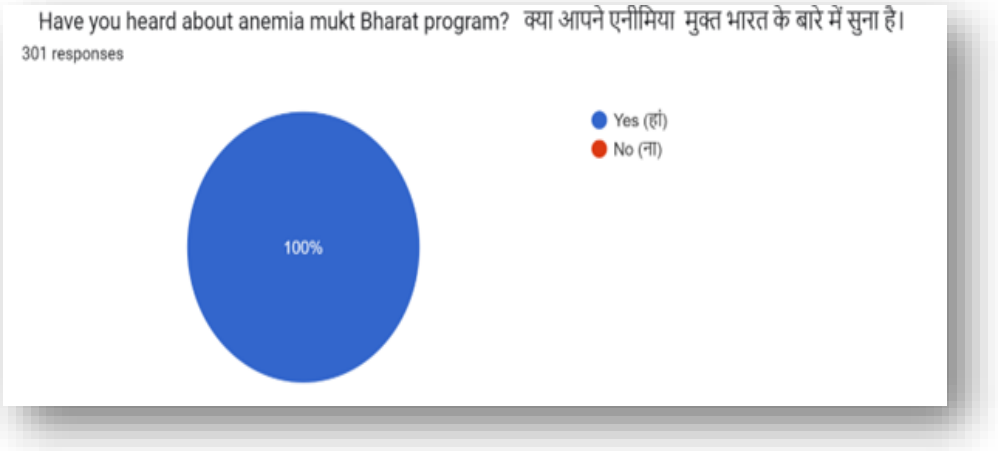
A survey was carried out among healthcare workers (HW) in the Bhopal division of Madhya Pradesh, with a specific focus on those working in HWC and PHC. The collected survey data was analysed using descriptive statistics. For each component of the evaluation, which included factors such as device performance, user acceptability, and challenges faced by the HW, the percentage were calculated to gain a comprehensive understanding of the results.

Ethical consideration: The study is conducted after obtaining approval from student's Ethical Review Board. All data collected is kept confidential and is being used only for the purpose of research. The participation of the respondents is completed on a voluntary basis. Consent is obtained from each respondent who will be willing to participate.

RESULTS

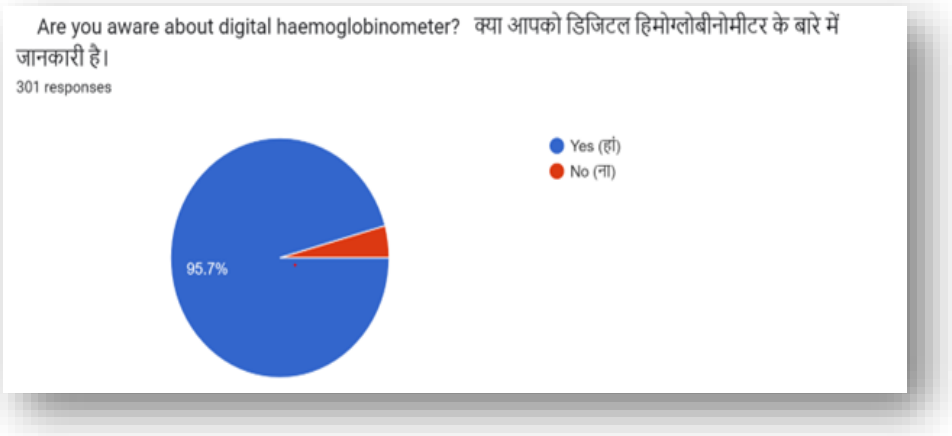
Here is the summary of the feedback received from the end users across various components:

Fig 1 :



Out of the 301 collected samples, all respondents were aware of the Anaemia Mukt Bharat program. The Health Workers (HW) demonstrated a comprehensive understanding of the program, with a positive response rate of 100%. This indicates a high level of awareness and knowledge about the program among the surveyed individuals

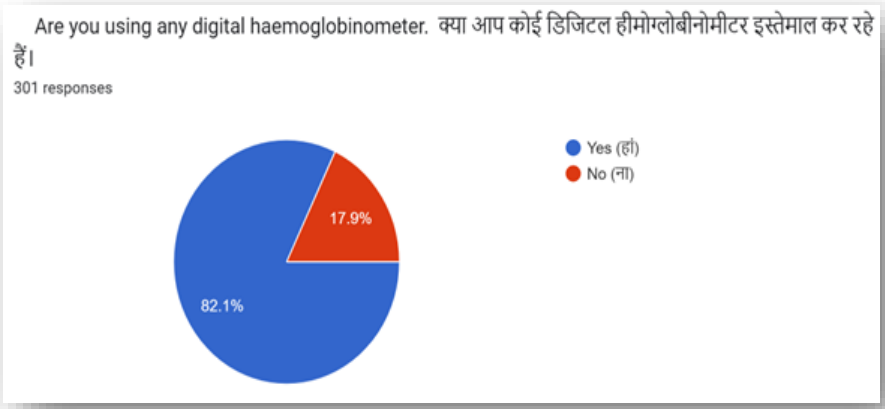
Fig 2 :



Among the Health Workers (HW) surveyed, 95% displayed awareness and knowledge about the digital haemoglobinometer, while the remaining 5% were unfamiliar with it.

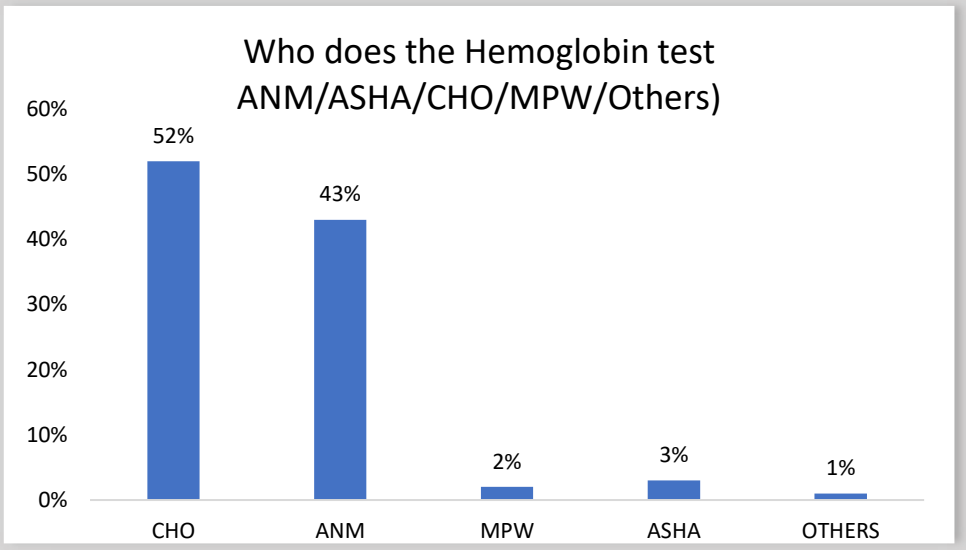
This indicates a high level of awareness and acceptance of the device among the majority of HW.

Fig 3 :



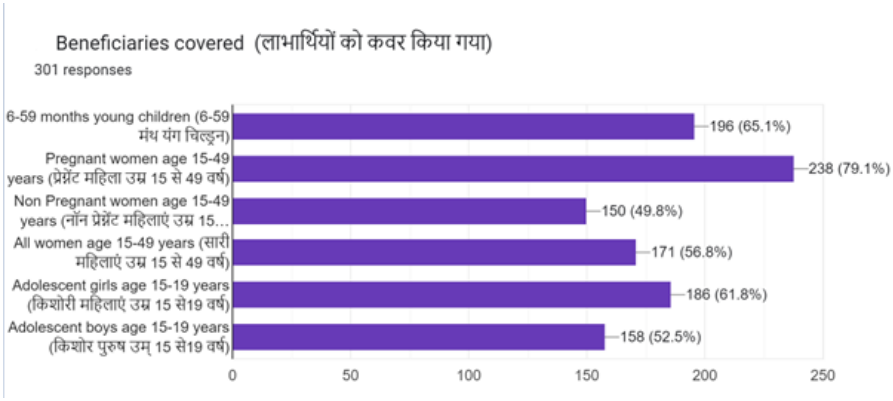
When inquired about the usage of digital haemoglobinometers, 82.1% of the respondents confirmed their familiarity with the device, indicating their active utilization. Conversely, 17.9% of the participants expressed unawareness regarding digital haemoglobinometers. These findings suggest that there is a substantial portion of the surveyed population who may benefit from further education and promotion of the device to increase its adoption and effectiveness.

Fig 4 :



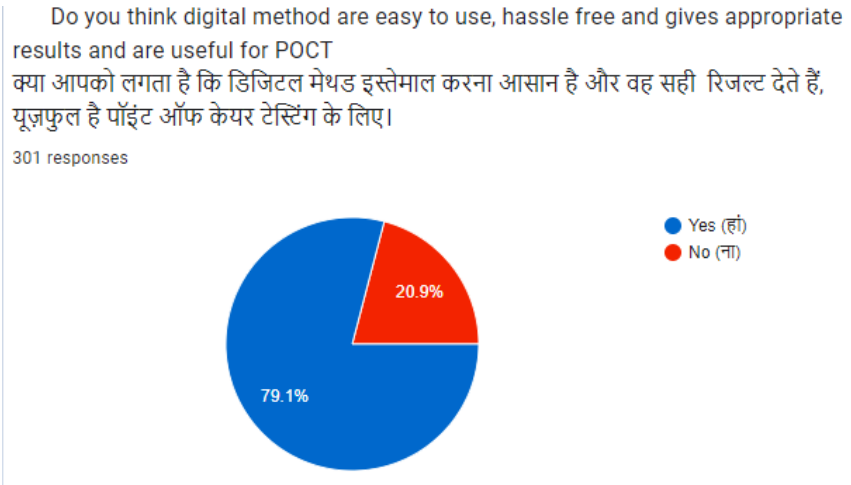
According to a survey conducted on the performance of haemoglobin tests in health institutions, 52% of respondents mentioned that CHO were responsible for conducting the tests. 43% stated that ANM alone conducted the tests, The remaining 2% of respondents indicated that MPW conducted the tests, and 3% mentioned ASHA does the test . Additionally, 1% of respondents cited other individuals as being responsible for performing the haemoglobin tests..

Fig 5 :



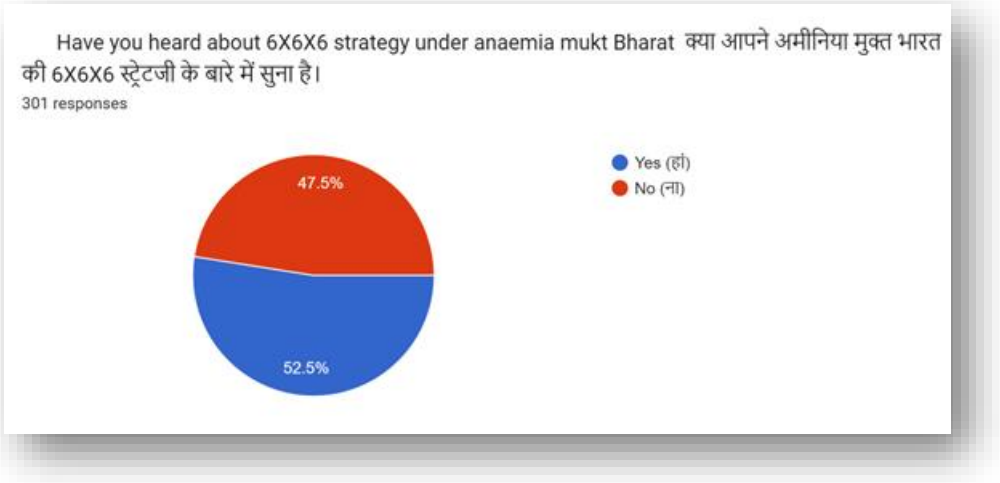
The Anaemia Mukt Bharat program primarily focuses on specific beneficiary groups. The majority of beneficiaries covered include pregnant women aged 15-49 years, accounting for 79.1% of the total. Following closely are young children aged 6-59 months, with a coverage rate of 65.1%. Adolescent girls aged 15-19 years are also a significant target group, with a coverage rate of 61.8%. Additionally, the program extends its reach to all women aged 15-49 years, covering 56.8% of this demographic. Other beneficiary groups, such as adolescent boys aged 15-19 years and non-pregnant females aged 15-49 years, have coverage rates of 52.5% and 49.8%, respectively.

Fig 6 :



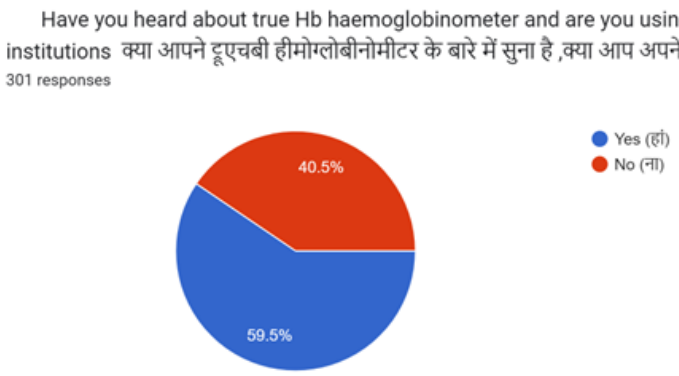
When questioned about the ease of usage, hassle-free operation, accurate results, and utility for POCT, 79.1% of the respondents agreed with these statements regarding digital haemoglobinometers. However, 20.9% of the participants expressed disagreement with these assertions. These findings highlight the overall positive perception and acceptance of the device among the majority of the surveyed individuals, indicating its effectiveness in providing convenient and reliable results at the point of care. Efforts can be directed towards addressing the concerns of the minority who expressed disagreement, aiming to improve their understanding and satisfaction with the digital haemoglobinometer.

Fig 7 :



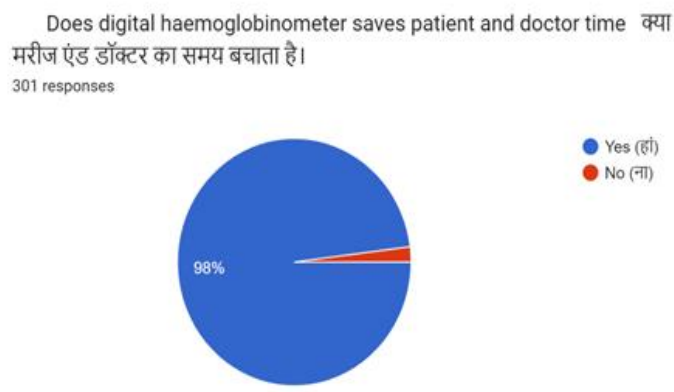
The survey results indicated that more than half of the participants, accounting for approximately 52.5%, were familiar with the "6*6*6 strategy" implemented in the Anaemia Mukt Bharat campaign, highlighting a notable level of awareness. However, it is noteworthy that a considerable proportion, around 47.5%, lacked knowledge regarding this specific strategy.

Fig 8 :



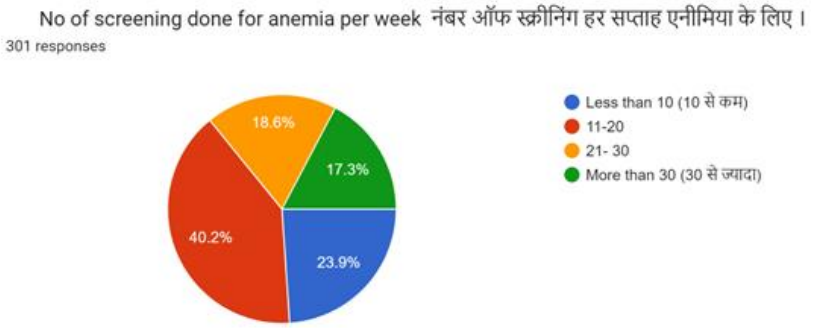
When inquired about their familiarity with the True Hb hemoglobinometer and its usage in their health institutions, 59.5% of respondents acknowledged being aware of it, while 40.5% indicated they had not heard of it. while a considerable number of respondents have heard about and are using the True Hb hemoglobinometer, there is still room for increased awareness and adoption within the remaining percentage.

Fig 9 :



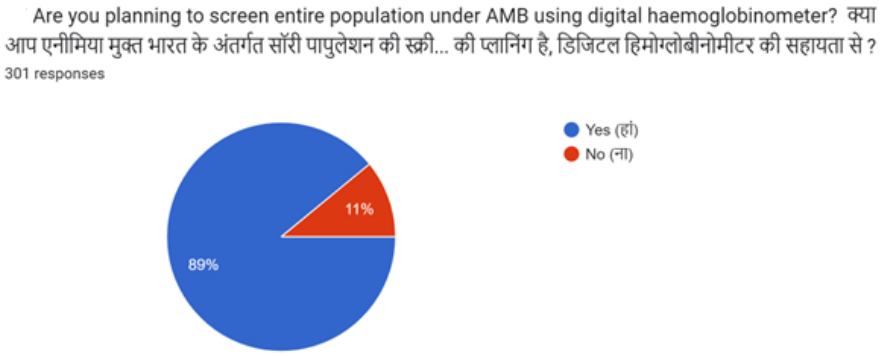
The survey results clearly indicate a strong consensus among respondents, with an overwhelming 98% agreeing that digital hemoglobinometers contribute to time-saving benefits for both patients and doctors. This underscores the perceived efficiency and convenience offered by these devices in healthcare settings. The small minority of 2% who expressed disagreement suggests the need for further investigation into their concerns or reservations, which could potentially shed light on specific considerations or limitations related to the use of digital hemoglobinometers.

Fig 10 :



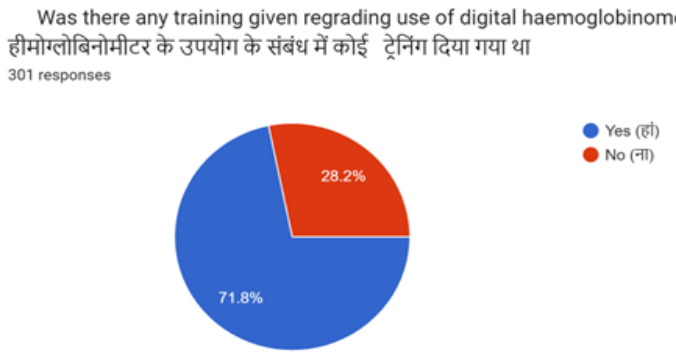
Around 40.2% of healthcare workers reported conducting 11-20 screenings for anaemia per week, while 23.9% stated that they performed less than 10 screenings weekly. Approximately 18.6% of healthcare workers mentioned conducting around 21-30 screenings per week, and 17.3% reported conducting more than 30 screenings weekly for anaemia. The majority of healthcare workers surveyed conducted a moderate number of anaemia screenings per week, with a significant portion performing screenings within the range of 11-20 per week.

Fig 11:



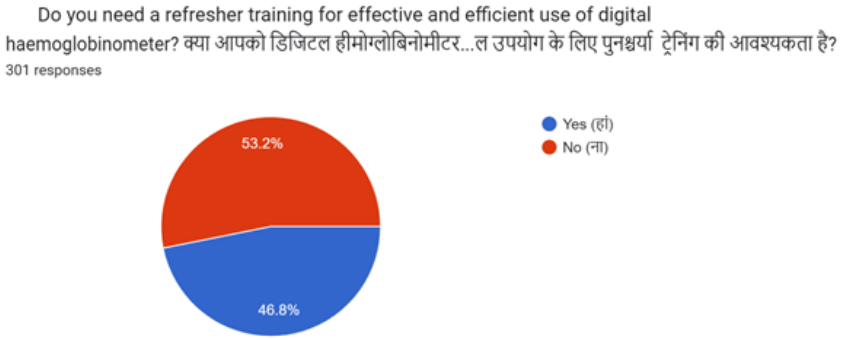
When inquired about screening the entire population under AMB ,89% of healthcare workers responded affirmatively, indicating their agreement with the approach. However, 11% of healthcare workers expressed their disagreement with screening the entire population. These results suggest that a majority of healthcare workers support the idea of implementing comprehensive screening for anaemia across the population, while a smaller percentage holds reservations about this approach.

Fig 12:



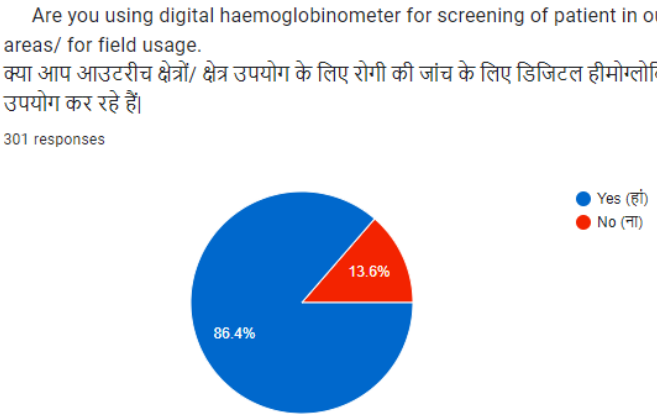
Out of the participants surveyed, 71.8% acknowledged receiving training for the use of digital haemoglobinometers, while 28.2% stated that they did not undergo any training in this regard. These findings indicate that a significant majority of individuals have been provided with training on operating digital haemoglobinometers, underscoring the importance placed on equipping healthcare workers with the necessary skills. In conclusion, there is a need to ensure that all healthcare workers receive adequate training to maximize the effective implementation of digital haemoglobinometers and improve patient care.

Fig 13 :



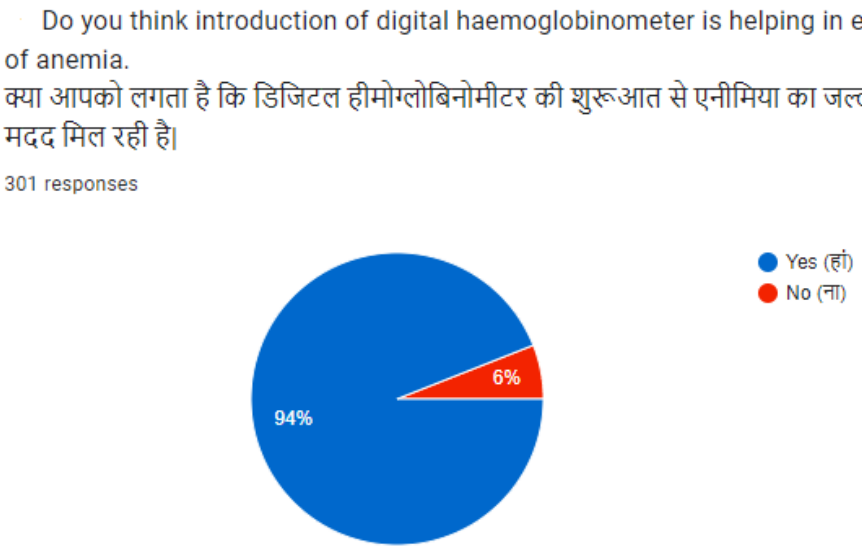
When questioned about the necessity of refresher training, 46.8% of respondents expressed that they did not require such training, while the remaining 53.2% stated that they also did not need it. a notable majority of healthcare workers (53.2%) responded that they do not perceive a need for refresher training. This suggests that a significant number of individuals feel adequately equipped and knowledgeable in their respective fields, potentially due to recent training or continuous professional development activities.

Fig 14 :



The utilization of digital haemoglobinometers for screening patients in outreach areas is prevalent among 86.4% of healthcare workers, while 13.6% do not employ this technology for field usage. These findings indicate that a significant majority of healthcare workers (86.4%) have adopted digital haemoglobinometers as a valuable tool for conducting screenings in outreach areas, highlighting the importance of this technology in enhancing healthcare delivery and addressing anaemia-related concerns in remote locations.

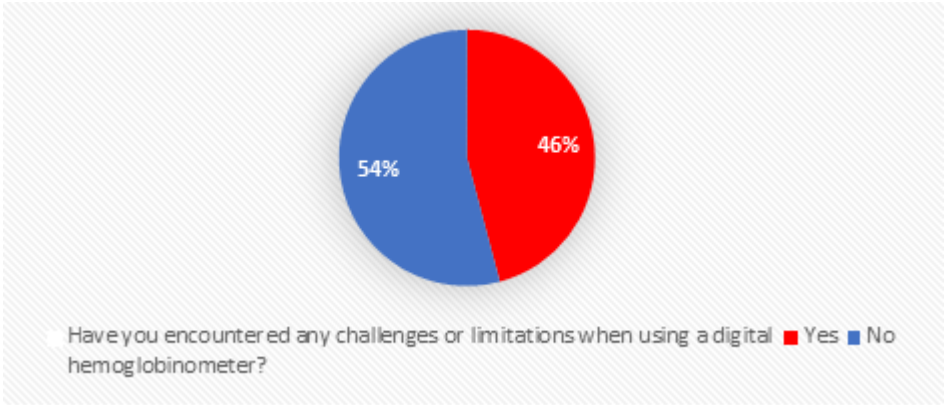
Fig 15 :



These findings highlight that a majority of the participants (94%) recognized the positive contribution of digital haemoglobinometers in enabling early detection of anaemia, indicating the effectiveness of this technology in improving healthcare outcomes. Conversely, 6% of respondents disagreed with this statement, signifies their

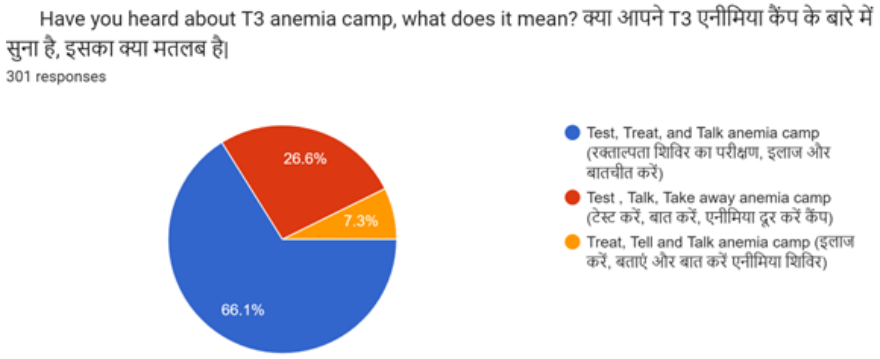
acknowledgement of its potential benefits, and reinforces the significance of this technology in enhancing anaemia screening and diagnosis.

Fig 16:



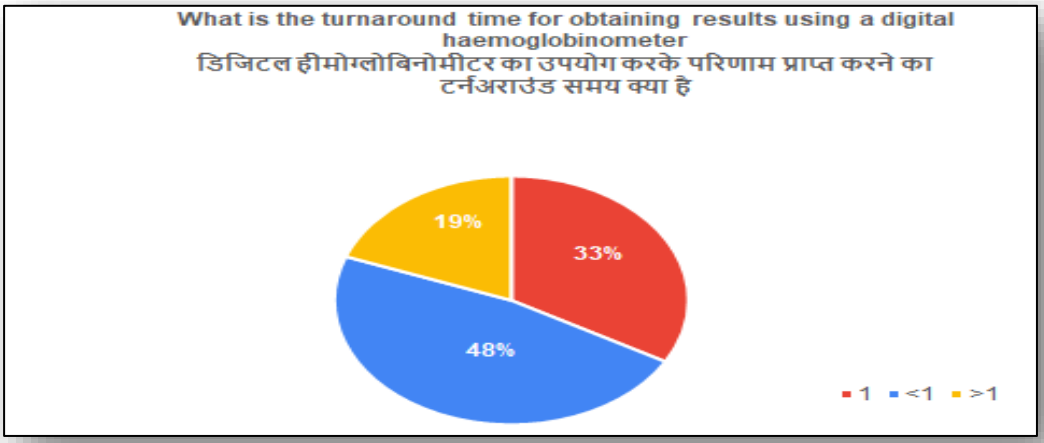
The findings indicated that a notable proportion of respondents, accounting for approximately 46%, faced troubleshooting problems such as encountering an E90 error, reading variations, and difficulties in turning on the digital hemoglobinometer. These issues were attributed to inadequate training in utilizing the device. On the other hand, the majority, comprising roughly 54% of participants, did not encounter any challenges during the usage of the device. , the survey highlights the importance of comprehensive training in effectively using the digital hemoglobinometer to minimize troubleshooting problems and ensure optimal utilization of the device.

Fig 17 :



These findings indicate that a significant majority (66.1%) of the participants were informed about the T3 anaemia camp, highlighting the dissemination of information and awareness regarding this initiative. However, it is worth noting that a notable percentage (33.9%) still lacked knowledge about the camp, indicating the need for further outreach and communication efforts. The results emphasize the importance of continuing efforts to raise awareness about the T3 anaemia camp, ensuring that more individuals become informed and can benefit from the services provided.

Fig 18 :



When inquired about the turnaround time of the digital haemoglobinometer being utilized, the survey revealed that only 33% of respondents provided the accurate response, stating that it takes within a minute to obtain the results. In contrast, 48% of participants indicated that the process takes less than a minute, while 19% mentioned that it takes more than a minute. These findings highlight the majority's perception that the digital haemoglobinometer provides rapid results, with a significant portion of respondents underestimating the actual time required.

Discussion:

The survey results provide valuable insights into the awareness, utilization, and perception of the Anaemia Mukt Bharat program and digital haemoglobinometers among healthcare workers. Overall, the findings indicate a high level of awareness and knowledge about the Anaemia Mukt Bharat program, with a positive response rate of 100% among the surveyed individuals. This suggests that the program has effectively reached the target audience and healthcare workers have a comprehensive understanding of its objectives.

Regarding digital haemoglobinometers, 95% of healthcare workers displayed awareness and knowledge about the device, indicating a high level of acceptance and familiarity. However, 17.9% of the participants expressed unawareness regarding digital haemoglobinometers, indicating a need for further education and promotion to enhance their adoption and effectiveness.

The survey also highlighted the shared responsibility between Community Health Officers (CHO) and Auxiliary Nurse Midwives (ANM) in conducting haemoglobin tests, with 39% of respondents mentioning both CHO and ANM as responsible parties. This information is crucial for effective coordination and collaboration between healthcare workers in implementing the Anaemia Mukt Bharat program. The coverage rates of different beneficiary groups under the program were also explored, with pregnant women aged 15-49 years being the primary focus, followed by young children aged 6-59 months and adolescent girls aged 15-19 years. These findings provide valuable insights for targeting and prioritizing interventions to address anaemia in vulnerable populations. The survey also assessed the ease of usage, accurate results, and utility of digital haemoglobinometers for point-of-care testing. The majority of respondents agreed with these statements, indicating a positive perception and acceptance of the devices. However, a minority expressed disagreement, highlighting the need to address their concerns and improve their understanding and satisfaction with the technology.

Similar hospital-based, cross-sectional study conducted in Haryana, India in January 2019, Yadav et al. assessed the haemoglobin levels of pregnant women attending antenatal clinics at a primary health center and subdivisional hospital. The findings would be valuable for healthcare professionals and policymakers, providing insights into the suitability of digital hemoglobinometers as point-of-care testing devices for haemoglobin estimation in antenatal care clinics. Toppo et al. conducted a hospital-based cross-sectional study in selected district hospitals of Madhya Pradesh, India. The study aimed to compare the performance and user-friendliness of digital hemoglobinometers with automated haematology analysers for haemoglobin estimation among pregnant women. The research included a total of 260 prenatal ladies from each of the five High Priority Districts of Madhya Pradesh. The study was conducted over a period of six months, from April to September 2017.

The findings of both studies conducted by Yadav et al. in Haryana and Toppo et al. in Madhya Pradesh show similarities with this research and expressed agreement with the ease of usage, hassle-free operation, accurate results, and overall utility of digital haemoglobinometers for point-of-care testing. Furthermore, they regarded these devices as suitable for efficiently screening patients in outreach areas. These findings emphasize the positive perception and acceptance of digital haemoglobinometers among healthcare workers, highlighting their effectiveness in facilitating accessible and reliable healthcare services in remote settings.

Suggestions:

Based on the survey findings, several suggestions can be made to improve the implementation of the Anaemia Mukt Bharat program and enhance the utilization of digital haemoglobinometers:

- Education and Training: Efforts should be made to provide comprehensive education and training to healthcare workers regarding the Anaemia Mukt Bharat program, its objectives, and the effective utilization of digital haemoglobinometers. This will ensure that healthcare workers are well-informed and equipped with the necessary skills to deliver quality services.
- Awareness Campaigns: There is a need for targeted awareness campaigns to increase the knowledge and understanding of digital haemoglobinometers among healthcare workers and the general population. These campaigns should emphasize the benefits and accuracy of the devices, addressing any misconceptions or reservations.
- Continued Support and Monitoring: Regular support, supervision, and monitoring should be provided to healthcare workers to address any challenges or troubleshooting issues they may face while using digital haemoglobinometers. This will help maximize their effectiveness and minimize errors.
- Expansion of Coverage: Efforts should be made to expand the coverage of the Anaemia Mukt Bharat program to reach a wider population, including beneficiaries who may currently be overlooked. This will help ensure that the program's objectives of reducing anaemia are achieved on a larger scale.

Key Challenges and Risks:

While the survey results provide promising insights, there are several key challenges and risks that need to be addressed for the successful implementation of the Anaemia Mukt Bharat program and the effective utilization of digital haemoglobinometers:

- Limited Awareness and Training: The survey highlighted a percentage of healthcare workers who lacked awareness and knowledge about digital haemoglobinometers. Insufficient training may hinder their ability to use the devices accurately, leading to potential errors and misinterpretation of results.
- Resistance to Change: Some healthcare workers may be resistant to adopting new technologies or approaches, including the utilization of digital haemoglobinometers. Overcoming this resistance and promoting acceptance among healthcare workers is crucial for the widespread adoption of these devices.
- Maintenance and Upkeep: Digital haemoglobinometers require regular maintenance and calibration to ensure accurate results. Adequate infrastructure and resources must be available to support the maintenance and upkeep of these devices, which can pose challenges in resource-constrained settings.
- Equity and Accessibility: Ensuring equitable access to digital haemoglobinometers and the Anaemia Mukt Bharat program may be challenging, particularly in remote or marginalized areas. Efforts should be made to bridge the gap and provide equal access to healthcare services for all individuals.

Conclusion:

The findings from this survey provide valuable insights into the awareness, utilization, and perception of the Anaemia Mukt Bharat program and digital haemoglobinometers among healthcare workers. The results indicate a high level of awareness and knowledge about the program, suggesting successful dissemination of information among the target audience. The majority of healthcare workers also displayed acceptance and familiarity with digital haemoglobinometers, indicating their potential as effective tools for anaemia screening.
However, the survey identified areas that require attention to maximize the program's impact. Firstly, there is a need for comprehensive education and training to address the portion of healthcare workers who expressed unawareness regarding digital haemoglobinometers. By providing targeted training programs, healthcare workers can be equipped with the necessary skills to fully utilize the benefits of these devices. This will enhance the effectiveness of anaemia screening and diagnosis.
Secondly, efforts should be directed towards addressing concerns and reservations among healthcare workers. The survey revealed a minority who expressed disagreement with the utility of digital haemoglobinometers. By addressing their concerns and improving their understanding and satisfaction with the technology, healthcare workers' acceptance and utilization of the devices can be further enhanced.
Moreover, the survey emphasized the importance of coordination and collaboration between Community Health Officers (CHO) and Auxiliary Nurse Midwives (ANM) in conducting haemoglobin tests. This shared responsibility is crucial for ensuring comprehensive anaemia screening coverage and effective implementation of the Anaemia Mukt Bharat program. Strengthening coordination mechanisms and fostering collaboration among healthcare workers will improve program outcomes.

Furthermore, the survey findings highlighted the need to expand coverage to reach underserved populations. While the program primarily focused on pregnant women aged 15-49 years, targeting other beneficiary groups such as adolescent boys and non-pregnant females aged 15-49 years is essential. Targeted interventions and awareness campaigns should be implemented to ensure a comprehensive approach to anaemia prevention and control.
In conclusion, the survey results provide valuable insights for policymakers and program implementers. By addressing the identified areas for improvement, such as comprehensive education and training, addressing concerns and reservations, and expanding coverage to underserved populations, the Anaemia Mukt Bharat program can achieve its objectives of reducing anaemia and improving the health outcomes of vulnerable populations. The utilization of digital haemoglobinometers holds significant potential for early detection and effective management of anaemia. Continued support, monitoring, and expansion of the program will contribute to better healthcare delivery and improved overall health .

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Annexures :

Questionnaire:

Research Topic: Digital hemoglobinometers as point-of-care hemoglobin testing devices in Bhopal division of Madhya Pradesh

Informed Consent Form

I confirm that I have understood all the details regarding the research, and I was given the opportunity to ask any questions regarding the same. I have understood that it is my personal choice to participate in this research and I am free to withdraw from the research. at any given point of time without giving any reason. I have also understood that all my personal information and answers given by me will be confidential and it would not be revealed at any point. I have also understood that all the information given by me will be strictly used for the purpose of research and no other ulterior motives.

Hence, I give my consent to participate in this research.

Respondent agrees to be interviewed _____(start interview)

Respondent doesn't give consent_____(End the interview)

Signature /verbal consent of interviewers_____

Date_____

S. No	Question	Option	
1.	Date		
2.	District		
3.	Name of health institution	_____	
4.	Name and designation of the respondent	_____	
5.	Have you heard about anemia mukt Bharat program	(Yes/ No)	
6.	Are you aware about digital haemoglobinometer	(Yes/ No)	
7.	Are you using any digital haemoglobinometer	(Yes/ No)	
8.	Who does the test (ANM/ASHA/CHO/MPW)	If others please specify _____	
9	Who are the beneficiaries covered under Anemia Mukt Bharat by you:	**Beneficiaries**	**Yes (tick mark)**
		Children aged 6-59 months	
		Pregnant women aged 15-49 years	
		Non Pregnant women aged 15-49 years	
		All women aged 15-49 years	
		Adolescent girls aged 15-19 years	
		Adolescent boys aged 15-19 years	
10.	Do you think digital method are easy to use, hassle free and gives appropriate results and are useful for POCT	(Yes/No)	
11.	Have you heard about 6X6X6 strategy under anaemia mukt Bharat	(Yes/No)	
12.	Have you heard about true Hb haemoglobinometer and are you using it in your health institutions	(Yes/No)	
13.	Does digital haemoglobinometer saves patient and doctor time	(Yes/No)	
14.	No of screening done for anemia per week	• Less than 10 • 11-20 • 21- 30 • More than 30	
15.	Are you planning to screen entire population under AMB using digital haemoglobinometer	(Yes/No)	
16.	Was there any training given regrading use of digital haemoglobinometer	(Yes/No)	

17.	Do you need a refresher training for effective and efficient use of digital haemoglobinometer	(Yes/No)	
18.	Are you using digital haemoglobinometer for screening of patient in outreach areas/ for field usage	(Yes/No)	
19.	Do you think introduction of digital haemoglobinometer is helping in early detection of anemia	(Yes/No)	
20.	Have you encountered any challenges or limitations when using a digital hemoglobinometer?	Please specify_____	
21.	Have you heard about T3 anemia camp , what does it mean	• Test, Treat, and Talk anemia camp • Test , Talk, Take away anemia camp • Treat, Tell and Talk anemia camp	
22.	What is the turnaround time for obtaining results using a digital haemoglobinometer	Please specify____	

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