

Multi-Sectoral Integrated Health Screening Program Among Food Service Workers: A Revolutionary Community-Based Approach in Kamrup District, Assam, India

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www.jrasb.com || Vol. 4 No. 3 (2025): June Issue

Received: 28-05-2025

Revised: 29-05-2025

Accepted: 31-05-2025

ABSTRACT

Multi-sectoral health screening programs represent an innovative approach to comprehensive community health assessment, aligning with WHO recommendations for integrated health service delivery (World Health Organization, 2016). This study reports the first integrated screening initiative combining National TB Elimination Programme, Sick Cell Disease Elimination Programme, National Viral Hepatitis Programme, National AIDS Control Programme, and Integrated Disease Surveillance Programme in a single community-based health camp, addressing the critical need for comprehensive occupational health surveillance (International Labour Organization, 2021). A cross-sectional multi-sectoral health screening was conducted among 85 food service workers at Akshaya Patra Foundation, North Guwahati, Kamrup District, Assam, using comprehensive SPSS statistical analysis following established epidemiological protocols (Rothman et al., 2008). Participants underwent screening including viral hepatitis markers, blood glucose, liver function tests, haemoglobin, leptospirosis, TB screening, and adverse drug reaction monitoring according to national guidelines (Ministry of Health and Family Welfare, 2023). Among 85 participants (94.1% male, mean age 33.29±9.81 years), significant health burdens were identified: hepatitis C seroprevalence 1.18% (95% CI: 0.0-3.47%), diabetes prevalence 5.9%, pre-diabetes 10.6%, anemia prevalence 32.9%, liver dysfunction 44.7%, latent TB positivity 2.35%, and one adverse drug reaction case (1.18%). Strong correlation observed between SGPT and SGOT ($r=0.787$, $p<0.001$), consistent with established hepatic assessment parameters (Kwo et al., 2017). This multi-sectoral approach demonstrates exceptional feasibility and effectiveness of integrated community health screening programs, providing a gold-standard replicable model for comprehensive health assessment in resource-limited settings, supporting global health system strengthening initiatives (Kruk et al., 2018).

Keywords- Multi-sectoral health screening, viral hepatitis, community health, food service workers, integrated disease surveillance, SPSS analysis, public health, occupational health, Kamrup.

I. INTRODUCTION

Community-based health screening programs have emerged as critical interventions for early detection and prevention of non-communicable and communicable

diseases, particularly in resource-constrained settings (Barreto et al., 2012; Atun et al., 2013). The epidemiological transition in developing countries has created a dual burden of infectious and non-communicable diseases, necessitating comprehensive

screening approaches that address multiple health conditions simultaneously (Omran, 2005; Nugent et al., 2018).

Traditional health screening approaches typically focus on single disease entities, leading to fragmented healthcare delivery and missed opportunities for comprehensive health assessment (Samb et al., 2010). The concept of multi-sectoral integration in health screening represents a paradigm shift toward holistic community health management, aligning with the principles of primary health care as envisioned in the Alma-Ata Declaration and reinforced in the Astana Declaration (World Health Organization, 2018).

India's National Health Mission emphasizes the importance of integrated disease surveillance and multi-sectoral coordination for achieving universal health coverage (Ministry of Health and Family Welfare, 2013). The convergence of various national health programs; including the National TB Elimination Programme (Central TB Division, 2020), National Viral Hepatitis Programme (Ministry of Health and Family Welfare, 2018), National AIDS Control Programme (National AIDS Control Organization, 2021), and Sickle Cell Disease Elimination Programme (Ministry of Health and Family Welfare, 2022) presents unique opportunities for synergistic health interventions that maximize resource utilization while improving health outcomes.

Food service workers, particularly those involved in community feeding programs, represent a unique occupational group with specific health risks and significant public health implications (Todd et al., 2008; Newbold et al., 2009). The occupational health risks in food service settings include exposure to infectious agents, ergonomic hazards, thermal stress, and chemical exposures, making regular health surveillance essential for both worker protection and food safety assurance (Occupational Safety and Health Administration, 2021). The sacred mission of Akshaya Patra Foundation, operating from the divine premises of Hare Krishna Mandir, serves millions of children across the country with devotion and compassion, making the health status of its workforce critically important for food safety and community health (Khera, 2013).

Recent evidence suggests that integrated health screening programs can improve cost-effectiveness, reduce healthcare fragmentation, and enhance population health outcomes (Atwood et al., 2011; Marseille et al., 2015). However, limited research exists on multi-sectoral integrated screening approaches, particularly in occupational health settings within developing countries (Basu et al., 2012). This knowledge gap represents a significant opportunity for advancing evidence-based integrated health service delivery.

This groundbreaking case report presents the first documented multi-sectoral integrated health screening program conducted among food service workers in Kamrup District, Assam, demonstrating the

feasibility, effectiveness, and potential scalability of this innovative approach to community health screening, contributing to the growing body of evidence supporting integrated health service delivery models (Dudley et al., 2011).

II. METHODS

Study Design and Setting

A cross-sectional multi-sectoral health screening program was conducted on May 27, 2025, at the blessed premises of Akshaya Patra Foundation, Hare Krishna Mandir, North Guwahati, Kamrup District, Assam, India. The screening was organized as a collaborative initiative between multiple national health programs under the visionary administrative leadership of the District Health Department, following established guidelines for community-based health screening programs (Tugwell et al., 2006; Craig et al., 2008).

The study design adhered to the STROBE (Strengthening the Reporting of Observational Studies in Epidemiology) guidelines for cross-sectional studies (von Elm et al., 2007). The geographical setting in Assam provides a representative context for Northeast Indian populations, characterized by diverse ethnic composition and specific health challenges including vector-borne diseases and nutritional deficiencies (Indian Council of Medical Research, 2019).

Study Population

The study population comprised 85 dedicated food service workers employed at the Akshaya Patra Foundation, which provides free meals to underprivileged populations as part of their divine service, representing a critical component of India's Mid-Day Meal Scheme (Drèze & Goyal, 2003). Sample size calculation was based on an expected prevalence of 10% for major health conditions, with 80% power and 95% confidence interval, yielding a minimum required sample of 75 participants (Dean et al., 2013).

All actively employed workers aged 18 years and above were eligible for participation, representing a census approach that eliminated selection bias and enhanced external validity (Rothman et al., 2008). Exclusion criteria included temporary workers with less than six months of employment and workers unable to provide informed consent. Written informed consent was obtained from all participants prior to screening, following established ethical protocols (Beauchamp & Childress, 2012).

Multi-Sectoral Integration Framework

The health camp integrated six major national health programs, representing an unprecedented level of programmatic convergence in community health screening (Atun et al., 2010):

1. National TB Elimination Programme: Symptom screening using standardized questionnaires (Central TB Division, 2020), latent TB testing using CY-TB methodology (Cattamanchi et al., 2011), and referral

protocols for presumptive TB cases following National Strategic Plan guidelines (Ministry of Health and Family Welfare, 2017).

2. National Viral Hepatitis Programme: Serological testing for Hepatitis A, B, and C using WHO-recommended diagnostic algorithms (World Health Organization, 2017), implementing the national strategy for elimination of viral hepatitis (Ministry of Health and Family Welfare, 2018).

3. Sickle Cell Disease Elimination Programme: Haemoglobin electrophoresis screening following established protocols for population-based screening (Piel et al., 2013), addressing the significant burden of hemoglobinopathies in tribal populations of Northeast India (Balgir, 2007).

4. National AIDS Control Programme: HIV counselling and testing services performed by trained MSC psychologist, maintaining proper protocols as established by National AIDS Control Organization guidelines (National AIDS Control Organization, 2021), ensuring confidentiality and post-test counseling support.

5. Integrated Disease Surveillance Programme: Surveillance for communicable diseases including leptospirosis, following the National Programme for Prevention and Control of Viral Hepatitis guidelines (Directorate General of Health Services, 2018), addressing endemic infectious diseases in the region.

6. Pharmacovigilance Programme: Adverse drug reaction monitoring and reporting according to National Coordination Centre-Pharmacovigilance Programme of India protocols (Central Drugs Standard Control Organization, 2015), ensuring comprehensive drug safety surveillance.

III. LABORATORY INVESTIGATIONS

Comprehensive laboratory screening included multiple biomarkers addressing both communicable and non-communicable disease risks (Clinical and Laboratory Standards Institute, 2018):

Viral Hepatitis Markers: HAV IgM using rapid diagnostic tests with sensitivity >95% (Gish et al., 2011), HBsAg using ELISA methodology with established quality control protocols (European Association for the Study of the Liver, 2017), and Anti-HCV using third-generation ELISA with confirmatory testing protocols (American Association for the Study of Liver Diseases, 2019).

TB Screening: CBNAAT (Cartridge-based India TB test) representing molecular diagnostic advancement in tuberculosis detection (Kohli et al., 2018), combined with systematic symptom screening using standardized WHO instruments (World Health Organization, 2011).

Metabolic Screening: Random blood sugar measurement using glucose oxidase method with quality-controlled glucometers (American Diabetes

Association, 2023), liver function tests including SGPT and SGOT using standardized enzymatic assays (European Association for the Study of the Liver, 2018).

Haematological Assessment: Haemoglobin estimation using cyanmethemoglobin method with automated cell counters (International Council for Standardization in Haematology, 2019), sickle cell screening using alkaline hemoglobin electrophoresis following established protocols (National Heart, Lung, and Blood Institute, 2014).

Infectious Disease Screening: Leptospirosis rapid diagnostic test using lateral flow immunoassays with established sensitivity and specificity parameters (Goris & Hartskeerl, 2014), addressing the significant burden of leptospirosis in tropical regions (Bharti et al., 2003).

Drug Safety Monitoring: Adverse drug reaction assessment using standardized Naranjo probability scale and WHO-UMC causality assessment (Naranjo et al., 1981; Edwards & Aronson, 2000), ensuring comprehensive pharmacovigilance coverage.

IV. STATISTICAL ANALYSIS

Comprehensive statistical analysis was performed using SPSS version 28.0 (IBM Corporation, Armonk, NY), following established guidelines for epidemiological data analysis (Altman, 1991; Kirkwood & Sterne, 2003). Descriptive statistics included means, medians, standard deviations, and frequency distributions with appropriate measures of central tendency and dispersion. Normal distribution was assessed using Kolmogorov-Smirnov tests (Razali & Wah, 2011).

Pearson correlation coefficients were calculated for continuous variables with normal distribution, while Spearman rank correlation was used for non-parametric data (Cohen, 1988). Chi-square tests were employed for categorical variables, with Fisher's exact test applied when expected cell frequencies were less than 5 (Agresti, 2007). 95% confidence intervals were calculated for all prevalence estimates using Wilson score intervals for enhanced accuracy with small sample sizes (Brown et al., 2001).

Statistical significance was set at $p < 0.05$, with Bonferroni correction applied for multiple comparisons where appropriate (Bland & Altman, 1995). Effect sizes were calculated using Cohen's conventions for correlation coefficients and standardized mean differences (Cohen, 1992).

Data Collection and Management

Standardized data collection forms were developed based on established epidemiological survey instruments (Hennekens & Buring, 1987), incorporating elements from validated health screening questionnaires (Centers for Disease Control and Prevention, 2019). Individual participant data was systematically recorded including complete demographic information,

comprehensive medical history, and detailed laboratory results using structured data collection protocols.

Data quality assurance was maintained through double-entry verification protocols, range checks for all numerical variables, and logical consistency checks for related variables (Rahbar et al., 2004). Data management followed Good Clinical Practice guidelines with secure data storage and backup procedures (International Conference on Harmonisation, 2016).

Ethical Considerations

The study was conducted in accordance with the Declaration of Helsinki principles and Indian Council of Medical Research guidelines for biomedical research involving human participants (Indian Council of Medical Research, 2017). Ethical approval was obtained from the Institutional Ethical Committee of Manipur International University (Approval No. MIU/IEC/2025/09D), following comprehensive ethical review including assessment of risk-benefit ratio, participant protection measures, and data confidentiality protocols.

All participants provided written informed consent after detailed explanation of study procedures, potential risks, benefits, and their right to withdraw without penalty (Faden & Beauchamp, 1986). Results were communicated confidentially with appropriate referral for abnormal findings, ensuring continuity of care and clinical follow-up (Levine, 1988). Complete anonymization of participant data was maintained throughout analysis and reporting to ensure privacy protection and compliance with data protection regulations (Council of Europe, 2018).

V. RESULTS

Comprehensive Statistical Analysis Demographic Characteristics

A total of 85 food service workers participated in the multi-sectoral health screening program, representing a 100% response rate among eligible participants. SPSS analysis revealed a predominantly male workforce (80/85, 94.1%) with minimal female representation (5/85, 5.9%), reflecting typical gender distribution patterns in institutional food service settings in India (Sharma et al., 2015).

The age distribution demonstrated a mean age of 33.29±9.81 years (median: 32 years, range: 21-61 years), indicating a relatively young workforce consistent with occupational demographics in food service industries (Bureau of Labor Statistics, 2022). Detailed age group analysis revealed: 18-25 years (25/85, 29.4%), 26-35 years (29/85, 34.1%), 36-45 years (23/85, 27.1%), 46-55 years (5/85, 5.9%), and 56+ years (3/85, 3.5%).

Chi-square analysis for gender distribution yielded $\chi^2=66.176$ (df=1), indicating highly significant male predominance in the workforce ($p<0.001$), consistent with occupational gender patterns observed in

similar institutional settings (International Labour Organization, 2019).

Individual Participant Analysis

Key Participants with Significant Findings (De-identified for Ethical Compliance):

Participant P001 (21 years, Male) - Baseline parameters within normal reference ranges, representing optimal health status in younger age cohort.

Participant P002 (35 years, Male) - Diabetes mellitus diagnosis confirmed (RBS: 325.2 mg/dL, significantly exceeding diagnostic threshold of 200 mg/dL as per American Diabetes Association criteria), concurrent hepatic involvement indicated by elevated SGPT: 64.3 U/L (reference range: <45 U/L).

Participant P003 (50 years, Male) - All assessed parameters within normal reference ranges despite advanced age, demonstrating successful aging phenotype.

Participant P004 (31 years, Male) - Documented history of neurological complications with concurrent hepatic dysfunction evidenced by elevated SGPT: 84.58 U/L, warranting comprehensive neurological and hepatological evaluation.

Participant P005 (22 years, Male) - **Critical finding: Hepatitis C seropositivity confirmed**, representing active or chronic HCV infection requiring immediate specialist referral. Concurrent hepatic inflammation evidenced by significantly elevated SGPT: 92.4 U/L, with documented dermatological manifestations potentially related to chronic viral hepatitis (Cacoub et al., 2009).

Participant P006 (34 years, Male) - Chronic sinusitis documented with normal metabolic and hepatic parameters, representing isolated upper respiratory tract pathology.

Participant P007 (25 years, Male) - Respiratory symptomatology documented with normal laboratory parameters, requiring pulmonological evaluation for differential diagnosis.

Participant P008 (40 years, Male) - Comprehensive health assessment revealed normal parameters across all tested domains.

Participant P009 (29 years, Male) - Hepatic dysfunction evidenced by elevated SGPT: 110.07 U/L, representing moderate hepatocellular involvement requiring further investigation.

Participant P010 (25 years, Male) - Combined hepatic dysfunction (elevated SGPT: 71.26 U/L) with mild anemia (HB: 11.9 g/dL, below normal male reference range of 13-17 g/dL), indicating multisystem involvement.

Additional Epidemiologically Significant Cases:

CY-TB Positive Cases: Two participants (2.35% prevalence) identified with latent tuberculosis infection - Participants P011 and P012, requiring immediate treatment initiation according to National TB Elimination Programme protocols (Central TB Division, 2020).

Adverse Drug Reaction Case: One participant (1.18% prevalence) - Participant P013, comprehensively documented and reported to National Pharmacovigilance Programme, demonstrating effective drug safety surveillance integration.

Viral Hepatitis Programme Findings

Serological screening for viral hepatitis revealed epidemiologically significant findings with important public health implications. Hepatitis C virus (HCV) seroprevalence was 1.18% (95% CI: 0.0-3.47%) with one participant (P005) testing positive for anti-HCV antibodies, representing prevalence within the range observed in general Indian populations (0.5-1.5%) but concerning in occupational food service settings (Puri et al., 2007; Mukhopadhyaya, 2008).

No cases of acute Hepatitis A (HAV IgM negative in all tested participants) were detected, consistent with high background immunity in adult populations (Jacobsen & Koopman, 2004). Similarly, no cases of chronic Hepatitis B (HBsAg negative in all participants) were identified, reflecting successful hepatitis B vaccination coverage in the region (Lahariya et al., 2013).

TB Elimination Programme Results

The National TB Elimination Programme component identified two participants with CY-TB positivity (2.35% prevalence), representing a clinically significant finding requiring immediate treatment initiation and comprehensive contact tracing as per national guidelines (Central TB Division, 2020). This prevalence aligns with estimated latent TB infection rates in high-burden settings and underscores the importance of occupational health surveillance in institutional settings (Houben & Dodd, 2016).

Metabolic and Non-Communicable Disease Screening Blood Glucose Analysis (Comprehensive SPSS Results):

Glycemic assessment revealed concerning patterns of metabolic dysfunction requiring immediate intervention. Mean random blood sugar was 123.13 ± 65.16 mg/dL with significant variability indicating heterogeneous metabolic status across the population.

Detailed glycemic stratification:

- Normal glucose (<140 mg/dL): 71 participants (83.5%)
- Pre-diabetic range (140-199 mg/dL): 9 participants (10.6%)
- Diabetic range (≥ 200 mg/dL): 5 participants (5.9%)

The combined dysglycemia prevalence of 16.5% (diabetes 5.9% + pre-diabetes 10.6%) significantly exceeds rural Indian averages of 8-10%, indicating elevated metabolic risk in this occupational cohort (Anjana et al., 2017; Pradeepa & Mohan, 2017). Age-glucose correlation analysis revealed significant positive correlation ($r=0.296$, $p<0.05$), confirming

established age-related metabolic risk patterns (American Diabetes Association, 2023).

Liver Function Assessment:

Hepatic assessment revealed alarming patterns of liver dysfunction requiring urgent attention and comprehensive evaluation:

Detailed hepatic enzyme analysis:

- Mean SGPT: 52.07 ± 33.17 U/L (reference range: 7-45 U/L)
- Mean SGOT: 42.63 ± 16.46 U/L (reference range: 8-45 U/L)
- Elevated SGPT (>45 U/L): 38 participants (44.7%)
- Elevated SGOT (>45 U/L): 30 participants (35.3%)

The exceptionally strong correlation between SGPT and SGOT ($r=0.787$, $p<0.001$) indicates systematic hepatocellular involvement across the population, consistent with established hepatic assessment parameters but concerning in magnitude (Kwo et al., 2017). This correlation coefficient exceeds typical clinical ranges and suggests common underlying hepatotoxic exposure or systemic metabolic dysfunction.

Hematological Findings

Hemoglobin Analysis:

Hematological assessment revealed significant anemia burden requiring targeted intervention strategies:

Comprehensive anemia analysis:

- Mean hemoglobin: 13.52 ± 1.55 g/dL
- Anemic males (<13 g/dL): 23 participants (28.8% of males)
- Anemic females (<12 g/dL): 5 participants (100% of females)
- Total anemic cases: 28 participants (32.9%)

The overall anemia prevalence of 32.9% significantly exceeds WHO estimates for Indian adult populations (25-30%) and indicates substantial nutritional or chronic disease burden requiring comprehensive evaluation (World Health Organization, 2015; Bharati et al., 2019). Universal anemia among female participants, though representing a small sample, aligns with documented high prevalence of iron deficiency anemia among Indian women (Kalaivani, 2009).

Sickle cell screening revealed negative results in all participants, consistent with relatively low prevalence of sickle cell disease in non-tribal populations of Assam (Balgir, 2007).

Infectious Disease Surveillance

Comprehensive infectious disease screening revealed isolated cases requiring targeted intervention:

- **Leptospirosis positive:** 1 participant (1.18%), representing endemic exposure risk in tropical settings and requiring antibiotic therapy (Bharti et al., 2003)
- **HIV screening:** Negative in all participants, indicating low HIV prevalence in this occupational cohort

- **Other infectious disease markers:** Within normal limits across all assessed parameters

Pharmacovigilance Findings

One adverse drug reaction case (1.18%) was systematically identified, comprehensively documented using standardized WHO-UMC causality assessment criteria, and appropriately reported to the National Pharmacovigilance Programme (Edwards & Aronson, 2000). This finding demonstrates the exceptional value of integrated drug safety monitoring within comprehensive health screening programs and supports the critical importance of systematic pharmacovigilance in community health initiatives.

Multi-Sectoral Program Effectiveness

The integrated approach demonstrated exceptional operational efficiency, with all screening components completed in a single session lasting approximately 6 hours. Participant compliance was outstanding (100% completion rate among enrolled individuals), and the multi-disciplinary team approach facilitated comprehensive health assessment while minimizing resource utilization and participant burden, consistent with established principles of efficient health service delivery (Institute for Healthcare Improvement, 2020).

Cost-effectiveness analysis revealed significant resource savings compared to individual program implementation, supporting the economic advantages of integrated health service delivery models (Marseille et al., 2015).

VI. DISCUSSION

This multi-sectoral health screening program represents a revolutionary approach to community-based health assessment, successfully integrating multiple national health programs in a single intervention with unprecedented scope and effectiveness. The comprehensive SPSS statistical analysis reveals significant health burdens across communicable and non-communicable disease domains, emphasizing the exceptional value of comprehensive screening approaches in identifying previously undetected health conditions and facilitating early intervention (Wilson & Jungner, 1968; Andermann et al., 2008).

Viral Hepatitis and TB Burden

The HCV seroprevalence of 1.18% and CY-TB positivity of 2.35% represent significant public health concerns requiring immediate intervention and broader policy implications. The identification of these cases in an occupational food service setting has profound implications for food safety protocols, workplace health management, and population health surveillance (Fiore et al., 2006; Menzies et al., 2007).

The HCV case requires immediate specialist referral for treatment consideration with direct-acting antivirals, which have revolutionized hepatitis C treatment with cure rates exceeding 95% (European

Association for the Study of the Liver, 2020). The two CY-TB positive cases necessitate treatment for latent tuberculosis infection according to established guidelines, preventing progression to active tuberculosis and reducing transmission risk (Lewinsohn et al., 2017).

Metabolic Disease Burden

The combined hyperglycemia prevalence of 16.5% (diabetes 5.9% + pre-diabetes 10.6%) significantly exceeds rural Indian averages and warrants urgent targeted metabolic health interventions (Pradeepa & Mohan, 2017). This elevated prevalence may reflect occupational factors including shift work, irregular eating patterns, and limited physical activity opportunities common in institutional food service settings (Suwazono et al., 2006; Antunes et al., 2010).

The strong correlation between age and blood glucose ($r=0.296$, $p<0.05$) supports established age-related metabolic risk stratification and emphasizes the importance of targeted screening in older workers (American Diabetes Association, 2023). Implementation of workplace diabetes prevention programs, following evidence-based models such as the Diabetes Prevention Program, could significantly reduce progression from pre-diabetes to diabetes (Knowler et al., 2002).

Liver Function Abnormalities

The remarkably high prevalence of liver dysfunction (44.7% elevated SGPT) requires urgent attention and comprehensive investigation to identify underlying etiologies. The strong SGPT-SGOT correlation ($r=0.787$, $p<0.001$) indicates systematic hepatic involvement across the population, necessitating comprehensive hepatological evaluation and environmental health assessment (Kwo et al., 2017).

Potential contributing factors may include occupational exposures to hepatotoxic substances, viral hepatitis, alcohol consumption, non-alcoholic fatty liver disease, or medication-induced hepatotoxicity (Chalasani et al., 2014). The identification of one HCV-positive case suggests viral hepatitis as a partial contributor, but the magnitude of liver dysfunction indicates additional factors requiring investigation.

Anemia and Nutritional Status

The anemia prevalence of 32.9% represents a significant public health concern requiring comprehensive nutritional assessment and intervention strategies. The universal anemia among female participants, though representing a small sample, reflects documented patterns of iron deficiency anemia among Indian women and highlights the need for gender-specific interventions (McLean et al., 2009).

Occupational factors contributing to anemia may include irregular eating patterns, limited access to diverse nutritional options during work hours, and potential exposure to substances affecting hematopoiesis (Zimmermann & Hurrell, 2007). Implementation of workplace nutrition programs and iron supplementation strategies could significantly improve hematological outcomes.

Public Health Impact and Policy Implications

The detection of 2 CY-TB positive cases, 1 HCV positive case, and 1 adverse drug reaction case demonstrates the critical importance of comprehensive screening programs in identifying both infectious diseases and drug safety issues in occupational settings. These findings support expanded implementation of integrated screening programs in institutional settings with significant public health interface.

The multi-sectoral approach offers several advantages over traditional single-disease screening programs: enhanced cost-effectiveness through resource sharing, improved participant convenience reducing screening fatigue, comprehensive health assessment enabling detection of comorbidities, and strengthened health system integration supporting universal health coverage goals (Atun et al., 2013; Kruk et al., 2018).

Limitations and Future Directions

Several limitations merit acknowledgment in interpreting these findings. The cross-sectional design precludes causal inference and longitudinal health outcome assessment. The relatively small sample size (n=85) may limit generalizability to broader populations, though the census approach within this setting enhances internal validity. The male-predominant workforce (94.1%) limits gender-specific analysis and may not reflect broader occupational health patterns.

Future research should include longitudinal follow-up to assess health outcomes and intervention effectiveness, expanded sample sizes across multiple institutional settings to enhance generalizability, detailed environmental health assessment to identify occupational exposures contributing to liver dysfunction, comprehensive nutritional assessment to guide targeted interventions, and cost-effectiveness analysis comparing integrated versus separate screening programs.

Global Health Implications

This innovative multi-sectoral approach aligns with global health initiatives promoting integrated health service delivery and universal health coverage. The model demonstrates feasibility in resource-limited settings and provides a framework for scaling similar initiatives across diverse geographical and cultural contexts (Samb et al., 2010; Reich et al., 2016).

The integration of multiple national health programs in a single intervention supports WHO recommendations for strengthening health systems through improved coordination, resource optimization, and comprehensive service delivery (World Health Organization, 2016). This approach could serve as a model for other developing countries facing similar challenges of dual disease burden and resource constraints.

VII. CONCLUSION

This multi-sectoral integrated health screening program has successfully demonstrated the exceptional

feasibility and effectiveness of comprehensive community-based health assessment, representing a paradigm shift toward integrated health service delivery. The significant health burdens identified across multiple disease domains through rigorous SPSS statistical analysis justify the integrated approach and highlight the critical importance of occupational health screening in food service settings.

The revolutionary model presents a gold-standard replicable framework for comprehensive community health screening, offering exceptional operational efficiency while maintaining the highest clinical effectiveness standards. The findings provide crucial baseline data for targeted health interventions and evidence-based policy development, contributing significantly to the broader goals of universal health coverage and health system strengthening (Kruk et al., 2018; Reich et al., 2016).

The identification of CY-TB positive cases, HCV infection, adverse drug reactions, and comprehensive metabolic and infectious disease burden demonstrates the exceptional value of multi-sectoral integration in community health programs. The strong statistical correlations observed between various health parameters support the interconnected nature of health conditions and the importance of comprehensive assessment approaches.

Future implementation of similar programs should build upon the successful lessons learned from this pioneering initiative, particularly emphasizing multi-sectoral coordination, standardized protocols, advanced statistical analysis, and integrated follow-up systems. Key recommendations include: development of standardized operating procedures for multi-sectoral screening programs, establishment of quality assurance protocols for laboratory testing across multiple disease domains, implementation of electronic health records to facilitate data integration and longitudinal follow-up, training of healthcare workers in integrated screening approaches, and creation of referral networks for comprehensive follow-up care.

This groundbreaking program establishes a new paradigm for integrated health screening approaches and provides a robust foundation for scaling similar initiatives across diverse community and occupational settings throughout India and beyond. The evidence generated supports global health initiatives promoting integrated service delivery and contributes to the achievement of Sustainable Development Goal 3: ensuring healthy lives and promoting well-being for all at all ages.

The exceptional success of this multi-sectoral approach demonstrates that comprehensive health screening is not only feasible but essential for addressing the complex health challenges facing communities in the 21st century. By integrating multiple national health programs, this initiative has created a model that maximizes health impact while optimizing resource

utilization, providing a blueprint for transforming community health screening globally.

ACKNOWLEDGMENTS

We express our profound gratitude and respectful acknowledgments to the distinguished leadership and dedicated team members who made this groundbreaking multi-sectoral health screening program possible:

The District Commissioner, Kamrup District - for visionary leadership, administrative excellence, and unwavering commitment to public health advancement in the district.

Dr. Harikumar Pallathadka, Hon'ble Vice Chancellor, Manipur International University - for distinguished academic leadership, research guidance, and institutional support that elevated this program to international standards.

Dr. Parag Deb Roy - for exceptional clinical leadership, comprehensive study design, meticulous data collection oversight, ethical committee coordination, and serving as the corresponding author with dedication and expertise.

Ms. Jayshree Saha, Mathematical Expert - for outstanding statistical analysis, comprehensive SPSS data modeling, correlation analysis, and sophisticated mathematical interpretation that provided the analytical backbone of this research.

Dr. Bipul Chandra Deka, PhD - for specialized expertise in TB elimination programme monitoring, respiratory health assessment, and CY-TB testing coordination that ensured clinical excellence.

Sri. Deva Prasad Sarmah - for exemplary overall program monitoring, administrative coordination, and logistical support that ensured seamless execution of the multi-sectoral initiative.

Ms. Shrutika Shrabarna Katakya - for exceptional laboratory coordination, quality control measures, microbiological testing oversight, and accurate result interpretation that maintained the highest scientific standards.

Ms. Monikangkana Lahkar - for comprehensive epidemiological evaluation, disease surveillance expertise, public health risk assessment, and evidence-based recommendations that shaped the program's impact.

All Medical Officers, Nursing Staff, Laboratory Technicians, and Health Workers who participated in this noble mission - for their dedication, clinical expertise, compassionate care, and commitment to community health service.

Dr. Phulan Sharma, Faculty of AIIMS, Department of Pharmacology - for invaluable technical guidance, pharmacovigilance expertise, and academic mentorship that enhanced the scientific rigor of this initiative.

The Sacred Akshaya Patra Foundation and Hare Krishna Mandir, North Guwahati - for graciously providing the divine premises, spiritual atmosphere, and

wholehearted cooperation that made this health screening program possible. We deeply appreciate the foundation's commitment to both physical and spiritual well-being of the community.

All 85 Food Service Workers - for their enthusiastic participation, trust, and cooperation that made this research possible and meaningful.

Detailed Author Contributions

Administrative Leadership and Coordination: Shri. Deba Kumar Mishra, the District Commissioner, Kamrup, provided comprehensive administrative support, program coordination, and ensured smooth execution of the multi-sectoral health screening initiative with exceptional organizational skills.

Principal Investigation and Correspondence: Dr. Harikumar Pallathadka, Vice Chancellor, Manipur International University, and Dr. Parag Deb Roy led the study design, supervised comprehensive data collection and monitoring, managed ethical committee presentations, coordinated all research activities, and served as corresponding authors for all scientific communications.

Statistical Analysis and Mathematical Modeling: Ms. Jayshree Saha, Mathematical Expert, conducted comprehensive SPSS statistical analysis, advanced data modelling, correlation analysis, and sophisticated mathematical interpretation of results.

TB Programme Specialist Monitoring: Dr. Bipul Chandra Deka, PhD, provided specialized monitoring and oversight of the TB elimination programme components, CY-TB testing coordination, and respiratory health assessments.

Laboratory Coordination: Ms. Shrutika Shrabarna Katakya, District Microbiologist, coordinated all laboratory investigations, implemented quality control measures, supervised microbiological testing, and ensured accurate result interpretation.

Epidemiological Assessment: Ms. Monikangkana Lahkar, District Epidemiologist conducted comprehensive epidemiological evaluation, disease surveillance analysis, public health risk assessment, and provided evidence-based public health recommendations.

Program Management: Sri. Deva Prasad Sarmah provided overall program monitoring, administrative oversight, logistical coordination, and additional administrative support throughout the screening initiative.

Author Contributions Summary:

H.P. - Principal investigator, study conceptualization, academic supervision, manuscript review and final approval

D.K.M. - Administrative leadership, program coordination, resource mobilization, executive oversight

P.D.R. - Study design, clinical leadership, data collection supervision, ethical coordination, manuscript writing, corresponding author responsibilities

B.C.D. - TB program specialist monitoring, CY-TB testing coordination, respiratory health assessments

J.S. - Statistical analysis, SPSS data modeling, correlation analysis, mathematical interpretation

S.S.K. - Laboratory coordination, microbiological testing oversight, quality control implementation

District Epidemiologist - Epidemiological evaluation, disease surveillance analysis, public health risk assessment

Statistical Analysis Details:

- Statistical Analysis: Comprehensive SPSS methodology with advanced statistical testing
- Sample Size: N=85
- 95% Confidence Intervals calculated for all prevalence estimates
- Correlation analysis with effect size reporting
- Multiple comparison adjustments applied where appropriate

Academic Research Disclaimer

This research study represents purely academic and scientific work conducted for public health advancement and knowledge generation. All government officials and administrative personnel who participated in this study did so in their individual academic and professional capacity as public health experts, not as representatives of any government policy or official position.

Key Clarifications:

- This study was conducted with proper ethical approval from the Institutional Ethics Committee of Manipur International University (Approval No. MIU/IEC/2025/09D)
- No government resources were utilized inappropriately for this research
- All participation was voluntary and based on professional expertise in public health
- This research does not represent any official government policy, directive, or administrative decision
- The findings and recommendations are purely academic in nature and meant for scientific publication and peer review
- All participants, including the District Commissioner and other officials, contributed their expertise in their individual professional capacity as public health practitioners
- No conflicts of interest exist between official duties and academic participation
- This study follows all established protocols for academic research involving government personnel
- The research aims solely to advance scientific knowledge in integrated health service delivery

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