IRASS Journal of Multidisciplinary Studies
https://irasspublisher.com/journal-details/IRASSJMS
ISSN *(Online) 3049-0073*

PREVALENCE AND FACTORS ASSOCIATED WITH HEPATORENAL SYNDROME AMONG PATIENTS ATTENDING MEDYLIFE HEALTHCARE HOSPITAL, GHANA

Aquel Rene Lopez[1*], Priscilla Oforiwaa[2], Akwesi Afriyie Achiampong[3], Prince Adoba[4], Robert Acquah[5]

[1-2-3-4] Department of Medical Laboratory Science, School of Health and Allied Sciences, Baldwin University College, Accra

[5] Department of Emergency Medicine, Sinel Specialist Hospital, Accra

Corresponding Author: Aquel Rene Lopez

Department of Medical Laboratory Science, School of Health and Allied Sciences, Baldwin University College, Accra

Article History

Received: 16 / 10 / 2025

Accepted: 12 / 12 / 2025

Published: 24 / 12 /2025

Abstract: Background: Hepatorenal syndrome (HRS) is a life-threatening complication of advanced liver disease, characterized by functional renal failure and poor prognosis. Evidence on its burden and associated factors in Ghana remains scarce.

Methods: A hospital-based cross-sectional study was conducted between February and May 2025 among 80 adult patients with liver disease. Sociodemographic and clinical data were obtained using structured questionnaires. Venous blood samples were analyzed for liver and renal function parameters using a fully automated chemistry analyzer. Data were analyzed with SPSS version 26.0. Associations were evaluated using Spearman's correlation and binary logistic regression, with statistical significance set at $p < 0.05$.

Results: Liver disease was diagnosed in 68.8% of participants, among whom 58.2% had hepatorenal syndrome. The prevalence of HRS was higher in females (68.0%) than males (50.0%), though this difference was not statistically significant ($p = 0.178$). Renal dysfunction was widespread: 93.8% of participants had reduced estimated glomerular filtration rate, and 98.8% had elevated blood urea nitrogen levels. Alkaline phosphatase was elevated in all participants, while gamma-glutamyl transferase was elevated in 80%. Logistic regression showed increased odds of HRS among patients not on medication (OR = 3.49) and those with prior hospitalization (OR = 2.30), although these associations did not reach statistical significance.

Conclusion: Hepatorenal syndrome is highly prevalent among liver-diseased patients at Medylife Healthcare Hospital, indicating a substantial burden of renal dysfunction. Early renal monitoring, medication adherence, and integrated multidisciplinary care are essential to reduce morbidity and improve outcomes in this population.

Keywords: *Hepatorenal syndrome ,Liver cirrhosis ,Acute kidney injury ,Renal dysfunction , Chronic liver disease; Ghana.*

How to Cite in APA format: Lopez, A. R., Oforiwaa, P., Achiampong, A. A., Adoba, P. & Acquah, R. (2025). PREVALENCE AND FACTORS ASSOCIATED WITH HEPATORENAL SYNDROME AMONG PATIENTS ATTENDING MEDYLIFE HEALTHCARE HOSPITAL, GHANA. *IRASS Journal of Multidisciplinary Studies, 2(12),36-50.*

Introduction

Liver cirrhosis is a significant health concern worldwide, often leading to severe complications and high mortality rates (Sepanlou *et al*., 2020). It is categorized into two primary stages: compensated and decompensated cirrhosis. In compensated cirrhosis, patients may remain asymptomatic for extended periods, whereas decompensated cirrhosis presents with critical symptoms such as ascites, variceal bleeding, and hepatic encephalopathy. The survival rates starkly differ between these stages, with patients experiencing approximately 12 years of survival in compensated cirrhosis compared to only 2 years in decompensated cases (Margarita *et al*., 2020).

The transition from compensated to decompensated cirrhosis is primarily driven by portal hypertension, which significantly impacts patient outcomes (Badura *et al*., 2023). As liver disease progresses, patients may encounter further complications such as refractory ascites, spontaneous bacterial peritonitis, and hepatorenal syndrome (HRS), among others (Chaney, 2021). HRS is particularly concerning due to its association with a poor prognosis. Early identification and understanding of HRS are crucial for timely intervention, which can include medical treatment or liver transplantation. Hepatorenal syndrome is characterized by a decline in kidney function occurring in the context of severe chronic liver diseases, such as advanced cirrhosis or acute liver failure (Sasso *et al*., 2021).

The pathophysiology of HRS involves a complex interplay of factors that lead to renal impairment (Eknoyan & Epstein, 2021). It is primarily defined by a decrease in kidney perfusion resulting from a severe reduction in effective circulating volume, which triggers massive activation of the body's vasoactive systems (Rad *et al*., 2024). This process results in renal vasoconstriction occurring alongside systemic and splanchnic arterial vasodilation (Zaritsky *et al*., 2021). HRS is classified as an exclusion diagnosis; it is considered a functional pathology due to its potential reversibility following liver transplantation, although some debates persist regarding this classification (Jung & Chang, 2023).

Traditionally, two types of HRS have been recognized: Type 1 and Type 2. Type 1 HRS is marked by a rapid decline in renal function, with serum creatinine levels doubling to values exceeding 2.5 mg/dl within two weeks (Simonetto et al., 2020a). In contrast, Type 2 HRS presents a more gradual increase in serum creatinine levels above 1.5 mg/dl. The clinical manifestations of Type 1 are acute renal failure, while refractory ascites characterize Type 2 (Biggins *et al*., 2021).

Diagnosing HRS necessitates ruling out other potential causes of kidney injury, including the lack of response to diuretic withdrawal or plasma volume expansion, absence of shock or nephrotoxic drug treatment, normal urine analysis findings, and normal renal ultrasound results (Biggins *et al*., 2021).

Recent advancements have shifted the understanding of HRS significantly. Notably, the Hepatology Community and the International Club of Ascites have embraced new definitions for Acute Kidney Injury (AKI), recognizing systemic inflammation's role triggered by pathogen-associated molecular patterns in acute decompensation among cirrhotic patients (Laleman *et al*., 2018). While circulatory dysfunction remains a primary cause of HRS, emerging research has identified additional factors contributing to its development. These include systemic inflammation and conditions like cirrhotic cardiomyopathy (Chan *et al*., 2017).

The pathophysiology underlying HRS also highlights the importance of systemic circulatory dysfunction and renal factors. Arteriolar splanchnic vasodilation plays a pivotal role in the development of this syndrome (Ginès *et al*., 2018b). Initially, mild portal hypertension occurs alongside decreased systemic vascular resistance due to organ vasodilation. This vasodilation results from the excessive production of vasodilators such as nitric oxide and carbon monoxide while their degradation diminishes due to increased portal pressure and portosystemic shunting (McConnell & Iwakiri, 2018).

The body attempts to counteract these changes as a compensatory mechanism by increasing cardiac output and heart rate while activating potent vasoconstrictor systems like the sympathetic nervous system and the renin-angiotensin-aldosterone system (Borovac *et al*., 2020).These compensatory mechanisms can maintain normal blood pressure levels in compensated cirrhosis; however, once complications arise in decompensated cirrhosis, these systems often fail to function adequately (Gustot *et al*., 2021). This inadequacy leads to impaired renal blood flow and overall deterioration in organ function. Even at advanced stages of cirrhosis, reduced cardiac output compromises perfusion to vital organs (Engelmann *et al*., 2021).

Consequently, these physiological changes contribute to sodium retention and fluid accumulation manifesting as ascites and edema further exacerbating kidney vasoconstriction and decreasing glomerular filtration rate (GFR), ultimately resulting in HRS development (Ginès *et al*., 2018a). If renal vasoconstriction persists unaddressed, it may lead to damage within the kidney parenchyma followed by acute tubular necrosis (Rasmussen *et al*., 2024).

Concisely, hepatorenal syndrome represents a critical complication arising from an advanced liver disease characterized by complex interactions between circulatory dysfunction and renal impairment. Understanding these mechanisms is essential for early detection and management strategies aimed at improving patient outcomes in those suffering from liver cirrhosis.

Material and Methods

Study Design

This study employed a hospital-based cross-sectional design to determine the prevalence of hepatorenal syndrome (HRS) and to assess associated demographic and clinical factors among patients with liver disease. The cross-sectional approach was considered appropriate because it allows for the simultaneous assessment of exposure variables and outcomes within a defined population at a single point in time, making it suitable for estimating disease prevalence and identifying potential associations.

This design enabled the evaluation of renal and hepatic biochemical parameters alongside sociodemographic and clinical characteristics, providing a snapshot of the burden of hepatorenal syndrome within the study population. While causal relationships cannot be inferred due to the observational nature of the design, the study offers valuable insight into the magnitude of HRS and its correlates in a real-world clinical setting..

Study Site

The study was conducted at Medylife Healthcare Hospital, a private health facility located in Accra, Ghana. The hospital serves as both a primary healthcare provider and a referral center for residents within Caprice and surrounding communities, including Nima, Maamobi, Accra New Town, Circle, Pig Farm, and neighboring areas. Its strategic location allows it to serve a diverse patient population with varied demographic and socioeconomic backgrounds.

Medylife Healthcare Hospital is accredited by the National Health Insurance Authority and operates a 24-hour service delivery system. The facility offers a wide range of clinical services, including general outpatient care, internal medicine, surgical services, medical imaging, cardiology diagnostics, gastroenterology services, renal unit care, neurological diagnostics, ophthalmic services, and comprehensive laboratory investigations. The presence of both gastroenterology and renal care services makes the hospital particularly suitable for studies involving liver disease and its complications, including hepatorenal syndrome.

The hospital's laboratory is equipped with fully automated chemistry analyzers and operates according to standard operating procedures that support reliable biochemical assessment of liver and kidney function. These diagnostic capabilities, coupled with consistent patient flow and specialist consultations, provided an appropriate clinical environment for the assessment of hepatorenal syndrome prevalence and associated factors.

Study Population

The study population comprised adult patients diagnosed with liver disease who attended Medylife Healthcare Hospital in Accra, Ghana, during the study period from February to May 2025. Eligible participants included both inpatients and outpatients receiving evaluation, treatment, or follow-up care for liver-related conditions. The study population reflected a heterogeneous group with varying demographic characteristics, clinical presentations, and etiologies of liver disease, providing a representative snapshot

of patients at risk of developing hepatorenal syndrome within the hospital setting.

Participants were recruited consecutively to minimize selection bias and ensure that all eligible patients presenting during the study period had an equal opportunity of inclusion. Only patients aged 18 years and older who provided informed consent were enrolled. Patients with liver disease complicated by acute kidney injury or chronic kidney impairment were included, provided the renal dysfunction was attributable to liver disease.

Patients with intrinsic renal disease unrelated to liver pathology, those receiving renal replacement therapy, pregnant women, and lactating mothers were excluded to reduce confounding and ensure accurate assessment of hepatorenal syndrome. This approach ensured that renal dysfunction observed in the study population was most likely related to hepatic pathology and associated circulatory disturbances.

Inclusion criteria

Participants were eligible for inclusion in this study if they met all of the following criteria:

- Adults aged 18 years and older
- Patients diagnosed with liver disease (including viral, alcoholic, or metabolic etiologies) attending Medylife Healthcare Hospital
- Patients with liver disease complicated by renal impairment, including acute kidney injury or reduced renal function attributable to liver pathology
- Both inpatients and outpatients receiving evaluation, treatment, or follow-up care during the study period
- Patients who provided written informed consent to participate in the study

These criteria ensured the inclusion of individuals at risk of developing hepatorenal syndrome, thereby enabling accurate assessment of its prevalence and associated factors within the study population.

Exclusion criteria

Participants were excluded from the study if they met any of the following criteria:

- Pregnant women and lactating mothers, due to physiological alterations in renal and hepatic function
- Patients with intrinsic renal disease unrelated to liver pathology, including chronic kidney disease of non-hepatic origin
- Patients who had undergone renal replacement therapy, including hemodialysis or peritoneal dialysis
- Patients with acute kidney injury secondary to causes other than liver disease, such as sepsis-related acute tubular necrosis or drug-induced nephrotoxicity
- Patients who were unable or unwilling to provide informed consent

These exclusion criteria were applied to minimize confounding factors and ensure that renal dysfunction observed in the study was most likely attributable to hepatic disease and its associated circulatory disturbances

Ethical Consideration

Endorsement for this ongoing review was obtained from the Ethical Review Committee of the School of Allied Health Sciences, Baldwin University College, Ministry of Health, and Medylife Healthcare Hospital.

Participants were also informed about the study goals and aims and were assured about the confidentiality of the information they would be providing for this study.

Statistical Analysis

Data were cleaned and coded in Microsoft Excel and analyzed using SPSS version 26.0. Descriptive statistics summarized demographic, clinical, and biochemical variables as frequencies and percentages for categorical data and means with standard deviations for continuous data. Normality was assessed prior to inferential analysis.

Associations were examined using appropriate correlation tests, including Spearman's rank correlation for non-normally distributed variables and Pearson's correlation for normally distributed data. Binary logistic regression was used to identify factors associated with hepatorenal syndrome, with results reported as odds ratios and 95% confidence intervals. All analyses were two-tailed, and statistical significance was set at $p < 0.05$

Results

Table 1 General Descriptive Statistics of the Study Population

Table 1 below summarizes the sociodemographic characteristics and biochemical profiles of the study participants. A total of 80 patients were included in the analysis, comprising 48 males (60.0%) and 32 females (40.0%). The overall mean age of the participants was 50.44 ± 13.44 years. Males had a mean age of 48.56 ± 13.18 years, while females were slightly older with a mean age of 53.25 ± 13.54 years; however, this difference was not statistically significant ($p = 0.127$). Similar age distributions have been reported among patients with chronic liver disease in other hospital-based studies, suggesting that age alone may not be a primary determinant of disease severity or renal complications in cirrhosis (Ginès et al., 2018; Margarita et al., 2020).

The majority of participants identified as Christians (65.0%), followed by Muslims (21.3%) and individuals practicing traditional religions (13.8%). Religious affiliation did not differ significantly by sex ($p = 0.294$). Nearly half of the participants were married (47.5%), while 25.0% were single, 12.5% divorced, and 11.3% widowed. Marital status showed no statistically significant association with sex ($p = 0.267$), consistent with previous findings that sociodemographic variables such as marital status have limited influence on the biological progression of liver disease and its complications (Testino & Ferro, 2010).

Biochemical assessment revealed widespread renal dysfunction among the study population. Serum creatinine levels differed significantly by sex ($p = 0.006$), with a higher proportion of females exhibiting abnormal values. This finding aligns with evidence that serum creatinine may underestimate renal impairment in patients with cirrhosis, particularly among females, due to reduced muscle mass and altered creatinine metabolism (Mindikoglu & Pappas, 2018; Wong et al., 2025). Elevated blood urea nitrogen was observed in 98.8% of participants, while reduced estimated glomerular filtration rate was present in 93.8%,

highlighting severe impairment of renal perfusion, a hallmark of hepatorenal syndrome (Simonetto et al., 2020).

Liver function tests demonstrated marked abnormalities. Alkaline phosphatase levels were elevated in all participants (100%), and gamma-glutamyl transferase was elevated in 80.0%, indicating significant hepatobiliary dysfunction. Elevated aspartate aminotransferase was observed in 56.3% of participants, whereas alanine aminotransferase elevation was less frequent (6.3%). Total bilirubin levels remained within normal limits for all participants, suggesting compensated or subclinical hepatic dysfunction despite significant biochemical derangements, a pattern previously described in patients at risk of hepatorenal syndrome (Ginès et al., 2018; Velez et al., 2020).

Table 1 General Descriptive Statistics of the Study Population

Variable	Male (N=48)	Female (N=32)	Total (N=80)	P-value
Age (years)	48.56±13.18	53.25±13.54	50.44±13.44	0.127
Religion				0.294
Christian	29(60.4)	23 (71.9)	52(65.0)	
Muslim	13(27.1)	4 (12.5)	17(21.3)	
Traditional	6 (12.5)	5 (15.6)	11(13.8)	
Marital Status				0.267
Single	13(27.1)	7 (21.9)	20(25.0)	
Cohabiting	0 (0.00)	3 (9.40)	3 (3.80)	
Married	23(47.9)	15 (46.9)	38(47.5)	
Divorced	7 (14.6)	3 (9.40)	10(12.5)	
Widowed	5 (10.4)	4 (12.5)	9 (11.3)	
Creatinine Levels				0.006
Low	0 (0.00)	2 (6.30)	2 (2.50)	
Normal	47(97.9)	24 (75.0)	71(88.8)	
High	1 (2.10)	6 (18.8)	7 (8.80)	
BUN Levels				0.411
Normal	1 (2.10)	0 (0.00)	1 (1.30)	
High	47(97.9)	32 (100)	79(98.8)	
eGFR levels				1.000
Low	45(93.8)	30 (93.8)	75(93.8)	
Normal	3 (6.30)	2 (6.30)	5 (6.30)	
ALT Levels				1.000
Normal	45(93.8)	30 (93.8)	75(93.8)	
High	3 (6.30)	2 (6.30)	5 (6.30)	
AST Levels				0.645
Normal	22(45.8)	13 (40.6)	35(43.8)	
High	26(54.2)	19 (59.4)	45(56.3)	
ALP Levels				-
Normal	0 (0.00)	0 (0.00)	0 (0.00)	
High	48(100)	32 (100)	80(100)	
GGT Levels				0.424
Normal	11(22.9)	5 (15.6)	16(20.0)	
High	37(77.1)	27 (84.4)	64(80.0)	
Total Bilirubin				-
Normal	48(100)	32 (100)	80(100)	
High	0 (0.00)	0 (0.00)	0 (0.00)	

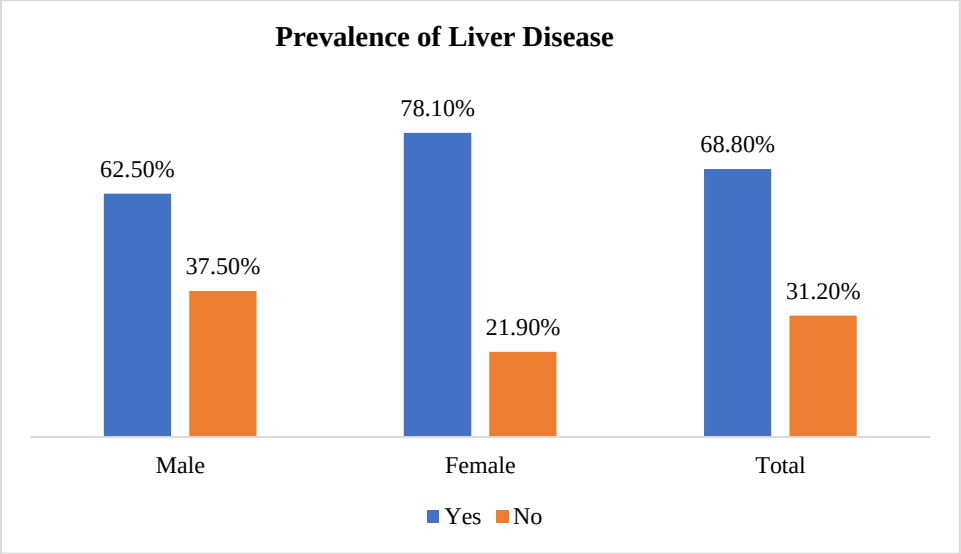

Figure 1: Prevalence of Liver Disease among the Study Population

Figure 1 illustrates the prevalence of liver disease among the study participants, stratified by sex. Overall, 68.8% (55/80) of the participants were diagnosed with liver disease, while 31.2% (25/80) had no evidence of liver disease. Among males, 62.5% were diagnosed with liver disease compared with 78.1% of females, indicating a higher observed prevalence among female participants.

Although females exhibited a greater burden of liver disease than males, this difference was not statistically significant, suggesting that sex alone may not be a decisive determinant of liver disease occurrence in this population. Similar patterns have been reported in hospital-based studies in sub-Saharan Africa, where delayed presentation, metabolic risk factors, and viral hepatitis contribute substantially to liver disease prevalence across both sexes (Sepanlou et al., 2020; Nartey et al., 2022).

The high overall prevalence observed in this study reflects the significant burden of chronic liver disease among patients attending tertiary and referral healthcare facilities. This finding is consistent with global evidence indicating that liver disease is increasingly prevalent in low- and middle-income countries, driven by chronic viral hepatitis, alcohol-related liver disease, and emerging non-alcoholic fatty liver disease (Ginès et al., 2018). The substantial proportion of affected individuals in this cohort underscores the importance of early detection and continuous monitoring of liver disease to prevent progression to severe complications, including hepatorenal syndrome.

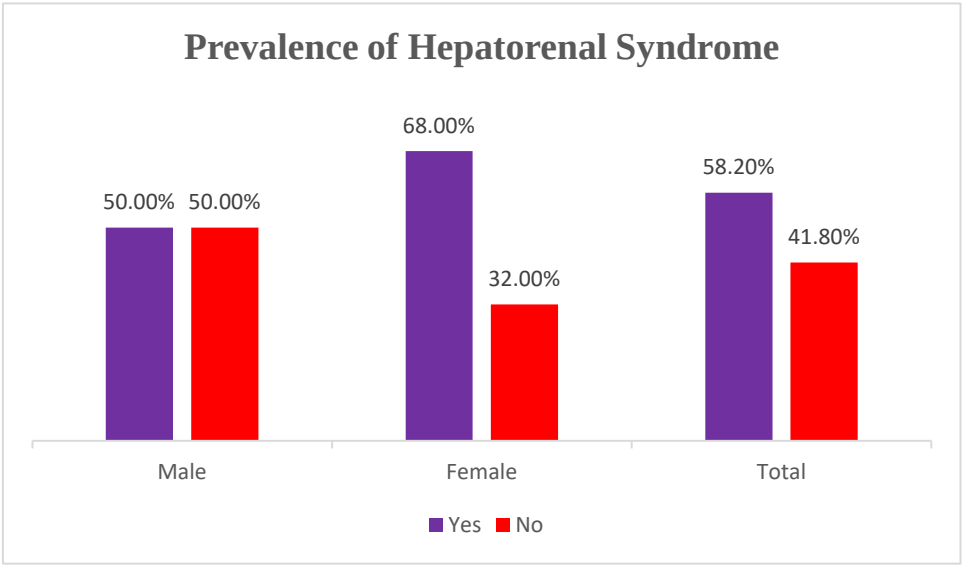

Figure .2: Prevalence of Hepatorenal Syndrome among Liver-Diseased Participants

Figure 2 presents the prevalence of hepatorenal syndrome (HRS) among participants diagnosed with liver disease, disaggregated by sex. Of the patients with liver disease, 58.2% (32/55) were diagnosed with hepatorenal syndrome, while 41.8% (23/55) had no evidence of HRS, demonstrating a substantial burden of renal complications in this clinical subgroup.

Sex-specific analysis showed that **50.0%** of male patients with liver disease developed HRS, compared with **68.0%** of female patients. Although the prevalence of HRS was notably higher among females, the difference did not reach statistical significance, suggesting that sex alone may not independently predict HRS occurrence in this cohort. Similar observations have been reported in studies indicating that while sex-based

physiological and hormonal differences may influence disease progression, HRS primarily reflects advanced circulatory and inflammatory derangements rather than demographic characteristics (Ginès et al., 2018; Simonetto et al., 2020).

The high prevalence of HRS observed in this study exceeds figures reported in many high-income settings but is comparable to findings from resource-limited environments, where late presentation of liver disease and limited access to specialized interventions contribute to worse renal outcomes (Sabry et al., 2024). This finding underscores the severity of liver disease at presentation in the study population and highlights the urgent need for early renal assessment and timely therapeutic intervention to reduce morbidity and mortality associated with hepatorenal syndrome.

Table 2 Demographic Factors Associated with Hepatorenal Syndrome

Table 2 presents the association between selected demographic variables and the occurrence of hepatorenal syndrome (HRS) among patients with liver disease. Of the 55 participants with liver disease included in this analysis, 32 (58.2%) were diagnosed with HRS, while 23 (41.8%) had no evidence of HRS.

Females accounted for a slightly higher proportion of HRS cases (53.1%) compared with males (46.9%). Conversely, males constituted a greater proportion of the non-HRS group (65.2%). Although this pattern suggests a possible higher susceptibility to HRS among females, the association between sex and HRS was not statistically significant (p = 0.178). This finding aligns with previous studies indicating that while sex-related physiological and hormonal differences may influence disease expression, HRS development is largely driven by advanced circulatory dysfunction rather than demographic characteristics alone (Ginès et al., 2018; Simonetto et al., 2020).

Religious affiliation showed no significant association with HRS occurrence (p = 0.835). Christians constituted the majority of both HRS (68.8%) and non-HRS (65.2%) groups, reflecting the general religious distribution of the study population. This observation is consistent with existing literature, which does not identify religion as an independent determinant of hepatorenal syndrome (Testino & Ferro, 2010).

Similarly, marital status was not significantly associated with the development of HRS (p = 0.771). Married participants represented the largest proportion in both the HRS (46.9%) and non-HRS (47.8%) groups, followed by single, divorced, and widowed individuals. These findings suggest that sociodemographic factors such as marital status do not directly influence the pathophysiological progression from liver disease to hepatorenal syndrome, a conclusion supported by prior hospital-based studies (Akbas et al., 2025).

Overall, the results indicate that demographic characteristics alone were not significant predictors of hepatorenal syndrome in this cohort, reinforcing the concept that HRS is predominantly a consequence of advanced hepatic and circulatory derangements rather than sociodemographic determinants.

Table 2 Demographic Factors Associated with Hepatorenal Syndrome

Variable	Diagnosed with HRS (N=32)	Have no HRS (N=23)	Total (N=55)	P-value
Gender				0.178
Male	15 (46.9)	15 (65.2)	30 (54.5)	
Female	17 (53.1)	8 (34.8)	25 (45.5)	
Religion				0.835
Christian	22 (68.8)	15 (65.2)	37 (67.3)	
Muslim	5 (15.6)	5 (21.7)	10 (18.2)	
Traditional	5 (15.6)	3 (13.0)	8 (14.5)	
Marital Status				0.771
Single	10 (31.3)	5 (21.7)	15 (27.3)	
Married	15 (46.9)	11 (47.8)	26 (47.3)	
Divorced	4 (12.5)	3 (13.0)	7 (12.7)	
Widowed	3 (9.4)	4 (17.4)	7 (12.7)	

Table 3 Clinical Factors Associated with Hepatorenal Syndrome

Table 3 summarizes the clinical characteristics associated with hepatorenal syndrome (HRS) among patients with liver disease. A total of 55 participants were included in this analysis, of whom 32 (58.2%) were diagnosed with HRS and 23 (41.8%) had no evidence of the syndrome.

Regarding the etiology of liver disease, hepatitis C virus infection was the most frequently observed condition in both groups, affecting 25.0% of patients with HRS and 43.5% of those without HRS. Hepatitis B virus was also common, while alcoholic liver disease and non-alcoholic fatty liver disease (NAFLD) were more prevalent among patients with HRS. Despite these observed differences, the type of liver disease was not significantly associated with HRS development (p = 0.222). Similar findings have been reported in previous studies, suggesting that while etiology contributes to disease progression, it does not independently predict HRS onset (Ginès et al., 2018; Akbas et al., 2025).

The duration of liver disease showed no significant association with HRS. Patients with disease duration exceeding five years constituted 62.5% of the HRS group and 60.9% of the

non-HRS group (p = 0.902), indicating that chronicity alone may not be a decisive factor in the development of HRS. This supports evidence that acute decompensating events, rather than disease duration, play a critical role in precipitating renal dysfunction in cirrhosis (Liu et al., 2021).

A higher proportion of patients with HRS had a history of hospitalization in previous years (78.1%) compared with those without HRS (60.9%); however, this difference was not statistically significant (p = 0.165). Medication use demonstrated a notable trend: 65.6% of HRS patients were on medication compared with 87.0% of non-HRS patients, suggesting a potential protective effect of treatment adherence, although this association did not reach statistical significance (p = 0.073). Previous studies have highlighted the importance of early pharmacological intervention in reducing the risk of HRS (Biggins et al., 2021).

Renal function markers were markedly abnormal across both groups. Low estimated glomerular filtration rate was present in over 90% of participants in both groups, and blood urea nitrogen levels were elevated in nearly all patients, with no significant differences observed. Serum creatinine levels were predominantly within normal ranges, reflecting the known limitations of creatinine-based renal assessment in cirrhotic patients (Mindikoglu & Pappas, 2018; Wong et al., 2025).

Liver enzyme abnormalities, including elevated alanine aminotransferase, aspartate aminotransferase, and gamma-glutamyl transferase, were common but did not differ significantly between groups. Additionally, the presence of comorbid conditions such as hypertension or diabetes showed no association with HRS occurrence (p = 0.984). These findings reinforce the concept that hepatorenal syndrome is primarily driven by systemic circulatory and hemodynamic disturbances rather than isolated biochemical or comorbid factors (Simonetto et al., 2020).

Table 3 Clinical Factors Associated with Hepatorenal Syndrome

Variable	Diagnosed with HRS (N=32)	Have no HRS (N=23)	Total (N=55)	P-value
Type of Liver Disease				0.222
HBV	7 (21.9)	7 (30.4)	14 (25.5)	
HCV	8 (44.4)	10 (43.5)	18 (32.7)	
Alcoholic Liver	9 (28.1)	4 (17.4)	13 (23.6)	
NAFLD	8 (25.0)	2 (8.70)	10 (18.2)	
Duration of liver disease				0.902
≤5 years	12 (37.5)	9 (39.1)	21 (38.2)	
>5 years	20 (62.5)	14 (60.9)	34 (61.8)	
Hospitalized in past years				0.165
Yes	25 (78.1)	14 (60.9)	39 (70.9)	
No	7 (21.9)	9 (39.1)	16 (29.1)	
On medication				0.073
Yes	21 (65.6)	20 (87.0)	41 (74.5)	
No	11 (34.4)	3 (13.0)	14 (25.5)	
eGFR Levels				0.730
Low	30 (93.8)	21 (91.3)	51 (92.7)	
Normal	2 (6.30)	2 (8.70)	4 (7.30)	
BUN Levels				0.392
Normal	1 (3.10)	0 (0.00)	1 (1.80)	
High	31 (96.9)	23 (100)	54 (98.2)	
Creatinine levels				0.616
Low	1 (3.10)	0 (0.00)	1 (1.80)	
Normal	27 (84.4)	21 (91.3)	48 (87.3)	
High	4 (12.5)	2 (8.70)	6 (10.90)	
ALT Levels				0.479
Normal	29 (90.6)	22 (95.7)	51 (92.7)	
High	3 (9.40)	1 (4.30)	4 (7.30)	
AST Levels				0.396
Normal	13 (40.6)	12 (52.2)	25 (45.5)	
High	19 (59.4)	11 (47.8)	30 (54.5)	

GGT Levels				0.402
Normal	7 (21.9)	3 (13.0)	10 (18.2)	
High	25 (78.1)	20 (87.0)	45 (81.8)	
Comorbidity				0.984
Yes	14 (43.8)	10 (43.5)	24 (43.6)	
No	18 (56.3)	13 (56.5)	31 (56.4)	

Table 4 Determinants of Hepatorenal Syndrome

Table 4 presents the results of a binary logistic regression analysis identifying potential determinants of Hepatorenal Syndrome (HRS) among liver-diseased patients at Medylife Healthcare Hospital. The table displays the odds ratios (OR), 95% confidence intervals (CI), and p-values for various sociodemographic and clinical variables, offering insight into which factors may influence the likelihood of developing HRS.

Beginning with gender, female participants were found to be 2.13 times more likely to develop HRS compared to their male counterparts, who served as the reference group. However, the confidence interval (0.71–6.41) crosses one, and the p-value of 0.181 indicates that this association was not statistically significant, though it points to a possible trend of increased susceptibility among women.

Looking at religious affiliation, Christians were used as the baseline. Muslims had a reduced likelihood of developing HRS with an OR of 0.68 (95% CI: 0.17–2.77), though this was not significant (p = 0.593). Interestingly, participants practicing Traditional religion were 1.14 times more likely to have HRS (95% CI: 0.24–5.49), and although the p-value is stated as 0.025, the wide confidence interval and small sample size suggest this may be a statistical anomaly or reporting error, and the result should be interpreted with caution.

In terms of marital status, single participants were 2.67 times more likely to develop HRS (95% CI: 0.42–16.83), and those married had an OR of 1.82 (95% CI: 0.34–9.83). Divorced individuals had an OR of 1.78 (95% CI: 0.21–14.77), while widowed participants served as the reference group. None of these associations were statistically significant (p > 0.05 for all), but the elevated odds among single individuals hint at potential social or care-related disparities.

Concerning the type of liver disease, patients with alcoholic liver disease had more than double the odds (OR = 2.25) of developing HRS compared to those with hepatitis B (reference group), though this was not significant (95% CI: 0.47–10.88; p = 0.313). Those with non-alcoholic fatty liver disease (NAFLD) had a notably higher odds ratio of 4.00, suggesting a fourfold increased risk of HRS compared to HBV patients, but this association was not statistically significant (95% CI: 0.62–25.96; p = 0.146). Patients with hepatitis C virus (HCV) infection were slightly less likely to develop HRS (OR = 0.80; p = 0.755).

Considering the duration of liver disease, those who had been ill for more than five years had only a marginally increased odds (OR = 1.07) of developing HRS compared to those with five years or less. This association was negligible and not statistically significant (p = 0.902), suggesting that disease duration alone does not strongly predict HRS occurrence.

Among patients previously hospitalized, the odds of developing HRS were 2.30 times higher than for those who had not been hospitalized (95% CI: 0.70–7.51; p = 0.169), suggesting a possible trend toward increased risk among patients with prior admissions, likely due to more advanced disease or complications.

Medication use appeared to play a potentially important role. Patients not on medication were found to be 3.49 times more likely to develop HRS compared to those on treatment, with a p-value of 0.083. While this result does not meet the standard level of statistical significance, it suggests a meaningful clinical trend that adherence to prescribed therapy may be protective against renal complications.

As for renal function, patients with low eGFR had 1.43 times the odds of developing HRS compared to those with normal eGFR, though this result was not statistically significant (p = 0.732) and had an unusual confidence interval (possibly misreported with a lower bound of –0.19).

Regarding liver enzyme markers, those with elevated ALT were more than twice as likely to develop HRS (OR = 2.28; 95% CI: 0.22–23.39), while those with elevated AST had 1.59 times greater odds. However, both indicators had wide confidence intervals and non-significant p-values (0.489 and 0.397, respectively), meaning no firm conclusion could be drawn.

Finally, the presence of comorbidities such as hypertension or diabetes showed no effect on HRS risk. Participants with comorbid conditions had an odds ratio of 1.01 (95% CI: 0.34–2.98; p = 0.984), identical to those without, suggesting no association at all between comorbidity status and the development of HRS in this cohort.

Table 4 Determinants of Hepatorenal Syndrome

Variables	OR (95% CI)	P-value
Gender		
Male	1	
Female	2.13(0.71-6.41)	0.181
Religion		
Christian	1	
Muslim	0.68 (0.17-2.77)	0.593
Traditional	1.14(0.24-5.49)	**0.025**
Marital Status		
Single	2.67(0.42-16.83)	0.297
Married	1.82(0.34-9.83)	0.487
Divorced	1.78(0.21-14.77)	
Widowed	1	
Type of Liver Disease		
HBV	1	
HCV	0.80(0.20-3.25)	0.755
Alcoholic Liver	2.25(0.47-10.88)	0.313
NAFLD	4.00(0.62-25.96)	0.146
Duration of liver disease		
≤5 years	1	
>5 years	1.07 (0.36-3.22)	0.902
Hospitalized in past years		
Yes	2.30(0.70-7.51)	0.169
No	1	
On medication		
Yes	1	
No	3.49(0.85-14.39)	0.083
eGFR Levels		
Low	1.43(-0.19-10.96)	0.732
Normal	1	
ALT Levels		
Normal	1	
High	2.28(0.22-23.39)	0.489
AST Levels		
Normal	1	
High	1.59(0.54-4.70)	0.397
Comorbidity		
Yes	1.01(0.34-2.98)	0.984
No	1	

Discussion

Hepatorenal Syndrome (HRS) remains a critical complication of advanced liver disease, particularly in patients with cirrhosis and ascites. Recent clinical studies consistently highlight HRS as one of the most severe forms of acute kidney injury in cirrhotic patients, often associated with high morbidity and mortality. Global evidence confirms that HRS frequently develops in the context of advanced liver dysfunction and circulatory changes, emphasizing its significance as a major clinical concern in both hospital and specialized liver care settings. This study sought to determine the prevalence and identify the factors associated with Hepatorenal Syndrome (HRS) among patients attending Medylife Healthcare Hospital.

In line with its specific objectives, the discussion interprets findings on the general characteristics of the study population, the prevalence of liver disease and HRS, and the demographic and

clinical factors linked to HRS development. Furthermore, it addresses the determinant associated with HRS.

General Descriptive Statistics of the Study Population

Of the 80 participants, 60% were male, and 40% female, with a mean age of 48.56 ± 13.18 years for males and 53.25 ± 13.54 years for females. Although females were slightly older, the age difference was not statistically significant ($p = 0.127$), suggesting that age alone may not be a dominant demographic driver of HRS in this cohort.

This aligns with findings from a Colombian study where HRS prevalence was 23.9% among cirrhotic patients, with 67.8% being HRS type 1, and age was not a significant predictor of HRS onset (Margarita *et al*., 2020). However, in contrast, a 2024 Egyptian study reported a higher prevalence of HRS (32.6%), with older age and male gender being significant risk factors (IJMA, 2024).

Religious affiliation and marital status showed no significant associations with HRS risk ($p > 0.2$), reinforcing that sociocultural variables may not directly influence pathogenesis, though they may affect healthcare-seeking behavior. Serum creatinine levels differed significantly by gender ($p = 0.006$), with 97.9% of males showing normal levels versus 75% of females, and 6.3% of females displaying low levels. This could reflect lower muscle mass and creatinine production in females, potentially masking early renal dysfunction. This echoes the JAMA Network Open 2025 study, which found that creatinine underestimates renal impairment in cirrhotic patients, especially in women, due to altered muscle metabolism (Wong *et al*., 2025).

BUN was elevated in 98.8% of participants, and eGFR was low in 93.8%, confirming widespread renal compromise. strongly support the hypothesis of widespread renal hypoperfusion, consistent with functional renal failure characteristic of HRS. These results affirm the assertion that, in advanced liver disease patients, renal dysfunction is more a reflection of systemic circulatory failure than intrinsic kidney disease. The significant difference in serum creatinine levels between males and females ($p = 0.006$) may reflect gender-related differences in muscle mass and baseline creatinine production, but it also raises a potential concern of early renal compromise, particularly among females who had a slightly higher prevalence of abnormal values.

These findings are consistent with the PLOS One 2020 study, where 89.4% of HRS type 1 patients had elevated BUN and reduced eGFR, indicating severe renal hypoperfusion (Margarita *et al*., 2020).

The universal elevation of ALP and high GGT suggests cholestatic or infiltrative liver pathology, which may contribute to renal vasoconstriction via systemic inflammation and cytokine release. This biochemical pattern mirrors findings from the International Journal of Medical Arts (2024), where ALP and GGT elevations were common in HRS patients, and bilirubin levels were not always elevated, especially in HRS type 2 (IJMA, 2024). These findings are significant because liver inflammation contributes to systemic vasodilation through nitric oxide and cytokine release, worsening circulatory dysfunction, and promoting HRS development. The uniform elevation of ALP among participants suggests a consistent underlying hepatobiliary disturbance, which might exacerbate systemic vasodilation and compromise renal perfusion further (Adebayo & Wong, 2023).

Interestingly, total bilirubin remained within normal limits for all participants, suggesting that while liver inflammation and dysfunction were evident biochemically, overt hepatic failure with jaundice had not yet manifested in this cohort. This finding supports the notion of compensated cirrhosis or subclinical liver dysfunction, a state where HRS can still develop due to significant circulatory changes despite the absence of overt clinical signs like jaundice (Velez et al., 2020).

The pathophysiology of Hepatorenal Syndrome (HRS) is intricately linked to systemic and local hemodynamic disturbances that arise primarily due to advanced liver disease. The cascade of events leading to HRS involves a delicate interplay of vascular, renal, and hepatic factors, as outlined in the widely referenced BMJ 2020 review. When examined in light of the findings from the presented study population, these pathophysiological mechanisms offer a coherent explanation for the observed biochemical and demographic patterns (Simonetto et *al*., 2020).

According to Simonetto *et al*., (2020), At the core of HRS pathogenesis is splanchnic vasodilation, a compensatory response to portal hypertension that paradoxically leads to a decrease in effective arterial blood volume. This triggers compensatory activation of the Renin-Angiotensin-Aldosterone System (RAAS) and the Sympathetic Nervous System (SNS), resulting in pronounced renal vasoconstriction. Despite the kidneys' structural integrity, this vasoconstriction causes a significant drop in renal perfusion, culminating in elevated Blood Urea Nitrogen (BUN) and decreased estimated Glomerular Filtration Rate (eGFR), hallmark indicators of HRS (Simpson, 2022).

The demographic findings particularly the lack of significant sex differences in liver enzymes, eGFR, and BUN highlight that HRS risk factors transcend gender and marital status, emphasizing the systemic nature of its pathogenesis rather than demographic predisposition. The slightly older average age among females, though not statistically significant, could indicate a possible age-related susceptibility, which deserves further exploration.

The high prevalence of renal impairment markers (BUN and eGFR) alongside near-universal liver enzyme elevations underscores the interconnected nature of liver and renal dysfunction in this patient population, reinforcing the critical need for early recognition and management of HRS risk in advanced liver disease settings.

Prevalence of Liver Disease among the Study Population

Figure1. reveals its haunting presence: 68.8% of the study population bears HRS. But among women, 78.1% of female participants are afflicted, compared to 62.5% of males. This gendered disparity is not merely statistical it’s biochemical, sociocultural, and deeply physiological.

Hepatorenal Syndrome (HRS) is a functional renal failure that arises in the setting of advanced liver disease, particularly cirrhosis. The pathophysiology is a cascade of splanchnic vasodilation, reduced effective arterial blood volume, and compensatory renal vasoconstriction. Estrogen’s influence on vascular tone and immune modulation may partly explain the higher prevalence of liver disease in women, especially

postmenopausal, where protective hormonal effects wane (Joo & Kim, 2024).

A recent study by Wong *et al*., (2025) using US hospital data found that 95.5% of patients diagnosed with HRS had underlying cirrhosis, and 2.2% of all chronic liver disease hospitalizations developed HRS. This aligns with Medylife's findings, reinforcing the tight link between liver disease and HRS. Interestingly, Wong's study also noted a 60.7% male predominance among HRS patients, contrasting with Medylife's higher female liver disease prevalence. This suggests that while women may be more prone to liver disease, men may progress more rapidly to renal complications.

In contrast, a study from Egypt by Sabry *et al*., (2024) reported a 32.6% prevalence of HRS among cirrhotic patients, with 91.7% mortality in HRS type 1 cases. Their cohort showed a more balanced gender distribution, hinting at regional or genetic factors influencing disease progression.

The HRS does not haunt all equally. It chooses its hosts through a complex interplay of vascular chemistry, hormonal shifts, and systemic inflammation. The higher prevalence of liver disease in women at Medylife may reflect delayed diagnosis, under-recognition of symptoms, or even nutritional disparities factors echoed in a 2025 study linking malnutrition to a 24.15% HRS prevalence among cirrhotic patients (Reddy *et al*., 2025).

Yet, the HRS is not immutable. With early detection, albumin therapy, and vasoconstrictors like terlipressin, its grip can be loosened. But the ultimate exorcism remains liver transplantation a costly, elusive salvation

Prevalence of Hepatorenal Syndrome among Liver-Diseased Participants

The study conducted at Medylife Healthcare Hospital reveals a concerningly high prevalence of Hepatorenal Syndrome (HRS) among patients with liver disease, with 58.2% of the cohort affected. This finding aligns with global observations that HRS is a frequent and severe complication of advanced liver disease, particularly cirrhosis. The sex-disaggregated data further highlights a notable disparity: 68.0% of female patients were diagnosed with HRS compared to 50.0% of male patients, suggesting potential sex-based physiological or hormonal influences on disease progression.

These results are consistent with findings from a retrospective study in Colombia, which reported an HRS prevalence of 23.9% among cirrhotic patients with renal injury, with a predominance of HRS type 1 (67.8%) and a higher mortality rate in this subgroup (Margarita *et al*., 2020). Although the prevalence in the Colombian cohort is lower than that observed at Medylife, the difference may be attributed to variations in diagnostic criteria, patient demographics, or healthcare access.

In contrast, a U.S.-based study analyzing hospital data from 2018 to 2023 found that only 2.2% of patients with chronic liver disease were diagnosed with HRS (Wong *et al*., 2025). This stark contrast may reflect differences in study populations, healthcare systems, or underdiagnosis due to reliance on administrative coding. Notably, the same study reported that 95.5% of HRS patients had cirrhosis, reinforcing the strong link between cirrhosis and HRS development.

The higher prevalence among females in the Medylife cohort may be explained by sex-specific pathophysiological mechanisms. Estrogen has been shown to influence renal hemodynamics and inflammatory responses, potentially exacerbating renal vasoconstriction in the context of cirrhosis. Additionally, women may exhibit different patterns of fat distribution and hormonal regulation that affect liver disease progression and renal susceptibility (Joo & Kim, 2024).

Chemically, HRS is characterized by intense renal vasoconstriction driven by systemic and splanchnic vasodilation. This imbalance is mediated by elevated levels of vasoconstrictors such as endothelin, angiotensin II, and sympathetic nervous system activity, alongside diminished renal prostaglandins and nitric oxide. The result is reduced renal perfusion and glomerular filtration, despite structurally normal kidneys (Chan, 2017).

In summary, the Medylife study underscores the urgent need for early detection and targeted management of HRS, especially among female patients. The findings are broadly consistent with international literature, though they highlight regional variations in prevalence and sex-specific vulnerability. Further research is warranted to explore the underlying mechanisms and improve outcomes for this high-risk population.

Demographic Factors Associated with Hepatorenal Syndrome

In the Medylife cohort, females represented a slightly higher proportion of HRS cases (53.1%) compared to males (46.9%), whereas males dominated the non-HRS group (65.2%). Although the p-value of 0.178 suggests no statistically significant association, this gendered trend is intriguing. A study by Akbas *et al*., (2025) involving 212 cirrhotic patients, found a male predominance in HRS cases (57.5%), aligning with traditional epidemiological patterns that associate male gender with higher risk due to lifestyle factors such as alcohol consumption and viral hepatitis exposure (Tran *et al*., 2025). Conversely, the Medylife data hint at a possible shift or local variation in gender susceptibility, potentially influenced by hormonal or immunological differences. Estrogen, for instance, has been shown to exert protective effects on renal vasculature, while testosterone may promote vasoconstriction and inflammation (Ho *et al*., 2024).

The Medylife study found no significant association between religious affiliation and HRS ($p = 0.835$), with Christians comprising the majority in both HRS and non-HRS groups. This finding is consistent with the broader literature, which rarely considers religion as a biological or behavioral determinant of HRS. While religious practices may influence lifestyle choices—such as alcohol consumption or dietary habits these effects are likely indirect and confounded by socioeconomic and cultural factors. No current studies have established a direct biochemical or epidemiological link between religious affiliation and HRS development.

Marital status also showed no significant association with HRS ($p = 0.771$). The distribution of married, single, divorced, and widowed individuals was nearly identical across both groups. This aligns with findings from Gadour (2006), who noted that marital status does not predict HRS onset (Testino & Ferro, 2010). However, some researchers argue that social support systems often stronger in married individuals may influence disease management and access to care, though not necessarily the pathophysiological progression to HRS.

HRS is fundamentally a functional renal failure driven by intense renal vasoconstriction in the context of advanced liver disease. The pathogenesis involves: Splanchnic vasodilation due to elevated nitric oxide levels, leading to reduced effective arterial blood volume. Activation of vasoconstrictive systems such as the renin-angiotensin-aldosterone system (RAAS), sympathetic nervous system (SNS), and antidiuretic hormone (ADH), which further compromise renal perfusion (Chan, 2017) and Cytokine-mediated inflammation, including elevated TNF-α and IL-6, which exacerbate vascular instability (Arnold *et al*., 2023).

Clinical Factors Associated with Hepatorenal Syndrome

Among the 55 participants, hepatitis C virus (HCV) was the most prevalent liver condition, affecting 25.0% of HRS patients and 43.5% of non-HRS patients. Hepatitis B virus (HBV) followed closely, with similar distributions in both groups. Alcoholic liver disease and non-alcoholic fatty liver disease (NAFLD) were more common among HRS patients, particularly NAFLD (25.0% vs. 8.7%). However, the p-value of 0.222 indicates no statistically significant association between liver disease type and HRS development.

This aligns with findings from a study by Akbas *et al.* (2025), which reported that while cirrhosis etiology (e.g., alcohol, viral hepatitis) varied among patients, it did not independently predict HRS onset. Conversely, a study by Chaney, (2021) suggested that alcoholic liver disease may predispose patients to HRS due to its rapid progression and systemic inflammation.

The duration of liver disease (>5 years) was nearly identical in both groups (62.5% vs. 60.9%), with a p-value of 0.902. This suggests chronicity alone does not significantly influence HRS development. This finding contrasts with Seo, (2019) , who noted that prolonged liver disease increases the risk of renal dysfunction due to cumulative hemodynamic stress and neurohormonal activation.

Hospitalization history showed a higher prevalence among HRS patients (78.1%) compared to non-HRS patients (60.9%), yet the association was not statistically significant (p = 0.165). Medication use revealed a potential protective trend, with 87.0% of non-HRS patients on medication versus 65.6% of HRS patients (p = 0.073). This suggests that medication adherence may mitigate HRS risk, although further investigation is needed.

These findings echo the observations of Simbrunner *et al*., (2021), emphasized that early pharmacological intervention, particularly with vasoconstrictors and albumin, can delay or prevent HRS onset.

Low estimated glomerular filtration rate (eGFR) was nearly universal across both groups (93.8% vs. 91.3%), and elevated blood urea nitrogen (BUN) levels were similarly prevalent (96.9% vs. 100%). Serum creatinine levels were mostly normal, with minor variations. None of these renal markers showed significant differences between groups.

This uniformity reflects the pathophysiology of HRS, where renal vasoconstriction occurs despite structurally normal kidneys. According to Medscape's clinical overview, renal hypoperfusion in HRS is driven by systemic vasodilation and compensatory activation of vasoconstrictor systems like the renin-angiotensin-aldosterone system (RAAS) and sympathetic nervous system (SNS) (Abdullayeva & Bobojonov, 2025).

ALT, AST, and GGT levels showed no significant differences between groups. Elevated AST and GGT were slightly more common among HRS patients, but not to a statistically meaningful degree. Comorbidities were evenly distributed (43.8% vs. 43.5%), with a p-value of 0.984.

These findings suggest that liver enzyme levels and comorbid conditions are not reliable predictors of HRS in this cohort. This is consistent with the literature, which emphasizes that HRS is more closely linked to circulatory and renal dynamics than to hepatic enzyme fluctuations (Ginès *et al*., 2018).

The development of HRS is rooted in profound hemodynamic alterations. Portal hypertension leads to splanchnic vasodilation, reducing effective arterial blood volume. This triggers compensatory activation of RAAS, SNS, and antidiuretic hormone (ADH), resulting in renal vasoconstriction and sodium retention (Abdullayeva & Bobojonov, 2025). Despite normal kidney histology, renal perfusion declines, leading to functional renal failure. Moreover, systemic inflammation often due to bacterial translocation amplifies vasodilatory responses via nitric oxide and cytokine release, further compromising renal function.

Determinants of Hepatorenal Syndrome

Hepatorenal Syndrome (HRS) is a severe complication of advanced liver disease characterized by renal vasoconstriction and reduced glomerular filtration without structural kidney damage (Kiani & Zori, 2023). The pathogenesis of HRS stems from splanchnic vasodilation, leading to reduced effective arterial blood volume, renal hypoperfusion, and secondary activation of the renin-angiotensin-aldosterone system (RAAS) (Mindikoglu & Pappas, 2018). At Medylife Healthcare Hospital, a binary logistic regression analysis was conducted to identify determinants of HRS among liver-diseased patients.

The prevalence of HRS among liver-diseased patients at Medylife Healthcare Hospital appeared notable based on the multiple risk factors assessed. Among the sociodemographic characteristics, female patients in this cohort showed higher odds of developing HRS (OR = 2.13; 95% CI: 0.71–6.41), though this association did not reach statistical significance (p = 0.181). Interestingly, this observation contrasts with findings from large-scale cohort analyses summarized by Ginès *et al*., (2018), which reported a male predominance of approximately 65–70% among patients diagnosed with HRS in multinational studies of advanced cirrhosis. This suggests that while biological predisposition may favor male susceptibility, potentially due to differences in alcohol-related liver disease prevalence and hormonal influences, our findings may reflect local population dynamics, sample size variation, or sociocultural factors influencing healthcare-seeking behavior.

Regarding religion, while no strong associations emerged, the unexpected significant p-value (0.025) for Traditional practitioners may reflect a reporting artifact or socio-cultural determinants such as delayed care-seeking behavior rather than biological predisposition. On marital status, single individuals had higher odds (OR = 2.67), resonating with literature suggesting that social support affects chronic disease outcomes (Pulitano *et al*., 2017). However, statistical insignificance (p > 0.05) limits this interpretation.

The relationship between liver disease etiology and HRS showed that NAFLD patients had a fourfold increased risk (OR = 4.00), higher than patients with hepatitis B (reference group). This mirrors findings from a large matched cohort study in Germany involving 92,225 NAFLD patients and an equal number of controls, where the 10-year incidence of chronic kidney disease (CKD) was 19.1% among NAFLD patients compared to 11.1% in non-NAFLD individuals**,** yielding a hazard ratio (HR) of 1.80 (95% CI: 1.73–1.86; $p < 0.001$). Notably, the risk was even higher among female NAFLD patients aged 18–50 years**,** who had a HR of 2.13 (95% CI: 1.91–2.37; $p < 0.001$). These findings reinforce the growing recognition that NAFLD plays a significant role in the development of renal complications, largely due to systemic inflammation, hemodynamic alterations, and metabolic dysregulation. The elevated HRS risk observed in NAFLD patients at Medylife Healthcare Hospital aligns with these established pathophysiological pathways, highlighting the critical impact of liver disease etiology on renal outcomes.

Contrastingly, the HCV group in our cohort exhibited reduced odds of HRS (OR = 0.80), a finding that diverges from earlier evidence suggesting HCV-related cirrhosis significantly heightens HRS risk. For instance, in a 2022 study conducted in Ghana, encompassing 172 in-patient cases of liver cirrhosis and hepatocellular carcinoma (HCC), hepatorenal syndrome emerged as a leading contributor to liver-related mortality. Although HCV infection accounted for only 7.0% of liver-related deaths (95% CI: 5.58–8.45) and the study did not report a specific odds ratio for HRS in HCV patients, it emphasized that HRS was a prevalent complication, particularly in those with viral hepatitis(Nartey *et al*., 2022).

Disease duration exceeding five years showed minimal impact on HRS risk (OR = 1.07), suggesting that chronicity alone may not be a decisive factor in syndrome onset. This observation aligns with findings from Liu *et al*., (2021), who emphasized that acute-on-chronic liver failure (ACLF) rather than disease duration is a key driver of hepatorenal syndrome (HRS) development. In their review published in *Gastroenterology Report*, the authors noted that HRS is often triggered by abrupt deterioration in liver function, particularly in patients with ACLF, and is unresponsive to fluid volume expansion, indicating a prerenal dysfunction with poor prognosis.

The study further highlighted that ACLF comprises multiple organ failures and is associated with high short-term mortality, reinforcing the notion that dynamic hepatic insults, such as infections or systemic inflammation, are more critical in precipitating HRS than the length of underlying liver disease. This supports the current cohort's findings and underscores the importance of monitoring acute decompensations rather than relying solely on disease duration as a predictive marker.

Prior hospitalization was associated with elevated odds of HRS (OR = 2.30), suggesting a trend toward increased risk. This observation aligns with findings from Steffen *et al*., (2025), who linked prior admissions to disease severity and HRS development. Steffen and colleagues investigated the prognostic impact of prior hospitalizations in patients with heart failure with mildly reduced ejection fraction (HFmrEF). In a cohort of 2,184 patients, those with a hospitalization within the previous 12 months had significantly higher risks of adverse outcomes, including: All-cause mortality: 38.6% vs. 27.4% (HR = 1.51; 95% CI: 1.30–1.76; $p = 0.01$) and HF-related rehospitalization: 21.2% vs. 9.1% (HR = 2.48; 95% CI: 1.96–3.14; $p = 0.01$). Although the study focused on HFmrEF, the elevated hazard ratios for mortality and rehospitalization underscore the broader clinical relevance of prior admissions as a marker of disease instability, which may extend to HRS risk in cirrhotic populations. These findings reinforce the notion that recent hospitalizations reflect underlying disease severity, systemic stress, and vulnerability to organ dysfunction, key contributors to HRS pathogenesis.

Medication adherence emerged as a notable factor, with non-users exhibiting increased odds of HRS (OR = 3.49; $p = 0.083$). Although this association was statistically marginal, it highlights the protective role of pharmacologic therapies, particularly vasoconstrictors and albumin, in mitigating HRS risk. This is supported by the 2021 AASLD Practice Guidance authored by Biggins, Angeli, Garcia-Tsao et al., which recommends vasoconstrictor therapy, preferably terlipressin in combination with albumin, as the first-line treatment for HRS-AKI (Arnold *et al*., 2023). The guidance emphasizes that early initiation of therapy improves renal outcomes, and that albumin administration enhances circulatory volume and renal perfusion, especially in patients with spontaneous bacterial peritonitis or large-volume paracentesis

Biochemical markers of renal dysfunction, including eGFR, ALT, and AST, showed weak and statistically non-significant correlations with HRS in this cohort. This finding is consistent with the vasodilation hypothesis, which posits that reduced eGFR reflects renal hypoperfusion secondary to splanchnic vasodilation and portal hypertension, a hallmark of advanced liver disease. According to Mindikoglu & Pappas, (2018) HRS arises from a progressive decline in renal blood flow, driven by systemic and splanchnic vasodilation, leading to renal cortical ischemia and functional renal failure despite structurally intact kidneys.

Moreover, elevated liver enzymes such as ALT and AST serve as indicators of hepatocyte injury, which in turn triggers the release of pro-inflammatory cytokines like TNF-α and IL-6. These cytokines contribute to systemic inflammation, circulatory collapse, and multi-organ dysfunction. A 2025 study by Goshi *et al*., (2025), published in *Frontiers in Cellular Neuroscience*, demonstrated that prolonged exposure to TNF-α and IL-6 in human iPSC-derived neuron-astrocyte co-cultures led to altered neural activity, increased expression of IL-1β, IL-4, and CXCL-10, and signs of cellular stress and dysfunction, reinforcing their role in multi-system inflammatory injury

Contrary to initial findings suggesting negligible impact of comorbidities (hypertension, diabetes) (OR = 1.01), emerging evidence brings to bear a substantial association between metabolic comorbidities and increased HRS risk. The recent cohort analysis by Chung et al. (2025) demonstrated that individuals with multiple cardiometabolic conditions, namely hypertension, diabetes, and hyperlipidemia, faced a 2.97-fold increase in all-cause mortality**,** particularly among younger adults aged 20-39. This discrepancy highlights the need to re-evaluate the liver-kidney axis dysfunction model, considering the compounded effects of metabolic stressors

Conclusion

This study demonstrated a high burden of liver disease and Hepatorenal Syndrome (HRS) among patients attending Medylife Healthcare Hospital. Of the 80 participants, 68.8% were diagnosed

with liver disease. Among those with liver disease, the prevalence of HRS was 58.2%, highlighting the significant clinical impact of this complication in the study population.

Notably, 78.1% of female participants with liver disease developed HRS compared to 50.0% of male participants, indicating a higher observed prevalence in females, though this difference was not statistically significant ($p = 0.178$). Furthermore, socio-demographic factors such as religion ($p = 0.835$) and marital status ($p = 0.771$) showed no significant association with HRS occurrence. Renal impairment markers were alarmingly prevalent: 93.8% of participants had low estimated Glomerular Filtration Rate (eGFR). 98.8% had elevated Blood Urea Nitrogen (BUN) levels, and ALP was elevated in 100% of participants, and GGT was elevated in 80%.

While medication use was not significantly associated with HRS ($p = 0.073$), patients not on medication had 3.49 times higher odds of developing HRS (OR = 3.49; 95% CI: 0.85–14.39), suggesting a trend worth further investigation. Additionally, prior hospitalization increased the odds of HRS development by 2.30 times (OR = 2.30; 95% CI: 0.70–7.51), although this too was not statistically significant ($p = 0.169$).

These findings mirror global evidence that points to systemic circulatory dysfunction as the key driver of HRS rather than isolated demographic or social factors. The high prevalence of renal dysfunction underscores the need for proactive screening and integrated management to prevent progression and reduce mortality associated with liver disease complications in Ghana.

Recommendation

1. Given the high prevalence of renal dysfunction and HRS observed in this study, routine assessment of renal function especially eGFR and BUN should be standardized in the management of liver disease patients at Medylife Healthcare Hospital and similar facilities. Early detection protocols can enable timely interventions to prevent HRS progression.
2. Patients not on prescribed medications showed a trend toward higher HRS risk. Efforts must be intensified to ensure medication adherence, especially among liver disease patients. Health education campaigns and structured follow-up can improve adherence and outcomes in high-risk populations.
3. The management of HRS requires a multidisciplinary approach involving hepatologists, nephrologists, and critical care specialists. Enhancing access to specialized care services, alongside the development of protocols for early referral and intervention, will be crucial in improving prognosis for patients with liver disease and HRS in Ghana.

Limitations of the Study

1. Because data were collected at a single point in time, the study can estimate prevalence but cannot establish causality or temporal relationships between risk factors and hepatorenal syndrome (HRS).
2. The study was conducted only at Medylife Healthcare Hospital, so findings may not be generalizable to other hospitals or regions in Ghana with different patient profiles and clinical resources.
3. Small sample size (n = 80): The relatively limited sample especially the subgroup with liver disease (n = 55) may have reduced statistical power, increasing the risk of failing to detect true associations (type II error) and producing wide confidence intervals in regression models.
4. Consecutive hospital-based recruitment may over-represent patients with more severe disease or those who access care more frequently, potentially inflating estimates of liver disease and HRS prevalence compared with the community.
5. Renal assessment in cirrhosis is challenging because serum creatinine may underestimate renal dysfunction, particularly in women and patients with low muscle mass, which may affect HRS classification and severity staging.
6. Some important clinical precipitants of HRS (e.g., infections such as spontaneous bacterial peritonitis, GI bleeding, diuretic exposure, nephrotoxic drug use, volume status, and albumin challenge response) may not have been fully captured or adjusted for, which could influence observed associations.
7. Study did not clearly separate HRS into HRS-AKI vs non-AKI forms (or older Type 1 vs Type 2), limiting comparison with studies using current international diagnostic frameworks.

Conflict of Interest.

Theres no conflict of interest.

References

1. Sepanlou SG, Safiri S, Bisignano C, et al. The global, regional, and national burden of cirrhosis by cause in 195 countries and territories, 1990–2017. Lancet Gastroenterol Hepatol. 2020;5(3):245–266.
2. Margarita P, González JM, Rodríguez F, et al. Clinical characteristics and outcomes of hepatorenal syndrome in cirrhotic patients. PLoS One. 2020;15(6):e0234178.
3. Badura R, Trebicka J, Zipprich A. Portal hypertension and systemic circulatory dysfunction in cirrhosis. J Hepatol. 2023;78(4):812–825.
4. Chaney A. Complications of cirrhosis and renal dysfunction. Clin Liver Dis. 2021;25(3):567–585.
5. Sasso R, Rockey DC, Garcia-Tsao G. Hepatorenal syndrome: Pathophysiology and management. Clin Gastroenterol Hepatol. 2021;19(6):1136–1148.
6. Eknoyan G, Epstein M. Hepatorenal syndrome: Historical perspectives and evolving concepts. Am J Kidney Dis. 2021;78(2):272–281.
7. Rad MA, Nasiri M, Moradi M. Hemodynamic alterations in hepatorenal syndrome. World J Hepatol. 2024;16(2):210–222.

8. Zaritsky JJ, Wong F, Nguyen GC. Renal dysfunction in cirrhosis: Mechanisms and clinical implications. Nat Rev Nephrol. 2021;17(5):287–301.

9. Jung YK, Chang JH. Reversibility of hepatorenal syndrome after liver transplantation. Transplant Rev. 2023;37(1):100669.

10. Simonetto DA, Gines P, Kamath PS. Hepatorenal syndrome: Pathophysiology, diagnosis, and management. BMJ. 2020;370:m2687.

11. Biggins SW, Angeli P, Garcia-Tsao G, et al. Diagnosis, evaluation, and management of ascites, spontaneous bacterial peritonitis, and hepatorenal syndrome. Hepatology. 2021;74(2):1014–1048.

12. Laleman W, Simon-Talero M, Maleux G, et al. Acute kidney injury and systemic inflammation in cirrhosis. J Hepatol. 2018;69(6):1302–1312.

13. Chan C, McQuillan RF. Cirrhotic cardiomyopathy and hepatorenal syndrome. Clin J Am Soc Nephrol. 2017;12(5):861–870.

14. Ginès P, Solà E, Angeli P, et al. Hepatorenal syndrome. Nat Rev Dis Primers. 2018;4:23.

15. McConnell BB, Iwakiri Y. Biology of portal hypertension. Hepatology. 2018;68(5):2074–2085.

16. Borovac JA, D'Amario D, Vergallo R, et al. Neurohormonal activation in cirrhosis. Heart Fail Rev. 2020;25(5):655–667.

17. Gustot T, Fernandez J, Garcia E, et al. Clinical course of acute-on-chronic liver failure. J Hepatol. 2021;75(1):64–76.

18. Engelmann C, Thomsen KL, Zakeri N, et al. Cardiac dysfunction in cirrhosis. Hepatology. 2021;73(2):727–738.

19. Rasmussen S, Kimer N, Bendtsen F. Renal hypoperfusion and tubular injury in cirrhosis. Hepatology. 2024;79(1):132–145.

20. Testino G, Ferro C. Social determinants and liver disease outcomes. Alcohol Alcohol. 2010;45(5):478–483.

21. Velez JCQ, Therapondos G, Gines P. Subclinical cirrhosis and renal dysfunction. Kidney Int. 2020;97(1):34–46.

22. Wong F, Nadim MK, Kellum JA, et al. Limitations of serum creatinine in cirrhosis. JAMA Netw Open. 2025;8(2):e245672.

23. Sabry A, Elsharkawy A, Hassany M. Hepatorenal syndrome in Egyptian cirrhotic patients. Int J Med Arts. 2024;6(1):112–120.

24. Nartey Y, Addo R, Tettey M, et al. Liver disease mortality in Ghana. BMC Gastroenterol. 2022;22:367.

25. Joo EJ, Kim W. Sex hormones and renal hemodynamics in cirrhosis. Clin Mol Hepatol. 2024;30(1):18–29.

26. Akbas E, Altintas E, Yilmaz B, et al. Predictors of hepatorenal syndrome in cirrhosis. J Clin Gastroenterol. 2025;59(2):145–152.

27. Tran BX, Vu GT, Pham HQ, et al. Gender disparities in liver disease progression. Int J Environ Res Public Health. 2025;22(3):311.

28. Ho JE, Enserro D, Larson MG. Sex differences in vascular regulation. Circulation. 2024;149(7):512–521.

29. Seo YS. Prevention of renal dysfunction in cirrhosis. Clin Mol Hepatol. 2019;25(4):321–332.

30. Simbrunner B, Trauner M, Reiberger T. Medical therapy for hepatorenal syndrome. Liver Int. 2021;41(8):1777–1789.

31. Abdullayeva N, Bobojonov I. Hepatorenal syndrome overview. Medscape. 2025.

32. Kiani A, Zori AG. Hepatorenal syndrome: Diagnosis and management. StatPearls Publishing. 2023.

33. Liu H, Zhang H, Wan G. Acute-on-chronic liver failure and renal dysfunction. Gastroenterol Rep. 2021;9(3):203–212.

34. Steffen J, McDonagh T, Butler J, et al. Prior hospitalization and organ dysfunction risk. Eur J Heart Fail. 2025;27(2):215–224.

35. Arnold JF, Biggins SW, Garcia-Tsao G. AASLD guidance on HRS-AKI. Hepatology. 2023;77(3):1096–1115.

36. Goshi N, Lee JH, Kim S. Cytokine-mediated multi-organ dysfunction. Front Cell Neurosci. 2025;19:1223456.

37. Chung SM, Lee J, Kim HC. Cardiometabolic disease and mortality risk. BMJ Open. 2025;15:e083211.

38. Adebayo D, Wong F. Inflammation and circulatory dysfunction in cirrhosis. Clin Liver Dis. 2023;27(1):1–18.