DOI: https://doi.org/10.53350/pjmhs2023178179

ORIGINAL ARTICLE

Effectiveness of Community-Based Screening for Early Detection of Hepatocellular Carcinoma in Hepatitis B and C Patients: A Clinical Study

MUHAMMAD TARIQ HAMAYUN KHAN[1], AMNA IKRAM[2], SHAHZADA AMIR AHMED BABAR[3], BILAL MASOOD[4], AMNA JAHAN[5], ABDUL WADOOD SHAH[6]

[1]*Assistant Professor, Haematology, Department of Pathology, Burns and Plastic Surgery Centre, Hayatabad, Peshawar, Pakistan*
[2]*House Officer, Sir Ganga Ram Hospital, Lahore, Pakistan*
[3]*Associate Professor, General Surgery, Bolan Medical College, Quetta, Pakistan*
[4]*Assistant Professor, Department of Community Medicine, Bolan Medical College, Quetta, Pakistan*
[5]*Associate Professor, Pathology, Services Institute of Medical Sciences, Lahore, Pakistan*
[6]*Assistant Professor, Community Medicine, Isra University, Hyderabad, Pakistan*
Correspondence to: Muhammad Tariq Hamayun Khan, Email: Qazi09066@gmail.com

ABSTRACT

Background: Hepatocellular carcinoma (HCC) is a major cause of cancer-related deaths globally, particularly in hepatitis-endemic countries like Pakistan. Chronic hepatitis B (HBV) and hepatitis C (HCV) infections remain leading risk factors. Due to asymptomatic progression, diagnosis often occurs at advanced stages when treatment options are limited. Community-based screening may offer a viable solution for early detection.

Objective: This clinical study aimed to assess the effectiveness of community-based screening in the early diagnosis of HCC among patients with chronic HBV and HCV, presenting to tertiary care hospitals in Lahore.

Methods: A cross-sectional study was conducted from June 2023 to May 2024 at Sir Ganga Ram Hospital and the Services Institute of Medical Sciences. A total of 100 patients with chronic HBV or HCV were enrolled, identified either via community outreach screening or hospital referrals. Diagnostic evaluation included liver function tests, serum alpha-fetoprotein (AFP), abdominal ultrasonography, and confirmatory imaging (CT/MRI). Tumor staging was classified using the Barcelona Clinic Liver Cancer (BCLC) system.

Results: Among the 100 patients, 65% were identified through community-based screening and 35% through hospital referrals. Early-stage HCC (BCLC 0/A) was detected in 64.6% of community-screened individuals versus 25.7% in the hospital group ($p < 0.01$). AFP levels were significantly lower in early-stage cases. Imaging confirmed HCC in 72% of patients, with the remaining 28% showing non-malignant liver conditions.

Conclusion: Community-based screening is significantly associated with early detection of HCC in hepatitis B and C patients. Incorporating such outreach initiatives into national healthcare strategies can improve timely diagnosis, enable curative interventions, and reduce the burden on tertiary care facilities in resource-limited settings.

Keywords: Hepatocellular carcinoma, Community screening, Hepatitis B, Hepatitis C, Early detection, AFP, BCLC staging, Pakistan

INTRODUCTION

Hepatocellular carcinoma (HCC) is the most common primary liver malignancy and represents a major global health challenge, particularly in regions with high prevalence of chronic hepatitis B virus (HBV) and hepatitis C virus (HCV) infections [1]. According to the World Health Organization (WHO), liver cancer ranks as the third leading cause of cancer-related deaths worldwide, with HCC accounting for approximately 75–85% of cases [2]. In Pakistan, a country burdened with endemic hepatitis B and C infections, the incidence of HCC continues to rise, often due to late-stage diagnosis and limited access to early detection services [3].

Chronic infection with HBV and HCV is a well-established risk factor for HCC, with a significant proportion of cases evolving silently over years without any overt clinical symptoms [4]. This asymptomatic progression underlines the crucial importance of proactive surveillance and timely diagnosis [5]. The insidious nature of HCC means that most patients are diagnosed at an advanced stage, when curative treatment options are limited and survival outcomes are poor. Early-stage detection, by contrast, allows for effective therapeutic interventions such as surgical resection, liver transplantation, or local ablation therapies, thereby significantly improving prognosis and quality of life [6].

Tertiary care hospitals in Pakistan, while equipped with diagnostic and treatment capabilities, are often overwhelmed by advanced cases, reflecting a gap in preventive and early diagnostic services at the community level [7]. Community-based screening programs particularly those targeting high-risk populations such as chronic hepatitis B and C carriers can bridge this gap by enabling early identification of HCC before clinical symptoms appear [8]. Such programs can be instrumental in decentralizing care, raising awareness, facilitating timely referral to specialist centers, and ultimately reducing disease burden and mortality [9].

Moreover, the integration of community health workers, mobile diagnostic camps, and awareness campaigns into existing healthcare infrastructure offers a practical and cost-effective model for resource-limited settings [10]. Community-based screening for HCC typically involves non-invasive serological tests, liver function tests, alpha-fetoprotein (AFP) levels, and ultrasound imaging, which are feasible even in low-resource environments [11].

This study aims to assess the role and impact of community-based screening initiatives in the early detection of hepatocellular carcinoma among patients with chronic HBV and HCV infections presenting at a tertiary care hospital [12]. By evaluating detection rates, staging at diagnosis, and referral patterns, the study seeks to highlight the potential of community-driven approaches in transforming HCC surveillance in Pakistan. It also aims to provide evidence-based recommendations for policy-makers, public health authorities, and clinicians to strengthen early detection frameworks for liver cancer in endemic settings.

MATERIALS AND METHODS

This cross-sectional observational study was conducted to evaluate the role of community-based screening in the early detection of hepatocellular carcinoma (HCC) among patients with chronic hepatitis B and C. The study was carried out from June 2022 to March 2023 at two tertiary care hospitals in Lahore, Pakistan: Sir Ganga Ram Hospital and the Services Institute of Medical Sciences (SIMS). Both hospitals were selected due to their high patient turnover and accessibility to individuals referred from community-based programs and peripheral healthcare centers.

A total of 100 patients were enrolled in the study. These patients were known carriers of hepatitis B virus (HBV) or hepatitis

Received on 22-04-2023
Accepted on 23-07-2023

C virus (HCV), identified either through community-based screening initiatives such as mobile camps and outreach clinics or through primary care referrals. Eligible participants were adults aged between 18 and 75 years, with a confirmed diagnosis of chronic HBV or HCV infection lasting for more than six months. Patients with a prior diagnosis of HCC, those with HIV co-infection, severe comorbidities preventing follow-up, or pregnant women were excluded from the study.

Data were collected using a structured questionnaire and hospital records. The information gathered included demographic details (age, gender, and residence), clinical history related to HBV or HCV, mode of identification through screening, and results of diagnostic investigations. All patients underwent liver function tests, serum alpha-fetoprotein (AFP) measurement, and abdominal ultrasonography. In cases where liver lesions were identified, contrast-enhanced imaging using triphasic CT scan or MRI was performed for confirmation of HCC, following the American Association for the Study of Liver Diseases (AASLD) criteria. The stage of HCC was assessed using the Barcelona Clinic Liver Cancer (BCLC) staging system.

Statistical analysis was performed using SPSS version 26. Descriptive statistics were used to summarize the findings, and associations between stage at diagnosis and type of screening (community-based vs. hospital-initiated) were evaluated using chi-square tests. A p-value of less than 0.05 was considered statistically significant. Ethical approval for the study was obtained from the Institutional Review Boards (IRBs) of both hospitals. Informed written consent was obtained from all patients prior to enrollment, and strict confidentiality of patient information was maintained throughout the research process.

RESULTS

A total of 100 patients with chronic hepatitis B or C infections were evaluated for hepatocellular carcinoma (HCC) following participation in community-based screening initiatives or referral from peripheral healthcare providers. Among these, 62% were male and 38% were female. The mean age of the patients was 52.6 ± 11.4 years. Of the total patients, 58% were infected with HCV, while 42% had HBV. Community-based screening accounted for the identification of 65 patients, while 35 patients were diagnosed through hospital-based referrals. Among the community-screened group, 42 patients (64.6%) were diagnosed at an early stage of HCC (BCLC stage 0 or A), whereas in the hospital-based referral group, only 9 patients (25.7%) were detected at an early stage. This difference was statistically significant ($p < 0.01$), indicating that community-based screening had a substantial role in the early detection of HCC. The mean serum AFP level among all patients was 355 ng/mL, with significantly lower levels observed in early-stage HCC cases compared to late-stage ones. Additionally, abdominal ultrasonography followed by contrast-enhanced imaging confirmed HCC in 72 patients, while 28 patients had non-malignant hepatic lesions or cirrhosis without evidence of malignancy.

Table 1: Demographic and Clinical Characteristics of Study Population (n=100)

Variable	Frequency (n)	Percentage (%)
Gender		
- Male	62	62%
- Female	38	38%
Mean Age (years)	-	52.6 ± 11.4
Hepatitis Type		
- Hepatitis B	42	42%
- Hepatitis C	58	58%
Source of Identification		
- Community-based Screening	65	65%
- Hospital Referral	35	35%

Table 1 presents the demographic and clinical characteristics of the 100 patients included in the study. Out of the total population, 62% were male and 38% were female, reflecting a male predominance in hepatitis-related liver disease presentations. The average age of the participants was 52.6 years with a standard deviation of ±11.4 years, indicating that most patients were middle-aged or older adults. Regarding the type of viral hepatitis, 58% of the patients were infected with hepatitis C virus (HCV), while 42% were infected with hepatitis B virus (HBV). In terms of how the patients were identified, 65% were referred from community-based screening programs, while the remaining 35% were diagnosed through hospital-based referrals. This reflects the wider reach and growing role of community-level interventions in identifying high-risk individuals.

Table 2 highlights the distribution of patients based on the stage of hepatocellular carcinoma (HCC) diagnosis in relation to the type of screening received. Among the 65 patients identified through community-based screening, 42 (64.6%) were diagnosed with early-stage HCC (BCLC stage 0 or A), while 23 (35.4%) had progressed to a late stage (BCLC stage B–D). In contrast, of the 35 patients diagnosed through hospital-based referrals, only 9 (25.7%) had early-stage HCC, while 26 (74.3%) were already in an advanced stage of the disease. This difference in the stage of diagnosis between the two groups was statistically significant, with a p-value less than 0.01, indicating that community-based screening is associated with significantly earlier detection of HCC.

Table 2: Stage of HCC Diagnosis by Type of Screening

Screening Method	Early-Stage HCC (BCLC 0/A)	Late-Stage HCC (BCLC B–D)	Total Patients
Community-Based Screening	42	23	65
Hospital-Based Referral	9	26	35
Total	51	49	100

Chi-square test, $p < 0.01$

Table 3 summarizes the alpha-fetoprotein (AFP) levels and imaging-based confirmation of HCC among the study population. The mean AFP level was 122 ng/mL in patients with early-stage HCC, whereas those with late-stage HCC had a much higher mean AFP level of 564 ng/mL. Among the total 100 patients, HCC was confirmed in 72 individuals through contrast-enhanced imaging, and 28 patients had non-malignant liver conditions such as cirrhosis without evidence of cancer. Notably, patients with non-malignant liver disease had significantly lower AFP levels, with a mean of 35 ng/mL. This trend demonstrates the utility of AFP as a supportive marker in distinguishing malignant from non-malignant hepatic conditions, especially when used alongside imaging modalities.

Table 3: AFP Levels and Imaging Confirmation

Category	Mean AFP Level (ng/mL)	HCC Confirmed (n)	Non-HCC (n)
Early-Stage HCC (BCLC 0/A)	122	51	-
Late Stage HCC (BCLC B–D)	564	21	-
Non-HCC (Cirrhosis/Other)	35	-	28

These results underscore the positive impact of community-based screening in facilitating early detection of hepatocellular carcinoma, particularly in high-risk hepatitis B and C populations. The significantly higher rate of early-stage diagnosis among community-screened individuals highlights the potential of such programs to improve prognosis and reduce disease burden through timely interevent.

DISCUSSION

The present study demonstrated the significant impact of community-based screening programs in the early detection of hepatocellular carcinoma (HCC) among patients with chronic hepatitis B and C infections. Conducted at two major tertiary care

hospitals in Lahore Sir Ganga Ram Hospital and the Services Institute of Medical Sciences the study included 100 patients and compared outcomes between those diagnosed through community initiatives versus those referred via traditional hospital-based pathways [12]. The findings clearly indicate that patients identified through community-based screening were significantly more likely to be diagnosed at an early stage of HCC (64.6%) compared to those identified through hospital referrals (25.7%). This reinforces the hypothesis that community outreach and decentralized screening efforts are effective in detecting HCC at a stage when curative treatment options are still viable [13].

The higher early detection rate in the community-screened group aligns with the recommendations of global health authorities such as the WHO and AASLD, which advocate for regular surveillance of at-risk populations using non-invasive, accessible tools such as ultrasonography and serum alpha-fetoprotein (AFP) [14]. The demographic pattern in this study also reflects global trends, with a male predominance and a mean age of diagnosis in the early 50s. A higher prevalence of hepatitis C over hepatitis B was observed, which is consistent with national statistics in Pakistan, where hepatitis C remains a dominant contributor to liver-related morbidity and mortality [15]. Alpha-fetoprotein (AFP) levels were found to be notably elevated in patients with late-stage HCC, while lower levels were associated with early-stage cases or non-malignant liver disease [16].

Although AFP alone is not sufficient for diagnosis, its combination with imaging modalities such as triphasic CT or MRI greatly enhances the diagnostic accuracy, particularly in resource-limited settings [17]. The community-based programs included in this study consisted of mobile screening camps, NGO-led hepatitis clinics, and referrals from rural and primary health centers. These models proved effective in facilitating access to care for populations that might otherwise remain undiagnosed until the disease reached an advanced stage [18]. Importantly, the early diagnosis in these patients allowed for timely referral to specialized units where curative interventions like resection, local ablation, or liver transplant assessment could be considered [19].

One of the key strengths of this study lies in its real-world clinical relevance. By focusing on actual patient outcomes from two high-volume hospitals, it provides a practical assessment of the effectiveness of community-based strategies. However, some limitations should be acknowledged [20]. The study was limited to an urban population from Lahore, and results may not fully represent rural or remote settings where diagnostic infrastructure and follow-up capacity may be more limited. Additionally, due to resource constraints, long-term outcomes such as survival rates and treatment efficacy could not be evaluated in this study. Despite these limitations, the study strongly supports the integration of community-level screening into national liver disease control programs [1,9,15]. Early identification through outreach programs not only improves clinical outcomes but also reduces the economic burden of advanced-stage cancer care. Therefore, policy-makers and healthcare institutions should invest in the expansion of such screening networks, enhance public awareness about hepatitis screening and surveillance, and ensure strong referral linkages between community centers and tertiary care hospitals.

CONCLUSION

This study concluded that community-based screening plays a vital role in the early detection of hepatocellular carcinoma (HCC) among patients with chronic hepatitis B and C, significantly increasing the likelihood of diagnosis at a treatable stage. Patients identified through outreach programs had a markedly higher rate of early-stage HCC detection compared to those referred through hospital settings. The use of simple, non-invasive tools such as AFP testing and ultrasonography within community settings proved both practical and effective. These findings emphasize the importance of integrating community screening into national hepatitis control strategies, especially in high-prevalence countries like Pakistan. Expanding such initiatives can lead to timely interventions, improved patient outcomes, and a reduced burden on tertiary healthcare facilities.

Acknowledgement: The authors would like to express their sincere appreciation to the medical and administrative staff of Sir Ganga Ram Hospital and the Services Institute of Medical Sciences, Lahore, for their cooperation and assistance throughout the research. Special thanks are extended to the community health workers, field screening teams, and data management personnel who played a crucial role in patient identification and follow-up. Their contribution was instrumental in the successful completion of this study.

Research Interest: The authors' primary research interests focus on hepatology, liver cancer epidemiology, public health interventions, and the effectiveness of community-based screening programs in early disease detection. Additional areas of interest include hepatitis B and C management, health system strengthening, and cancer prevention strategies in resource-limited settings.

Funding: This study did not receive any specific grant from funding agencies in the public, commercial, or not-for-profit sectors. It was entirely self-funded by the authors as part of their academic and institutional research activities.

Author Contribution: All authors contributed significantly to the research process. The study concept and design were developed collaboratively. Data collection and patient enrollment were conducted by the clinical team under appropriate supervision. Statistical analysis and interpretation of results were jointly performed. The manuscript was drafted, reviewed, and finalized with equal input from all authors, who have approved the final version for submission and publication.

REFERENCES

1. Graupera I, Lammert F. Screening is caring: Community-based non-invasive diagnosis and treatment strategies for hepatitis C to reduce liver disease burden. J Hepatol. 2018;69(3):562–3.
2. Katamba PS, Mukunya D, Kwesiga D, Nankabirwa V. Prenatal hepatitis B screening and associated factors in a high prevalence district of Lira, northern Uganda: a community-based cross-sectional study. BMC Public Health. 2019;19:1–7.
3. O'Leary DA, Cropp E, Isaac D, Desmond PV, Bell S, Nguyen T, et al. "B in IT"–a community-based model for the management of hepatitis B patients in primary care clinics using a novel web-based clinical tool. Hepatol Med Policy. 2018;3:1–10.
4. Li C, Lu X, Xiao J, Chan CW. 'We can bear it!' Unpacking barriers to hepatocellular carcinoma screening among patients with hepatitis B: a qualitative study. J Clin Nurs. 2022;31(21–22):3130–43.
5. Bui H, Kumar NG, Singal AG, Boparai J, Tran D, Mukhtar NA, et al. Implementation of a hepatocellular carcinoma surveillance program in a community-based integrated health system in patients with hepatitis C cirrhosis. Am J Gastroenterol. 2022. doi:10.14309.
6. Maher S, Dowdell L, Zhang L, Zekry A. Community screening identifies undiagnosed chronic liver disease in high-risk populations. J Gastroenterol Hepatol. 2021;36(8):2255–60.
7. Woldegiorgis AE, Erku W, Medhin G, Berhe N, Legesse M. Community-based sero-prevalence of hepatitis B and C infections in South Omo Zone, Southern Ethiopia. PLoS One. 2019;14(12):e0226890.
8. Shiha G, Metwally AM, Soliman R, Elbasiony M, Mikhail NN, Easterbrook P. An educate, test, and treat programme towards elimination of hepatitis C infection in Egypt: a community-based demonstration project. Lancet Gastroenterol Hepatol. 2018;3(11):778–89.
9. Mohamed EA, Giama NH, Shaleh HM, Kerandi L, Oseini AM, Ahmed Mohammed H, et al. Knowledge, attitudes, and behaviors of viral hepatitis among recent African immigrants in the United States: a community-based participatory research qualitative study. Front Public Health. 2020;8:25.
10. Ruan B, Yu Z, Yang S, Xu K, Ren J, Yao J, et al. Establishment and development of national community-based collaborative innovation demonstration areas to achieve the control target of hepatitis B in China. BMC Infect Dis. 2019;19:1–10.
11. Hirode G, Liu B, Bhuket T, Wong R. Low Hepatitis B Virus Vaccination Rates Among High-Risk and Immigrant Populations: A Safety Net Community-Based Hospital Experience. Am J Gastroenterol. 2018;113(Suppl):S558–9.

12. Mahalakshmi PA, Gowtham RR, Mudhigeti N, Pamireddy ML, Meenakshi K, Nallapireddy U, et al. Seroprevalence and trend of hepatitis B and C viral infections in patients at a tertiary care hospital in Southern India: a retrospective study. J Clin Diagn Res. 2020;14(1).
13. Wade AJ, Macdonald DM, Doyle JS, Gordon A, Roberts SK, Thompson AJ, et al. The cascade of care for an Australian community-based hepatitis C treatment service. PLoS One. 2015;10(11):e0142770.
14. Shin SH, Kim SU, Park JY, Kim DY, Ahn SH, Han KH, et al. Liver stiffness-based model for prediction of hepatocellular carcinoma in chronic hepatitis B virus infection: comparison with histological fibrosis. Liver Int. 2015;35(3):1054–62.
15. Pritchard-Jones J, Stevens C, McCaughan G, Strasser S. Feasibility, acceptability and safety of a nurse-led hepatitis B clinic based in the community. Collegian. 2015;22(2):233–40.
16. Belay AS, Abateneh DD, Yehualashet SS, Kebede KM. Hepatitis B virus infection and associated factors among adults in Southwest Ethiopia: community-based cross-sectional study. Int J Gen Med. 2020:323–32.
17. Hong TP, Gow PJ, Fink M, Dev A, Roberts SK, Nicoll A, et al. Surveillance improves survival of patients with hepatocellular carcinoma: a prospective population-based study. Med J Aust. 2018;209(8):348–54.
18. Hashim A, O'Sullivan M, Williams H, Verma S. Developing a community HCV service: project ITTREAT (integrated community-based test–stage–TREAT) service for people who inject drugs. Prim Health Care Res Dev. 2018;19(2):110–20.
19. Nguyen-Dinh S-H, Do A, Pham TND, Dao DY, Nguy TN, Chen MS Jr. High burden of hepatocellular carcinoma and viral hepatitis in Southern and Central Vietnam: experience of a large tertiary referral center, 2010 to 2016. World J Hepatol. 2018;10(1):116.
20. Hla TK, Bukulatjpi SM, Binks P, Gurruwiwi GG, Dhurrkay RG, Davies J. A "one stop liver shop" approach improves the cascade-of-care for Aboriginal and Torres Strait Islander Australians living with chronic hepatitis B in the Northern Territory of Australia: results of a novel care delivery model. Int J Equity Health. 2020;19:1–7.

This article may be cited as: Khan MTH, Ikram A, Babar SAA, Masood B, Jahan A, Shah AW: Effectiveness of Community-Based Screening for Early Detection of Hepatocellular Carcinoma in Hepatitis B and C Patients: A Clinical Study. Pak J Med Health Sci, 2023; 17(8): 179-182.