Age and Sex Patterns of Hepatitis B and C Seropositivity and Coinfection Among Gastroenterology Outpatients in South Punjab, Pakistan: A Comparative Cross-Sectional Study

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ABSTRACT

Background: Hepatitis B virus (HBV) and hepatitis C virus (HCV) are the major drivers of liver disease in Pakistan; however, age and sex patterns of seropositivity and coinfection among gastroenterology outpatients in South Punjab are not known.
Objective: To compare age and sex distribution of patients positive for hepatitis B surface antigen (HBsAg) only, antibody to HCV (anti-HCV) only, or both (serological coinfection).
Methods: This comparative cross-sectional study was conducted in the Department of Gastroenterology, Nishtar Medical University and Hospital, Multan from September 2025 to February 2026, involving 717 consecutive symptomatic patients who were positive for HBsAg and/or anti-HCV on third-generation enzyme-linked immunosorbent assay (ELISA) without testing for HCV RNA and HBV DNA. Chi-square, Fisher's exact and trend tests and unadjusted compositional odds ratios (ORs) were used for analyses. Results refer to composition, not prevalence, as only seropositive patients were included.
Results: There were 543 anti-HCV-only (75.7%; 95% confidence interval [CI] 72.5–78.7), 154 HBsAg-only (21.5%; 18.6–24.6) and 20 with serological coinfection (2.8%; 1.7–4.3). Pattern differed by sex ($p = 4.2 \times 10^{-5}$) and age ($p = 7.1 \times 10^{-5}$). Women had higher odds of anti-HCV-only (83.2% vs 68.8%; OR 2.24, 95% CI 1.57–3.21) and men of HBsAg-only (27.7% vs 14.8%; OR 2.21, 1.52–3.21). The anti-HCV-only share increased and the HBsAg-only share decreased across age groups (both trend $p < 0.001$). Coinfection did not differ by sex (3.5% vs 2.0%; $p = 0.26$) or age ($p = 0.36$).
Conclusion: Anti-HCV positivity was more common than HBsAg-only positivity, especially among women and older patients, while HBsAg-only positivity was more common among men and younger adults. These patterns can inform targeted testing and awareness by age and sex, with dual-marker testing and HCV RNA confirmation.

Keywords: Hepatitis B; Hepatitis C; Seropositivity; Coinfection; Gastroenterology outpatients; Pakistan; Age and sex patterns.

INTRODUCTION

Chronic viral hepatitis continues to be one of the major causes of death worldwide. According to WHO estimates, there were 287 million people with chronic infection with hepatitis B virus or hepatitis C virus in 2024, and these infections caused 1.34 million deaths, approximately 1.1 million due to hepatitis B and 240,000 due to hepatitis C.[1] According to current WHO fact sheets, there are approximately 240 million people with chronic hepatitis B virus (HBV) and 47 million with chronic hepatitis C virus (HCV) infection worldwide.[2,3] HBV is found mainly in Africa and the Western Pacific, where perinatal and early childhood transmission is the main source of infection, while HCV is found mainly in the Eastern Mediterranean and parts of Europe, and is mainly associated with unsafe injections, other health-care exposures and injecting drug use.[3–6] Pakistan is one of the top 10 countries contributing 58% of the world's deaths due to hepatitis C.[1] The national burden was reported in the national survey conducted in 2007-2008, which revealed that 2.5% of the general population had hepatitis B surface antigen (HBsAg) and 4.8% had antibody to HCV (anti-HCV), for a total of 7.6%.[7] According to a serosurvey conducted in 2019, 1.0% of people in Sindh were positive for HBsAg and 6.1% were positive for anti-HCV.[8] The most well documented risk factors for HCV transmission in Pakistan are therapeutic injections and syringe reuse,[9,10] and the burden varies between provinces and districts.[10–13] There are relatively few reports on the burden of hepatitis B and hepatitis C in Pakistan, particularly in hospital settings in South Punjab, a densely populated area with large referral hospitals.[14]

HBV and HCV markers should be discussed separately. Large population-based studies are lacking and the population prevalence of true HBV/HCV coinfection is unknown, and the virological interaction between the two viruses is complex and dynamic.[15] Dually infected patients seem to be at higher risk for advanced liver disease and hepatocellular carcinoma (HCC) than mono-infected patients,[15–19] and antiviral therapy selection and monitoring rely on the identification of both infections. The reported figures in Pakistan vary from one hospital to another due to differences in population, assays and denominators.[20–22]

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While previous studies in Pakistan have concentrated on seroprevalence or molecular detection of HBV and HCV, little is known about the age and sex distribution of patients with HBsAg-only, anti-HCV-only and coinfection status in a tertiary-care gastroenterology outpatient population. We therefore examined age and sex specific patterns of seropositivity and coinfection of HBV and HCV in consecutive seropositive patients attending Gastroenterology outpatient department of a tertiary hospital in South Punjab and estimated the serological coinfection with confidence intervals. The main purpose was to compare the sex and age category distribution of anti-HCV-only, HBsAg-only and coinfected patients. Secondary aims were to estimate the proportion of serological coinfection and to determine whether any differences were robust to the exclusion of the coinfected group. The study was not designed to estimate prevalence or risk as there were no seronegative patients in the cohort.

METHODOLOGY

This was a record-based comparative cross-sectional study reported according to Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) statement.[23] It was carried out at the Department of Gastroenterology, Nishtar Medical University and Hospital, Multan, a tertiary referral centre for South Punjab. The patients were included from September 2025 to February 2026 and the data were abstracted from the hospital records. Symptomatic patients presenting to the Gastroenterology OPD (outpatient department) were included based on seropositivity for HBsAg and/or anti-HCV and symptom details were not analysed. The study is analytic in its aim, as patterns of seropositivity and coinfection were compared within a single consecutive cohort, by sex and age, rather than in the sampling, with no separate comparison group recruited.

Consecutive patients who were positive for HBsAg, anti-HCV or both were included. At the eligibility stage, patients with incomplete records (missing age, sex or serological results) were excluded, and there were no missing values for age, sex or serological status in the analytic cohort. No formal sample size calculation was done; all eligible consecutive patients over the study period were included, resulting in 717 patients. Only seropositive patients were included, so the study does not have a seronegative comparison group or a denominator of persons tested, and proportions are not prevalence.

The outcome was serological pattern and the explanatory variables were age and sex. Third-generation enzyme-linked immunosorbent assay (ELISA) kits were used to measure HBsAg and anti-HCV, following the manufacturers' instructions. Due to resource constraints, HCV RNA and HBV DNA testing were not performed. Patients were divided into three mutually exclusive serological groups: anti-HCV only (anti-HCV positive, HBsAg negative), HBsAg only (HBsAg positive, anti-HCV negative) and coinfection (both positive). These are not terms for active infection, but rather serological patterns: coinfection is defined as serological co-positivity for both markers, anti-HCV may persist after spontaneous or treatment-induced clearance and is a marker for exposure, and the coinfection group may include resolved HCV infection. Age and sex were obtained from hospital records and laboratory reports. Age was grouped a priori as 11–20 (the youngest patient was 11 years), 21–40, 41–60 and ≥61 years. Categorical variables are displayed as numbers and percentages. Confidence intervals (CIs) for proportions were Wilson intervals, except for coinfection where small counts resulted in the use of exact Clopper–Pearson intervals. The associations between serological pattern (three categories) and sex or age category were tested using Pearson's chi-square test; due to the small expected cell counts, Monte Carlo exact p values (20,000 permutations) and Cramér's V as effect size are also reported. For sex, we calculated unadjusted odds ratios (ORs; Woolf 95% Cis) for each pattern compared to all other patterns, and used Fisher's exact test for p values. These are compositional odds ratios, as they are only for seropositive patients and do not reflect risk of infection. Ordinal trends across the four age categories were tested using the Cochran–Armitage test with equally spaced scores (which assumes that age is an ordered category but does not assume that there is a linear relationship in years); the same results were obtained using a sensitivity analysis with category midpoints (15.5, 30.5, 50.5 and 70 years). Patients were also compared by age group (age ≥41 years vs age ≤40 years) for coinfection. The sex and age analyses were repeated without coinfected patients to ensure that findings were not due to the small coinfection group. The p values are reported exactly and $p < 0.05$ (two-sided) was deemed statistically significant. Analyses were descriptive and not multiplicity adjusted, but the main findings would still be significant after Bonferroni correction for the nine comparisons in Table 2. Exact tests and confidence intervals were performed using SPSS version 26.0 (IBM Corp., Armonk, NY, USA) and Python 3 (SciPy). Patterns are reported within each age category and within each sex separately; no model was fitted jointly adjusted for age and sex because age–sex cross-tabulations were not included in the analysis dataset; age–sex interaction effects are not estimated.

RESULTS

Cohort characteristics and overall distribution

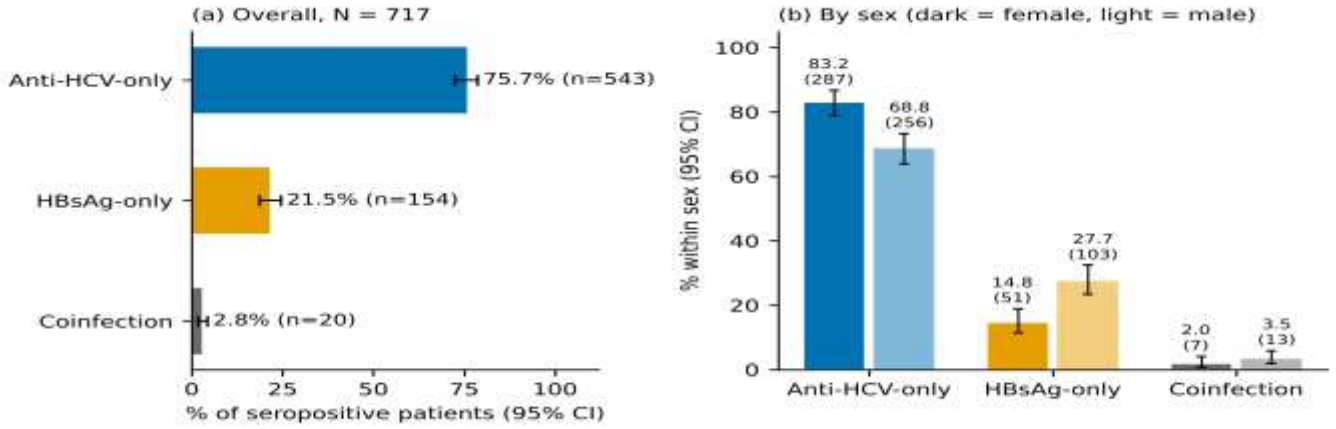
The cohort comprised 717 patients: 345 women (48.1%) and 372 men (51.9%). By age, 34 (4.7%) were 11–20 years, 263 (36.7%) were 21–40, 336 (46.9%) were 41–60 and 84 (11.7%) were ≥61 years (Table 1). Overall, 543 patients (75.7%; 95% CI 72.5–78.7) were anti-HCV-only, 154 (21.5%; 18.6–24.6) were HBsAg-only and 20 (2.8%; 1.7–4.3) had serological coinfection (Fig. 1a). Counting all patients with each marker, 563 (78.5%) were anti-HCV positive and 174 (24.3%) were HBsAg positive. The anti-HCV-only patients outnumbered the HBsAg-only patients by 3.5:1.

Table 1. Serological pattern by sex and age category among 717 seropositive patients, n (row %).

Characteristic	Total n	Anti-HCV-only	HBsAg-only	Coinfection	*p* (overall test)
All patients	717	543 (75.7)	154 (21.5)	20 (2.8)	
Sex					
Female	345	287 (83.2)	51 (14.8)	7 (2.0)	4.2×10^{-5}
Male	372	256 (68.8)	103 (27.7)	13 (3.5)	
Age category (years)					
11–20	34	22 (64.7)	12 (35.3)	0 (0.0)	7.1×10^{-5}
21–40	263	177 (67.3)	80 (30.4)	6 (2.3)	
41–60	336	277 (82.4)	48 (14.3)	11 (3.3)	
≥61	84	67 (79.8)	14 (16.7)	3 (3.6)	

Anti-HCV-only, antibody to hepatitis C virus positive and hepatitis B surface antigen (HBsAg) negative; HBsAg-only, HBsAg positive and anti-HCV negative; coinfection, both markers positive (serological co-positivity). These denote serological patterns, not confirmed active infection. Each p value is from a single Pearson chi-square test of serological pattern against sex (χ^2 = 20.140, df = 2) or age category (χ^2 = 28.656, df = 6); df, degrees of freedom. Row percentages may not sum to 100 because of rounding.

Fig. 1. Serological pattern of 717 seropositive patients. (a) Overall distribution (95% confidence intervals (CIs)). (b) Distribution by sex (dark bars = women, light bars = men) with 95% Cis and number of patients in parentheses. Wilson intervals are shown for anti-HCV-only and HBsAg-only, and exact intervals for coinfection. Percentages refer to the seropositive population and not to the prevalence of the population. HBsAg: hepatitis B surface antigen; anti-HCV: antibody to hepatitis C virus.



Sex differences

Serological pattern differed significantly by sex (χ^2 = 20.140, df = 2, p = 4.2 × 10−5; Monte Carlo exact p < 0.0001; Cramér's V = 0.17, a small-to-moderate effect). The difference was driven by anti-HCV-only and HBsAg-only patients: women had higher odds of anti-HCV-only (83.2% vs 68.8%; unadjusted OR 2.24, 95% CI 1.57–3.21; p = 7.9 × 10−6) and men had higher odds of HBsAg-only (27.7% vs 14.8%; unadjusted OR 2.21, 1.52–3.21; p = 2.6 × 10−5). Coinfection was numerically more frequent in men (13/372, 3.5%) than in women (7/345, 2.0%), but the difference was not statistically significant (OR 1.75, 0.69–4.44; Fisher's p = 0.26) (Table 2). There was no statistically significant difference between the sexes in coinfection and the confidence interval was consistent with no difference and a greater than four-fold difference.

Table 2. Tests of association, effect sizes and trends.

Comparison	Measure	Estimate	95% CI	*p* value
Serological pattern × sex	Cramér's V	0.168	–	4.2×10^{-5}
Serological pattern × age category	Cramér's V	0.141	–	7.1×10^{-5}
HBsAg-only, male vs female	Unadjusted OR	2.21	1.52–3.21	2.6×10^{-5}
Anti-HCV-only, female vs male	Unadjusted OR	2.24	1.57–3.21	7.9×10^{-6}
Coinfection, male vs female	Unadjusted OR	1.75	0.69–4.44	0.26
Coinfection, ≥41 vs ≤40 years	Unadjusted OR	1.67	0.64–4.40	0.36
Anti-HCV-only, age trend	Cochran–Armitage *z*	3.87	–	1.1×10^{-4}
HBsAg-only, age trend	Cochran–Armitage *z*	−4.51	–	6.5×10^{-6}
Coinfection, age trend	Cochran–Armitage *z*	1.18	–	0.24

CI, confidence interval; OR, odds ratio; HBsAg, hepatitis B surface antigen; anti-HCV, antibody to hepatitis C virus. All odds ratios are unadjusted and compositional: they compare the mix of serological patterns between groups within a seropositive cohort and do not estimate risk of infection. CIs are Woolf intervals; p values for odds ratios are from Fisher's exact test and for Cramér's V rows from Pearson chi-square tests. Monte Carlo exact p values were <0.0001 (sex) and 0.00025 (age).

Age differences

Serological pattern also differed by age category (χ^2 = 28.656, df = 6, p = 7.1 × 10−5; Monte Carlo exact p = 0.00025; V = 0.14). Two of 12 cells (16.7%) had expected counts below 5 (minimum 0.95 in the coinfection cell for ages 11-20) and the exact test concurred. The anti-HCV-only share was 64.7% (95% CI 47.9–78.5) at 11–20 years, 67.3% (61.4–72.7) at 21–40, 82.4% (78.0–86.1) at 41–60 and 79.8% (70.0–87.0) at ≥61 years. The HBsAg-only share showed the mirror image: 35.3% (21.5–52.1), 30.4% (25.2–36.2), 14.3% (10.9–18.4) and 16.7% (10.2–26.1) (Table 3, Fig. 2). Both ordinal trends were significant (Cochran–Armitage z = 3.87, p = 1.1 × 10−4 for anti-HCV-only; z = −4.51, p = 6.5 × 10−6 for HBsAg-only; midpoint-score sensitivity analysis z = 3.90 and −4.54). There were only 34 patients aged 11-20 and the estimates are not precise, so no inference is made for this age group.

Coinfection occurred in 0/34 (95% exact CI 0.0–10.3%), 6/263 (2.3%), 11/336 (3.3%) and 3/84 (3.6%) patients across the four age categories. This pattern did not reach significance as an ordinal trend (z = 1.18, p = 0.24), and the proportion at ≥41 years (14/420, 3.3%) did not differ significantly from that at ≤40 years (6/297, 2.0%; unadjusted OR 1.67, 95% CI 0.64–4.40; Fisher's p = 0.36) (Table 2).

Fig. 2. Serological pattern according to age group. (a) Composition of each age category. (b) Proportions of anti-HCV-only and HBsAg-only patients with 95% Wilson confidence intervals; trend p values are from Cochran–Armitage ordinal trend tests. Patients with coinfection (n = 20) are not shown in (b) due to low numbers. HBsAg: hepatitis B surface antigen; anti-HCV: antibody to hepatitis C virus.

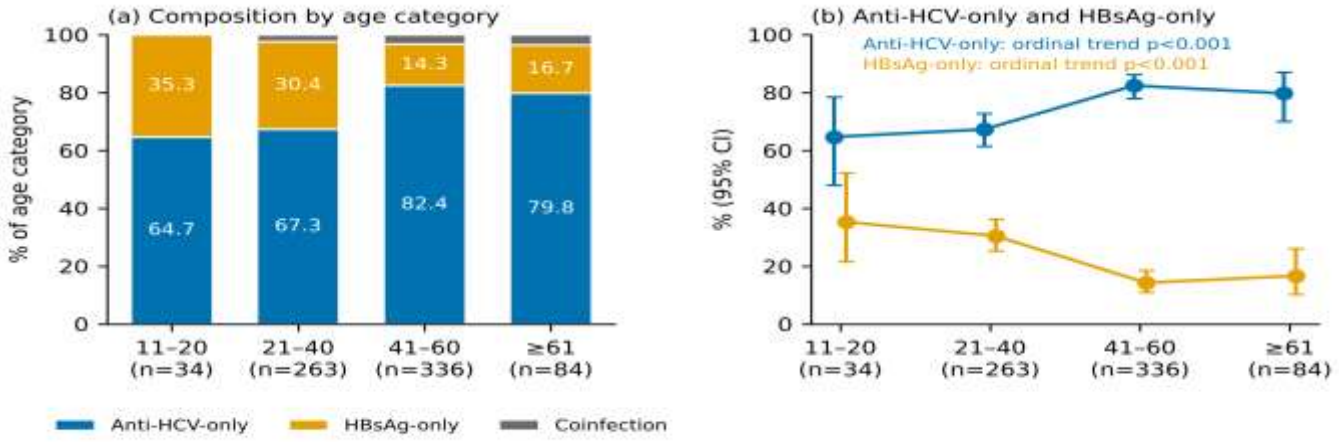


Table 3. Proportions (%) with 95% confidence intervals by sex and age category.

Group	n	Anti-HCV-only % (95% CI)	HBsAg-only % (95% CI)	Coinfection % (95% CI)
All patients	717	75.7 (72.5–78.7)	21.5 (18.6–24.6)	2.8 (1.7–4.3)
Female	345	83.2 (78.9–86.8)	14.8 (11.4–18.9)	2.0 (0.8–4.1)
Male	372	68.8 (63.9–73.3)	27.7 (23.4–32.4)	3.5 (1.9–5.9)
11–20 years	34	64.7 (47.9–78.5)	35.3 (21.5–52.1)	0.0 (0.0–10.3)
21–40 years	263	67.3 (61.4–72.7)	30.4 (25.2–36.2)	2.3 (0.8–4.9)
41–60 years	336	82.4 (78.0–86.1)	14.3 (10.9–18.4)	3.3 (1.6–5.8)
≥61 years	84	79.8 (70.0–87.0)	16.7 (10.2–26.1)	3.6 (0.7–10.1)

CI, confidence interval; HBsAg, hepatitis B surface antigen; anti-HCV, antibody to hepatitis C virus. Proportions are shares of the seropositive cohort, not prevalence in the population. Wilson intervals are shown for anti-HCV-only and HBsAg-only; Clopper–Pearson (exact) intervals for coinfection.

Sensitivity analysis excluding coinfected patients

After excluding the 20 patients with coinfection (697 patients remaining), the HBsAg-only share remained higher in men than in women (103/359, 28.7% vs 51/338, 15.1%; OR 2.26, 95% CI 1.56–3.30; χ^2 = 18.71, df = 1, p = 1.5 × 10−5). It also varied by age category (χ^2 = 26.85, df = 3, p = 6.3 × 10−6; Cramér's V = 0.20; ordinal trend z = −4.41, p = 1.0 × 10−5). The main findings were thus not influenced by the small coinfection group.

DISCUSSION

Principal findings

Three-quarters of 717 seropositive gastroenterology outpatients at a tertiary hospital in South Punjab were anti-HCV-only, while approximately one-fifth were HBsAg-only, with a significant difference between the two groups in terms of sex and age. Anti-HCV-only patients were relatively more common in women and patients aged 41 years or older, while HBsAg-only patients were relatively more common in men and patients aged 40 years or younger. These differences remained when coinfected patients were removed. Serological coinfection was rare (2.8%) but was slightly more common in men and older patients, but not significantly different by either of these factors, and our findings are most relevant to the comparison of the two single-marker patterns.

Magnitude of the differences

The differences were significant both in absolute terms and statistically. The anti-HCV-only share was 14.4 percentage points higher in women than in men (83.2% vs 68.8%), and the HBsAg-only share was 12.9 percentage points higher in men (27.7% vs 14.8%). The HBsAg-only share decreased by approximately 21 percentage points across age categories from 11-20 years (35.3%) to 41-60 years (14.3%) and the anti-HCV-only share increased by approximately 18 percentage points. The Cramér's V values (0.17 for sex and 0.14 for age) suggest small to moderate associations, as would be expected if a single demographic variable is associated with a three-category serological outcome. These estimates are stable, as indicated by the agreement of the asymptotic and Monte Carlo exact tests, and of the ordinal and midpoint-scored trend tests.

Comparison with existing evidence

The anti-HCV positivity was higher than HBsAg positivity in this tertiary care cohort, which was directionally similar to the national survey data where anti-HCV was more prevalent than HBsAg[7] and the difference was greater in Sindh in 2019.[8] However, direct quantitative comparison is not appropriate as the present study was limited to seropositive hospital attendees and therefore included referral and care-seeking as well as underlying infection. In the context of systematic reviews of both infections, persistent HCV transmission via health-care exposures reported in Pakistan[9,10] the impact of infant HBV immunisation on younger age groups2 are plausible background factors.[11,12] Multicentre data from Punjab[13] and the hospital-based report from Bahawalpur[14] are both from the same region, while our results include serological pattern data by age and sex from a Multan referral department. There is also a difference in age distribution between the hospital series and ours, with positive results in Islamabad being concentrated at 21-40 years of age,[20] while almost half of our patients were aged 41-60 years. These differences could be due to case-mix and referral patterns.

Sex and age patterns

Women had higher odds of being anti-HCV-only (OR 2.2) and men had higher odds of being HBsAg-only (OR 2.2). These are the ratios of composition in a seropositive population and do not

indicate that women are more susceptible to infection. Laboratory data from Karachi also revealed that HBsAg reactivity was significantly higher in males with a mean age of about 30 years.[24] This is similar to the male predominance and younger adult predominance of HBsAg-only positivity observed here. Testing practices can also play a role. Women can be tested during antenatal care or before procedures, and CDC guidelines suggest that all pregnant women be tested for HCV[25] (may detect anti-HCV, even if there is no risk). It was not possible to determine whether this was true for our patients. The most consistent and strongest result was the inverse age gradients. All these explanations are hypotheses, since there was no information on exposure or vaccination history and age and sex were not modelled together. No inferences are made for the 11-20 age group (n = 34).

Coinfection

The coinfection rate of 2.8% (95% CI 1.7–4.3) is the proportion of seropositive patients positive for both markers. It is not a measure of the prevalence of confirmed active HBV/HCV coinfection. Other Pakistani series have different denominators, assays and definitions: 1.3% in suspected viral hepatitis in Islamabad,[20] HBV DNA in 17.9% of 108 anti-HCV positive samples in Hyderabad[21] and HBV DNA in approximately 6% of 501 PCR confirmed HCV patients (dual infection more prevalent in males 69%).[22] These are not directly comparable with our figure. The male excess in the molecular series is in the same direction as our point estimate, but our confidence interval is consistent with no difference.

HBV/HCV infection is clinically relevant. Coinfected patients were significantly more likely to have ascites and encephalopathy than singly infected patients in a Rawalpindi series of 97 chronic liver disease patients.[26] In Peshawar, 20.98% of 348 HBV-HCV coinfected patients had HCC, and age > 45 years, cirrhosis and duration of infection > 5 years were independent predictors.[27] These cohorts were from existing liver disease and cannot be compared to our outpatient proportion. Previous cohorts and pooled analyses have reported increased incidence of HCC in coinfected patients compared to monoinfected patients, and a synergistic effect.16–19 A case-control study in Johannesburg reported relative risks of 23.3 for HBsAg alone, 6.6 for anti-HCV alone and 82.5 for both HBsAg and anti-HCV.[28]

The mechanism of this more severe course is still unclear. In early clinical studies, an inverse correlation between HBV and HCV replication and increased cytopathic effects were observed.[29] Both viruses replicated in the same cells in an in vitro model, with no direct interference, indicating that interference is mediated by host immune responses.[30] The predominant virus can also change with time.[15] Serology cannot determine which virus is replicating. Anti-HCV was found in 7% of 837 HBsAg-positive patients in an Italian multicentre study. Of 36 coinfected patients who underwent virological testing, only 5 were coinfected with HBV DNA and HCV RNA, 16 were coinfected with HBV DNA only, 9 were coinfected with HCV RNA only and 6 were not coinfected with either.[31,32] This reinforces our warning about dual seropositivity not necessarily indicating dual infection.

In patients with HBsAg positivity, hepatitis delta virus is another factor to consider. Anti-HDV was found in 5/501 HCV patients in one Pakistani series.[22] However, community double-reflex testing in eastern Balochistan revealed approximately two-thirds of HBsAg-positive individuals were anti-HDV positive, with 58.1% of the anti-HDV-positive individuals being HDV viraemic.[33] Some HBsAg-only patients may have been HDV infected, as this was not evaluated here.

Implications

Based on our findings, screening and awareness campaigns in South Punjab may be targeted by age and sex rather than applied uniformly. The highest proportion of anti-HCV was seen in women and those aged 41 years or older. This helps raising awareness of injection and surgical safety among these groups[9,10] and offering HCV testing during routine contact points like antenatal and pre-procedure care.[25] HBsAg-only positivity was more prevalent in males and adults aged 40 years or less. This may help facilitate HBV testing and vaccination catch-up in young men who may be infected at a young age and not realise it. These patterns are not risk or prevalence patterns, but rather composition of seropositive patients. They should inform outreach based on hypotheses, and not be a substitute for population screening.

From a clinical standpoint, anti-HCV is a test for past and current infection, and reflex HCV RNA testing of antibody-positive patients is required prior to treatment decisions.[3,25] The dual seropositivity should also be confirmed by HCV RNA and HBV DNA, and the testing of HDV should be considered in HBsAg-positive patients.[15,33] Our data provide a baseline for planning diagnosis and linkage to care in a tertiary referral department in South Punjab, where such data are scarce, under the WHO 2030 elimination framework.[1] No cost or yield analysis was done. Multicentre studies in the future should incorporate a denominator of persons tested, exposure and vaccination history, HCV RNA, HBV DNA and HDV testing, and age and sex models adjusted for together.

Strengths and limitations

The strengths are consecutive enrolment from a single tertiary outpatient service, uniform third generation ELISA testing, verification of results with laboratory reports, and effect sizes with exact confidence intervals. The study also provides outpatient data from South Punjab, where there is relatively little published data on HBV and HCV serological patterns. The limitations include the single-centre setting, the inclusion of seropositive patients only (so the results are compositional and not prevalence), serology alone (without HCV RNA or HBV DNA), and separate rather than jointly adjusted age and sex analyses; the coinfection group was small.

CONCLUSION

Anti-HCV positivity was more common than HBsAg-only positivity in seropositive gastroenterology outpatients of a tertiary hospital in South Punjab, especially in females and those aged 41 years and above. Serological coinfection was rare (2.8%) and we did not observe any differences in serological coinfection by sex or age. The outpatient-based patterns reinforce the need to consider dual testing, HCV RNA confirmation, and to continue to focus on injection safety and HBV vaccination status. Virological testing, exposure data and adjusted analysis are warranted for confirmation in multicentre studies.

Ethical Approval

This study was performed in compliance with the Declaration of Helsinki and the ICMJE Recommendations. The research project was approved by the Institutional Ethical Review Board (IERB), Nishtar Medical University, Multan (Reference No. 16105).

Data Availability

The data analysed in this study are available from the corresponding author upon reasonable request.

Author Contributions

Conceptualization: Hira Khan.
Data curation: Hira Khan.
Methodology: Hira Khan and Muhammad Ilyas.

Formal analysis: Hira Khan and Talha Khan Jadoon.
Software: Hira Khan.
Investigation: Hira Khan and Muhammad Ilyas.
Supervision: Muhammad Ilyas.
Validation: Muhammad Ilyas and Anas Jahangir.
Visualization: Hira Khan and Talha Khan Jadoon.
Writing – original draft: Hira Khan, Muhammad Ilyas and Talha Khan Jadoon.
Writing – review and editing: Hira Khan, Muhammad Ilyas and Anas Jahangir.
Project administration: Muhammad Ilyas.
Resources: Muhammad Ilyas.
All authors have read and approved the final version of the manuscript.

Informed Consent
The study was conducted using data obtained from electronic medical records and informed consent was not required as approved by the IERB of Nishtar Medical University, Multan.

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Conflict of Interest
None.

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Declaration of AI-Assisted Language Editing
No artificial intelligence assistant was used in the preparation of the manuscript.

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