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STATISTICAL ANALYSIS TO FIND THE RISK FACTORS OF HEPATITIS C VIRUS (HCV) A CASE STUDY IN TEHSIL BATKHELA KPK PAKISTAN

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ABSTRACT

The objective of the research was to determine the major risk factors for Hepatitis C Virus (HCV) and estimate the prevalence of the virus in Tehsil Batkhela. Data were collected through a questionnaire from 202 individuals in the area, encompassing both medical and personal information. Statistical analysis indicated that HCV occurrence is most strongly associated with age, sex, area, accidents, surgery, and street drug use. HCV was treated as a binary response variable, with "1" indicating an HCV-positive patient and "0" indicating an HCV-negative patient. Because the answer variable was categorical, a binary logistic regression model was applied. The predictors included age, sex, marital status, occupation, HBS, HAV, maternal HCV status, siblings, life partner, prevalence in the area, use of government water, accidents, diabetes, tattoos, surgery, circumcision by a doctor, street drug use, and shaving outside. The analysis identified age, sex, area, accidents, surgery, and street drug use as the most significant factors influencing HCV incidence.

Keywords: Hepatitis C Virus (HCV), Binary Logistic Regression, Risk Factors, Sex, Accidents, Surgery, Street Drugs.

1.INTRODUCTION

A viral infection called hepatitis C can seriously harm the liver by inflaming it. It is spread via tainted blood and is treated with oral medicine and weekly injections. These were once necessary for therapy, but many people couldn't afford them because of health problems or adverse consequences. Currently, using daily oral medicines for two to six months is frequently curative for chronic HCV. Although there isn't a vaccination for HCV, antiviral medications are used to treat and cure over 90% of patients. Hepatitis C is a virus that attacks the liver and was first discovered in 1989. Blood transfusions, hemodialysis, and needle jabs can all spread the infection. Possible.

1.1 Symptoms of Hepatitis C

Hepatitis C patients sometimes report having flu-like symptoms. Of people with acute HCV infection, 70–80% report having no symptoms at all. People may experience mild to severe symptoms such as fever, fatigue, nausea, vomiting, jaundice, joint pain, dark urine, stomach pain, loss of appetite, and weight loss soon after they catch the HCV virus.

1.2 Causes of Hepatitis C

Hepatitis C is caused by the percutaneous transmission of the infected blood virus. Percutaneous refers to the requirement that the contaminated blood pass through the skin and into another person's circulation. Approximately seven times as many people can get hepatitis C than HIV/AIDS. The following are the reasons why HCV spreads. birth to a mother who has HCV, Intercourse, medical practices, hemodialysis, transplantation of organs.

1.3 Background

The hepatitis C virus was initially discovered in 1989, and a commercial test to detect it was created in 1991. The bulk of cases formerly classified as "non-A, non-B hepatitis" were revealed to be caused by hepatitis C [1]. Hepatitis C, a global disease-causing chronic liver disease and death, has six genotypes and over 50 subtypes, with over 170 million people infected [2]. The main way that an infection spreads is through blood-to-blood contact with an infected person or object. Acute and chronic hepatitis C (CHC) can be caused by HCV. About 25% of people who have acute hepatitis C will get rid of the infection on their own [3]. The residual 75% experience CHC, which can develop into liver failure, cirrhosis, or hepatocellular cancer [4]. Every year, HCV causes over 2.5 million deaths [5]. The estimated prevalence of HCV in Pakistan varies from 2.4% to 6.5% [6]. The hepatitis C virus has infected over 1,600 people in Ireland through tainted blood and blood products. This category comprises women who contracted the infection from anti-D immunoglobulin, individuals receiving blood transfusions, those with hemophilia and other clotting abnormalities, and those who underwent renal disease treatment [7].

1.4 HCV in Worldwide

For all women who had received anti-D between 1970 and 1994, the Irish Blood Transfusion Service (IBTS) launched a nationwide Hepatitis C screening program in February of that year [8]. At the start of 1995, a more focused look-back campaign was put in place to find the donors and users of potentially contaminated blood. September 1995 saw the introduction of an optional program in response to the inability of the targeted look-back to identify every recipient [9].On October 31, 2011, the United Nations reported that there were 7 billion people on the planet. A slightly different estimate was offered by the U.S. Census Bureau, which stated that on March 12, 2012, the 7 billion mark was attained. There are about 7.4 billion people on the planet as of 2016 [10]. It is estimated that 130–170 million people worldwide, or 2%–3% of the world's population, are infected with the hepatitis C virus (HCV) [11]. Significant morbidity and mortality are associated with this infection, particularly in its chronic form. Over 350,000 deaths annually are linked to HCV infection; the majority are caused by hepatocellular carcinoma (HCC) and liver cirrhosis [12].

1.5 HCV in United State

In the US, hepatitis C is a serious public health issue. Roughly 17,000 new cases of Hepatitis C are reported annually. This suggests that the virus is still spreading and infecting new people every year. Even with these new infections, the number of persons who have chronic Hepatitis C remains rather high—roughly 3.2 million. When someone has chronic Hepatitis C, it indicates that they have had the infection for a longer time than just recently or acutely. Over time, chronic hepatitis C can cause major health issues such as liver damage, cirrhosis, and liver cancer. The large number of chronic cases highlights the ongoing burden of Hepatitis C on the healthcare system and the importance of efforts to diagnose, treat, and prevent the disease. A striking aspect of this situation is that up to 75% of these chronic infections are found in individuals born between 1945 and 1965, a group often referred to as the "baby boomer" generation. Most of these individuals are unaware of their infection, which poses significant challenges for both their health and public health efforts. This lack of awareness can delay essential medical care, increase the risk of severe liver disease, and facilitate the further spread of the virus. The higher prevalence of hepatitis C in this demographic is likely due to factors such as past medical practices, like blood transfusions before the widespread screening for HCV, and behaviors that were more common in those decades. Consequently, public health initiatives often focus on enhancing awareness, promoting screening, and ensuring treatment, particularly among baby boomers, to mitigate the impact of hepatitis C [13].

1.6 HCV in Asia

Hepatitis C infection rates vary significantly across different regions of the world, with Southeast Asian countries like India, Malaysia, and the Philippines reporting higher prevalence rates of 1.5%, 2.3%, and 2.3% respectively. In Japan, the incidence is somewhat lower at 1.2%. However, the most alarming rates are observed in many African nations, with Egypt experiencing an exceptionally high prevalence of 14.5%. This stark contrast in infection rates highlights the varying impact of hepatitis C globally, influenced by factors such as healthcare infrastructure, public health practices, and socio-economic conditions. Addressing this disparity requires targeted public health initiatives, improved screening, and access to treatment, particularly in regions with the highest burden of the disease [14].

1.7 HCV in Pakistan

Pakistan's population was estimated to be 193,427,550 as of July 2016. It is estimated that approximately 10 million people in this sizable population have hepatitis C virus (HCV) infection. This indicates that a sizable segment of the populace is coping with a persistent viral infection, which, if ignored, might result in major liver conditions including cirrhosis and liver cancer. There are variations in the prevalence of HCV in Pakistan.it varies significantly across its four provinces. This variation could be due to differences in healthcare infrastructure, public health initiatives, awareness levels, and risk factors prevalent in each region. For instance, factors such as unsafe medical practices, use of unsterilized needles, and blood transfusions might be more common in certain areas, leading to higher rates of infection. Understanding these regional differences is crucial for developing targeted public health strategies to control and prevent the spread of HCV in the country. Punjab reports the highest prevalence rate at 6.7%, followed by Sindh at 5%. In contrast, Baluchistan and Khyber Pakhtunkhwa have considerably lower prevalence rates of 1.5% and 1.1%, respectively. These variations highlight regional disparities in HCV infection rates, which may be influenced by factors such as healthcare access, public health initiatives, and socio-economic conditions within each province. Addressing the HCV epidemic in Pakistan requires a comprehensive approach that considers these provincial differences and implements targeted interventions to reduce the overall burden of the disease [15,16].

1.8 HCV in Khyber Pakhtunkhwa

Khyber Pakhtunkhwa, one of Pakistan's four provinces, is located in the northwestern region of the country. According to estimates from the 2017 census, the province has a population of approximately 35.5 million, accounting for about 11.9% of Pakistan's total population. Within this population, around 3 million are Afghan refugees. The prevalence of Hepatitis C Virus (HCV) in Khyber Pakhtunkhwa stands at about 1.1%, indicating a notable health concern. Although the prevalence rate is relatively low, it is still significant and calls for targeted public health strategies to manage and reduce HCV infections, particularly given the additional health challenges associated with the large refugee population [17].

1.9 Population of Tehsil Batkhela

Batkhela is the main tehsil and the capital city of Malakand District in Khyber Pakhtunkhwa, Pakistan. According to the 2017 census, Batkhela has a population of 68,200. The World Gazetteer estimates the population to be approximately 69,703. As the administrative center of the district, Batkhela plays a crucial role in the region's governance and development [18,19]. Batkhela, the main tehsil and capital city of Malakand District in Khyber Pakhtunkhwa, Pakistan, currently has an approximate population of 69,603. Batkhela, a well-known business hub in Khyber Pakhtunkhwa province, also hosts the Batkhela General Civil Headquarters Hospital, the primary healthcare facility in Malakand District. Research in this area aims to achieve several key objectives: identifying various risk factors associated with Hepatitis C Virus (HCV), examining the relationship of these risk factors with HCV specifically in Tehsil Batkhela, and providing quantitative results to health professionals. These findings are intended to help in better understanding and managing the disease. Such research is crucial for developing targeted public health interventions and improving overall healthcare outcomes in the region.

2. Literature Review

According to Totten et al., 20,000 persons in Canada are thought to be afflicted with chronic hepatitis C (CHC), which continues to be a serious public health concern. About 44% of people with CHC were not aware they were infected as of 2011. Hepatitis C is an infectious disease that, in its chronic form, can cause serious health problems such as liver cirrhosis, hepatocellular cancer, and liver failure if left untreated. These ailments, which are frequently linked to comorbidities, significantly tax the Canadian healthcare system. But recent developments in the treatment of hepatitis C have drastically changed the clinical environment [20].

According to Hala et; order to spot patterns in the frequency and incidence of transfusion-associated infections among voluntary blood donors who are asymptomatic, it is essential to track infection markers in the blood donor community. In order to acquire samples from willing blood donors for their study, a survey was created to collect information on risk factors. 16.8% of 1,000 blood donors who appeared healthy tested positive for hepatitis C antibodies, according to the study. Positive anti-HCV test results were found to be correlated with a number of behavioral, medical, and sociodemographic risk factors. As a result, the study offered thorough and trustworthy information on the possible risk factors affecting the hepatitis C outbreak in the area [21].

Farhad et al., investigated Hepatitis C virus (HCV) infection was studied by Farhad et al., who found that it is a major global source of chronic liver disease and related problems. Their study employed a cluster sampling technique and was one of the few population-based analyses of HCV prevalence and risk factors in Iran. In Amol, 6,145 people of different ages and genders from both rural and urban areas participated in the study. Iranian nationality, willingness to participate, and long-term residency in Amol and its environs were prerequisites for participation. Using a third-generation ELISA, anti-hepatitis C antibodies were found; positive findings were validated by quantitative HCV-RNA polymerase chain reaction (PCR) testing and the recombinant immunoblot assay (RIBA). Potential risk factors for HCV transmission were noted in the study, and it was concluded that the actual prevalence of HCV infection in [22].

Javed et al., the Hepatitis C virus (HCV) affects over 350 million people globally and presents a serious health concern. In 50–80% of instances, the virus leads to chronic liver disease. Investigating the risk factors for HCV transmission was the goal of this investigation. 210 consecutive HCV patients of both sexes, ages 20 to 69, who were sent to the Sheikh Khalifa Bin Zyad Hospital/Combined Military Hospital in Muzaffarabad, Azad Kashmir, participated in this prospective study. PCR qualitative tests for HCV RNA were performed on patients whose ELISA results indicated a positive diagnosis of HCV. After each patient answered a questionnaire, a number of common risk factors were found, including shaving ($p<0.001$), ear and nose piercings ($p<0.001$), dental surgeries ($p<0.010$), injections ($p<0.05$), and surgical procedures ($p<0.001$). Additionally, a univariate study revealed that tattooing ($p=0.033$) was a significant [23].

Nancy et al. explored the relative contributions of unsafe sexual behaviors and blood exposures to the risk of hepatitis C virus (HCV) infection among at-risk youths, noting that these factors are not well understood. From December 1995 to September 1996, the study recruited 437 youths aged 14 to 25 years who met specific criteria for itinerancy. The research found a marginal association between having more than one tattoo and HCV infection, while body piercing did not show a significant link. Given that injection drug users are a major factor in the HCV epidemic in Canada, the study underscores the urgent need for increased intervention efforts to prevent the initiation of drug injection to help mitigate the epidemic [24].

Ijaz et al The relative contributions of blood exposures and risky sexual behaviors to the likelihood of hepatitis C virus (HCV) infection in young people who are at risk for the disease were investigated by Nancy et al., who noted that these factors are poorly known. The study recruited 437 youths, aged 14 to 25, who satisfied certain requirements for itinerancy between December 1995 and September 1996. The study discovered a weak correlation between multiple tattoos and HCV infection, while no meaningful connection was observed with body piercings. The study emphasizes the urgent need for greater intervention efforts to prevent drug injection beginning in order to help alleviate the HCV pandemic, as injectable drug users are a key contributing cause to the epidemic in Canada [24].

Faridullah et al performed a case-control observational study to determine the hepatitis C prevalence in those who suffer from depression. From January to November of 2004, this study was conducted at the Federal Government Services Hospital in Islamabad, in the Department of Medicine. Patients of both sexes who satisfied the DSM-IV (Diagnostic and Statistical Manual of Mental Disorders, Fourth Edition) criteria for depression were included; they had to be 13 years of age or older. HCV was checked in blood samples from patients and donors. 135 depressive patients with ages ranging from 17 to 82 years old and a mean of 37 years were included in the study. There were 70 male patients and 65 female patients. Of these depressed patients, 31 had positive HCV tests and 77 had negative tests. Furthermore, 718 (10%) of the 7,358 individuals that were screened for HCV [26].

Carmen et al In this review study, the prevalence of hepatitis C virus (HCV) among injecting drug users (IDUs) was investigated worldwide. Public and grey literature from 1998 to 2005 were analyzed. Data on HCV prevalence among IDUs from 152 sub-national areas and 57 countries were compiled for the study. According to research, there was at least a 50% HCV prevalence among IDUs in 49 different nations or territories. East Asia and the Pacific, 5% to 60% in North Africa and the Middle East, 2% to 100% in Latin America, 8% to 90% in North America, 25% to 88% in Australia and New Zealand, 2% to 93% in North America, and 10% to 100% in Eastern Europe and Central Asia were among the regions with the most disparate estimates [27].

Massimo et al; In order to better understand the causes and timing of vertical transmission of the hepatitis C virus (HCV) in women without HIV-1 infection, Massimo et al. conducted a study. The study monitored infants for a median of 28 months (range from 24 to 38 months) who were delivered to mothers with HCV antibodies but no HIV-1. 403 of the 442 moms and infants who were initially enrolled in the study finished it. The neonates' levels of alanine aminotransferase activity, viral RNA, and HCV antibodies were assessed by the researchers. Thirteen of the forty-three children had contracted HCV at the conclusion of the follow-up period. None of the 128 moms who tested negative for HCV RNA transferred the virus to any of the infants born to mothers who tested positive for HCV RNA [28].

Esteban et al; A recombinant-based immunoassay was used to measure the prevalence of hepatitis C virus (HCV) infection in Spain by looking for serum anti-HCV antibodies. 836 serum samples from 676 patients were analyzed; the patients were chosen based on the existence of liver disease and their risk of blood-borne viral infections. 85% of patients with post-transfusion non-A, non-B hepatitis, 62% of patients with chronic hepatitis or cirrhosis and a history of blood transfusion, 70% of hemophiliacs undergoing replacement therapy, 70% of intravenous drug users, and 20% of hemodialysis patients were found to have anti-HCV antibodies among patients at high risk of infection. On the other hand, 1.2% of healthy individuals without known risk factors had an overall anti-HCV prevalence [29].

3. Methodology

This section explains the target population, the derivation of the sample size, and the questionnaire process used in the survey for data collection. as the target population, and describes the statistical methods employed to ensure a representative sample size. The section outlines the development and pre-testing of the questionnaire, which gathered data on demographics, academic background, parental influence, and classroom environment. Additionally, it presents evidence on various risk factors for Hepatitis C Virus (HCV), categorizing them into behavioral, medical, and environmental classes. Detailed information on the statistical approaches used, including descriptive statistics, inferential statistics, and ridge regression, is provided to ensure a comprehensive analysis of the data collected.

3.1 Target area

This research was carried out in Tehsil Batkhela, which is a subdivision of District Malakand in Pakistan. Tehsil Batkhela is organized into 17 distinct administrative units known as Union Councils.

3.2 Data collection tools

We collected data from different Union Councils of Tehsil Batkhela to identify various risk factors for HCV. A total of 202 samples were collected through simple random sampling from the targeted area.

3.3 Risk factors for this research study

The conducted study investigated the relationship between various factors and HCV infection. These factors include gender (male, female), marital status, age, occupation, presence of HCV infection, blood clotting disorders, history of organ transplant, maternal HCV infection, sibling HCV infection, liver disease, prevalence of HCV in the area, use of government tank water, history of accidents, diabetes, employment in the medical field, history of surgery, presence of tattoos, circumcision by a doctor, drug use, and co-infections with HAV and HBS.

3.4 Statistical methodology

The statistical methodology for this study includes various modeling methods, with a focus on binary logistic regression to model the prevalence of HCV among the people of Tehsil Batkhela. Binary logistic regression, which belongs to the generalized linear model family, will be used to understand the relationship between HCV and the various risk factors. Different diagnostic tools will be described and used to fit and assess the goodness of fit for the model [30].

3.4.1 Logistic regression

The incapacity of simple linear regression to handle discrete outcome variables that are categorical or dichotomous is one of its main drawbacks. This restriction is addressed by the special case of the generalized linear model (GLM) known as logistic regression. When the independent variables might be discrete, continuous, categorical, or a combination of these, and the dependent variable is binary or categorical, it is especially helpful. Based on a collection of independent variables, a discrete outcome's probability is predicted using logistic regression. It is extensively utilized in disciplines including sports sciences, social sciences, and health. Unlike classical linear regression, logistic regression does not assume that the dependent variable is normally distributed, nor does it require the predictors to have equal variance or be normally distributed. Additionally, logistic regression does not assume a linear relationship between the dependent variable and the predictors. According to Hosmer et al., there are two primary reasons for using logistic regression in medical studies: it is mathematically straightforward and flexible, and it provides meaningful interpretations of the parameters [31].

3.4.2. Binary logistic regression model

In this research investigation, the response variable was binary, signifying the presence or absence of HCV in a person. A binary logistic regression model was therefore used. The response variable can have just two possible values (usually coded as 1 or 0) because it is binary. In this case, HCV is represented by a number of 1, which indicates its existence, and a value of 0 indicates its absence. Given a collection of predictor variables, the binary logistic regression model predicts the probability of one of these two outcomes, making it a good fit for this investigation.

$$x_j = \begin{cases} 1, & \text{if the } j^{th} \text{ individual has HCV} \\ 0, & \text{no HCV.} \end{cases}$$

We can interpret X_j as the realization of a random variable X_j, which takes on the values 1 and 0 with probabilities P_j and 1-P_j, respectively. In this framework, X_j follows a Bernoulli distribution with parameter P_j

$$\{X_j = x_j\} = p_j^{x_j}(1 - p_j)^{1-x_j}. \qquad (1)$$

When X_j = 1 the probability P_j is observed, while when X_j = 0 the probability 1− P_j is observed. Consequently, the expected value of X_j denoted as $E[X_j]$ is equal to the probability being 1. The variance of X_j is denoted is $Var(X_j)$ which is the spread or variability of X_j around its expected value. Thus, for a Bernoulli random variable with parameter P_j, the expected value is X_j and the variance is $P_j(1 - P_j)$.

$$(X_j) = p_j \quad \text{and} \quad var(X_j) = p_j(1 - p_j) \qquad (2)$$

define a model in Tehsil Batkhela that investigates the relationship between HCV and other risk variables, let pj be a linear function of the covariates, for example Let pj be a linear function of the covariates. Then, to investigate if HCV is associated with different risk factors in Tehsil Batkhela, say

$$p_j = \beta o + \sum \beta_j x_j, j = 1,2, \dots n \qquad (3)$$

$$p_j = p(x) = p\left(y = \frac{1}{X} = x\right) = 1 - p\left(y = \frac{0}{X} = x\right) \qquad (4)$$

$$p_j = \frac{1}{1 + e^{-\beta o + \sum \beta_j x_j}} \qquad (5)$$

As a result, we shall first convert the probability P_j to the odds.

$$odds_j = \frac{p_j}{1 - p_j} \qquad (6)$$

Define as the ratio of favorable to adverse cases, or the probability of its complement. Second, we may compute the logarithm, often known as the logit or log-odds.

$$logit[(p_j)] = \log\left(\frac{p_j}{1 - p_j}\right) = \beta o + \sum \beta_j x_j \quad j = 1,2, \dots \dots, n \quad (7)$$

A statistical technique for predicting a binary result based on one or more predictor variables is the logistic regression model. It works by using a linear combination of the predictors to model the log-odds of the outcome probability. In particular, the equation that converts the probability into a log-odds scale yields the log-odds, or logit, of the probability Pj. This conversion is extremely important because it converts the probability, which is limited to a range of 0 to 1, into a range that extends from negative to positive infinity. As a result, the logistic model offers a useful way to deal with binary outcomes and gives important information about the variables that affect them. The model helps to understand by equating the logit link function to the linear predictor [32].

4. Analysis and Discussion

The occurrence of HCV among people in Tehsil Batkhela was analyzed using a binary logistic regression model to evaluate the strength of the relationship between various risk factors and HCV infection. Initially, chi-square analysis was employed to identify any associations between each risk factor and HCV. The frequency of different risk factors among individuals with HCV was then described using various charts, and their significance was assessed. Following this, odds ratio analysis was conducted using the backward elimination procedure, and a sorting plot was generated to evaluate the accuracy of the predictions. The data were analyzed using MINITAB version 16, and the results are displayed below.

Table-4.1 Percentage frequency distribution of HCV

Sex	HCV(Positive)	HCV(Negative)	Total	Sex %	HCV(Positive)%
Male	19	126	145	71.8%	13.1%
Female	10	47	57	28.2%	17.5%
Total	29	173	202	100%	14.4%

The data reveals distinguished differences in HCV infection rates between males and females within the population. Males make up the majority of the population at 71.8%, with 19 out of 145 males (13.1%) testing positive for HCV. In contrast, females constitute 28.2% of the population, and 10 out of 57 females (17.5%) are HCV-positive. This indicates that while males have a higher total number of HCV-positive cases due to their larger population size, females have a higher prevalence of HCV infection relative to their total number. Specifically, the proportion of HCV-positive cases among females is higher compared to males, suggesting that females are more likely to be HCV-positive when considering their population size. Overall, 14.4% of the entire population is HCV-positive, but females, despite being fewer in number, exhibit a higher infection rate.

Table-4.2. Significant factors of HCV

Predictors	Coefficient	SE Coef	Z	P	Odds Ratio	95% CI	
						Lower	Upper
Age	0.0927868	0.0369130	2.51	0.012	1.10	1.02	1.18
Sex	-7.22075	3.54050	-2.04	0.041	0.00	0.00	0.75
Common in area	2.16913	0.891426	2.43	0.015	8.75	1.52	50.21
Accident	2.14197	0.876337	2.44	0.015	8.52	1.53	47.44
Surgery	1.89654	0.791186	2.40	0.017	6.66	1.41	31.41
Street drugs	3.33192	1.39488	2.39	0.017	27.99	1.82	430.88

The table presents the significant factors associated with HCV infection. Age shows a positive relationship with HCV risk, with each additional year increasing the odds of infection by 10% (Odds Ratio: 1.10, p = 0.012). Sex has a negative coefficient, indicating a reduced likelihood of HCV infection, but the Odds Ratio of 0.00 suggests that the interpretation is uncertain and may require further examination (p = 0.041). Living in an area with higher HCV prevalence significantly increases the odds of infection by 8.75 times (Odds Ratio: 8.75, p = 0.015). Accidents and Surgery are also significant predictors, with odds ratios of 8.52 and 6.66, respectively, both suggesting increased risk (p = 0.015 and p = 0.017). The use of Street drugs is the strongest predictor, raising the odds of HCV infection by nearly 28 times (Odds Ratio: 27.99, p = 0.017). Overall, the results highlight several factors, particularly street drug use and area prevalence, as critical determinants of HCV risk.

Table-4.3. Overall risk factors of HCV

Predictors	Coefficient	SE Coef	Z	P	Odds ratio	95% CI	
						Lower	Upper
Age	0.0927868	0.0369130	2.51	0.012	1.10	1.02	1.18
Sex	-7.22075	3.54050	-2.04	0.041	0.00	0.00	0.75
Marital status	-0.204008	1.58870	-0.13	0.898	0.82	0.04	18.35
Occupation	-0.147287	0.0886598	-1.66	0.097	0.86	0.73	1.03
HBS	22.3627	25011.7	0.00	0.999	5.15228E+09	0.00	*
HA	26.1220	16766.6	0.00	0.999	2.21129E+11	0.00	*
Mother HCV	1.49095	1.42061	1.05	0.294	4.44	0.27	71.90
Siblings	-0.0445264	0.880261	-0.05	0.960	0.96	0.17	5.37
Life partner	0.488879	0.824083	0.59	0.553	1.63	0.32	8.20
Common Area	2.16913	0.891426	2.43	0.015	8.75	1.52	50.21
Govt Water	0.293966	0.776646	0.38	0.705	1.34	0.29	6.15
Accident	2.14197	0.876337	2.44	0.015	8.52	1.53	47.44
Diabetes	-2.230670	1.35335	-1.65	0.098	0.11	0.01	1.52
Tattoo	1.89722	1.77347	1.07	0.285	6.67	0.21	215.54
Surgery	1.89654	0.791186	2.40	0.017	6.66	1.41	31.41

Circumcised by doctor	-1.44636	1.24458	-1.16	0.245	0.24	0.02	2.70
Street drugs	3.33192	1.39488	2.39	0.017	27.99	1.82	430.88
Shave outside	-1.18028	0.991234	-1.19	0.234	0.31	0.04	2.14

The analysis identifies several significant predictors of HCV infection. Age is positively associated with HCV risk, with each additional year increasing the odds by 10% (Odds Ratio: 1.10, p = 0.012). Common area prevalence and street drug use are strong predictors, with odds ratios of 8.75 and 27.99, respectively (p = 0.015 and p = 0.017). Accidents and surgery also significantly increase HCV risk, with odds ratios of 8.52 and 6.66 (p = 0.015 and p = 0.017). Other factors such as marital status**,** occupation, and HCV-related health conditions show non-significant or unreliable results, with some predictors like HBS and HA yielding implausibly high odds ratios, suggesting data or model issues. Overall, the findings emphasize the importance of area prevalence, street drug use, and certain medical interventions in influencing HCV risk.

Table-4.4 HCV in different Age groups

Age	HCV (Positive)	HCV (Negative)	Total	HCV (Positive)%
05 – 14	1	7	8	12.5%
15 – 24	4	61	65	6.1%
25 – 34	8	57	66	12.1%
35 – 44	8	28	36	22.2%
45 – 54	5	12	16	31.2%
55 – 64	2	7	9	22.2%
65– over	1	1	2	50%
Total	29	173	202	14.4%

The data highlights variations in HCV infection rates across different age groups. The highest percentage of HCV-positive cases is observed in the 65 and over age group, with 50% testing positive, although this group has the smallest sample size. The 45 to 54 age group also shows a high infection rate of 31.2%. Conversely, the 15 to 24 age group has the lowest infection rate at 6.1%, despite having a larger sample size. The 35 to 44 age group has a significant infection rate of 22.2%, similar to the 55 to 64 age group, which also stands at 22.2%. The 25 to 34 age group has a moderate infection rate of 12.1%, while the 05 to 14 age group has the lowest infection rate of 12.5%. Overall, the data suggests that HCV infection rates tend to be higher in older age groups, particularly in those aged 45 and above.

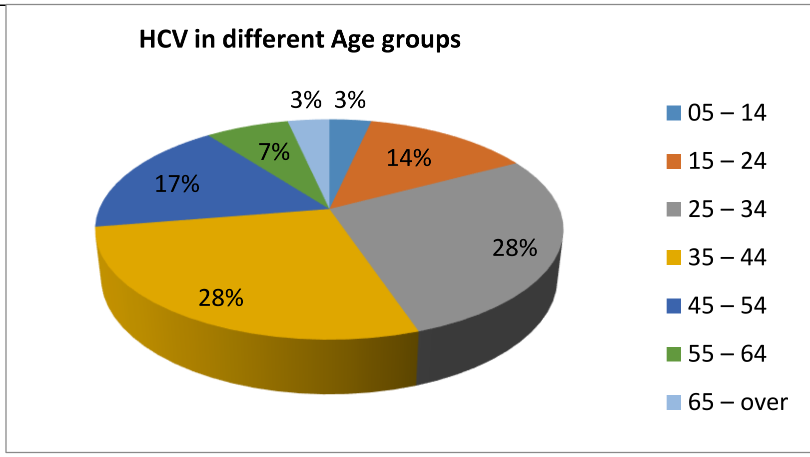

Figure: 1 HCV in different Age groups

The pie chart titled "HCV in different Age groups" shows the distribution of HCV positive cases across various age groups. The largest proportions of HCV positive cases are found in the 35–44 and 45–54 age groups, each representing 28% of the total cases. This is followed by the 25–34 age group, which accounts for 17% of the cases, and the 15–24 age group, representing 14%. The 55–64 age group constitutes 7% of the cases, while the youngest (05–14) and oldest (65 and over) age groups each represent 3% of the total HCV positive cases. This distribution highlights that the majority of HCV positive cases are concentrated in the middle-aged groups (35–54), suggesting a higher prevalence of HCV in these age ranges.

Table-4.5 Gender wise distribution of HCV

Sex	**HCV (Positive)**	**HCV (Negative)**	**Total**	**HCV (Positive)%**
Male	19	126	145	13.1%
Female	10	47	57	17.5%
Total	29	173	202	14.4%

The data reveals differences in HCV infection rates between sexes. Females have a higher percentage of HCV-positive cases at 17.5% compared to males, who have a 13.1% infection rate. Although males make up a larger portion of the total population with 145 individuals compared to 57 females, females exhibit a higher proportion of HCV-positive cases relative to their total number. This indicates that, proportionally, females are more likely to test positive for HCV compared to males. Overall, the infection rate of 14.4% for the total population is influenced by these sex-based differences, with females showing a higher prevalence of HCV infection relative to their smaller group size.

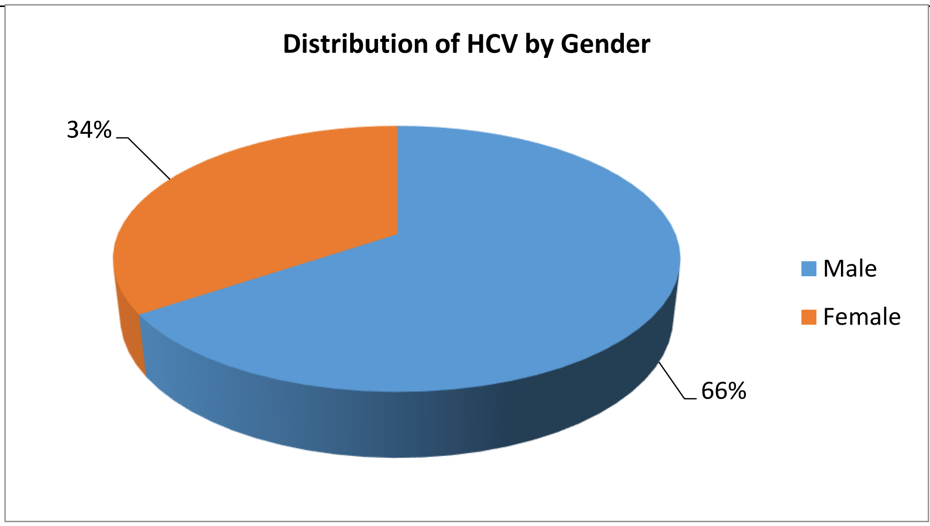

Figure: 2 Distribution of HCV by Gender

Table-4.6 Distribution of HCV by Area

Area	HCV (Positive)	HCV (Negative)	Total	HCV (Positive)%
Common	26	68	94	27.6%
Not common	3	105	108	2.7%
Total	29	173	202	14.4%

In Table 4.6 out of 94 individuals, 26 (27.6%) have been infected with HCV and live in areas where HCV is common. In contrast, only 3 individuals (2.7%) have been infected with HCV in areas where the virus is not common. This suggests a strong correlation between the prevalence of HCV in a given area and the likelihood of individuals contracting the virus, indicating that living in areas where HCV is common significantly increases the risk of infection.

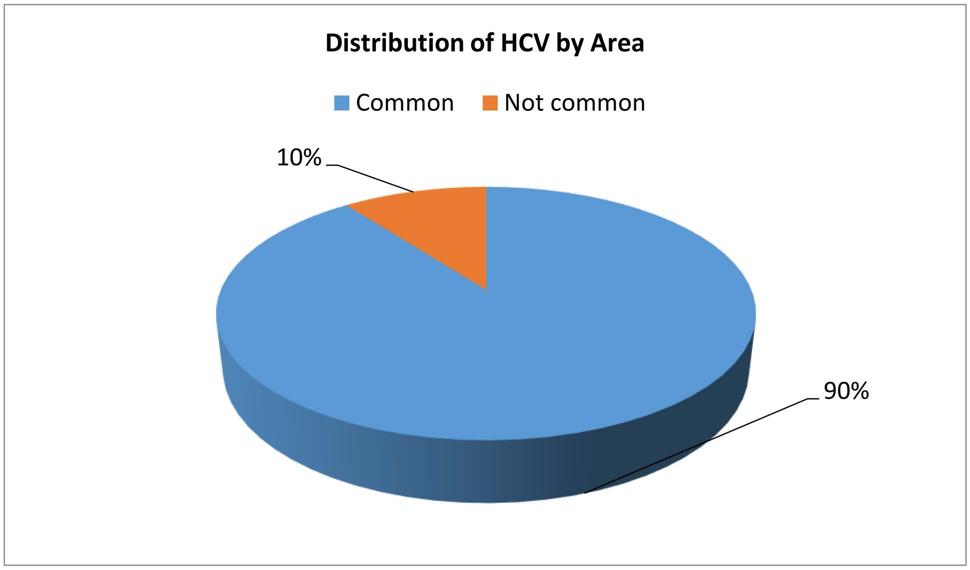

Figure: 3 Distribution of HCV by Area

Table-4.7 Prevalence of HCV due to Accidents

Accident	HCV (Positive)	HCV (Negative)	Total	HCV (Positive)%
Yes	15	36	51	29.4%
No	14	137	151	9.3%
Total	29	173	202	14.4%

In Table 4.7, the data presents a comparison of HCV infection rates between individuals who have been injured in accidents and those who have not. Out of 51 individuals who were injured in accidents, 15 (29.4%) are found to be HCV infected. This indicates that nearly one-third of the individuals in this group have contracted HCV. Conversely, among the 151 individuals who had not been injured in any accident, only 14 (9.3%) are HCV infected. This shows a much lower prevalence of HCV infection in individuals without accident-related injuries, with less than one in ten people affected. The stark difference between the two groups highlights a significantly higher prevalence of HCV infection among those who have experienced accidents compared to those who have not. The data suggests that injuries sustained in accidents may be a notable risk factor for HCV infection. This could be due to factors such as increased exposure to contaminated blood or medical procedures following accidents, which might raise the risk of HCV transmission. Consequently, the data underscores the importance of heightened preventive measures and screening for HCV among individuals who have been injured in accidents to mitigate this risk.

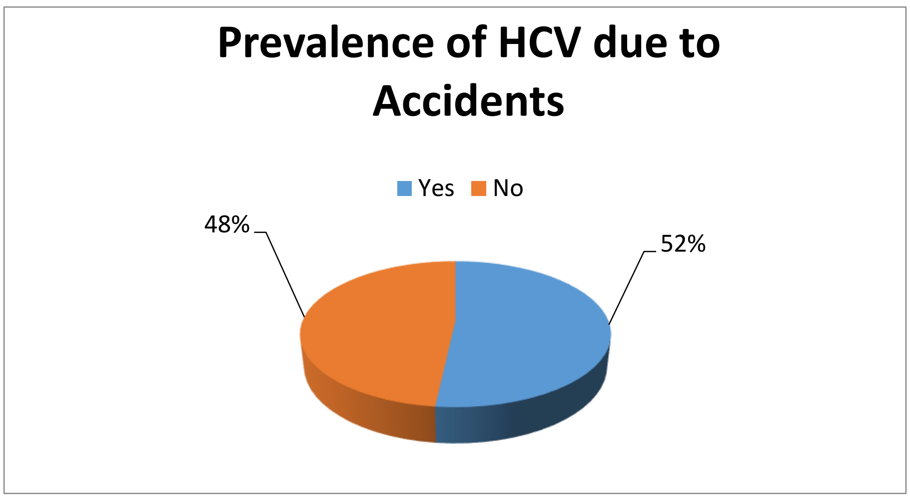

Figure: 4 Prevalence of HCV due to Accidents

Table-4.8

Table-4.8 Prevalence of HCV due to Surgery

Surgery	HCV (Positive)	HCV (Negative)	Total	HCV (Positive)%
Yes	22	56	78	28.2%
No	7	117	124	5.6%
Total	29	173	202	14.4%

In Table 4.8, the data reveals a notable difference in HCV infection rates between patients who had surgery before contracting the virus and those who had not undergone any surgical procedures. Specifically, 22 out of 78 patients (28.2%) who had surgery before their HCV infection were found to be infected with the virus. In contrast, only 7 out of 124 patients (5.6%) who had never undergone any surgery were infected. This disparity indicates that a higher proportion of HCV-infected patients had previously undergone surgery compared to those who had no surgical history. This observation could suggest a potential link between undergoing surgery and an increased risk of HCV infection, though further research would be necessary to confirm any causal relationship.

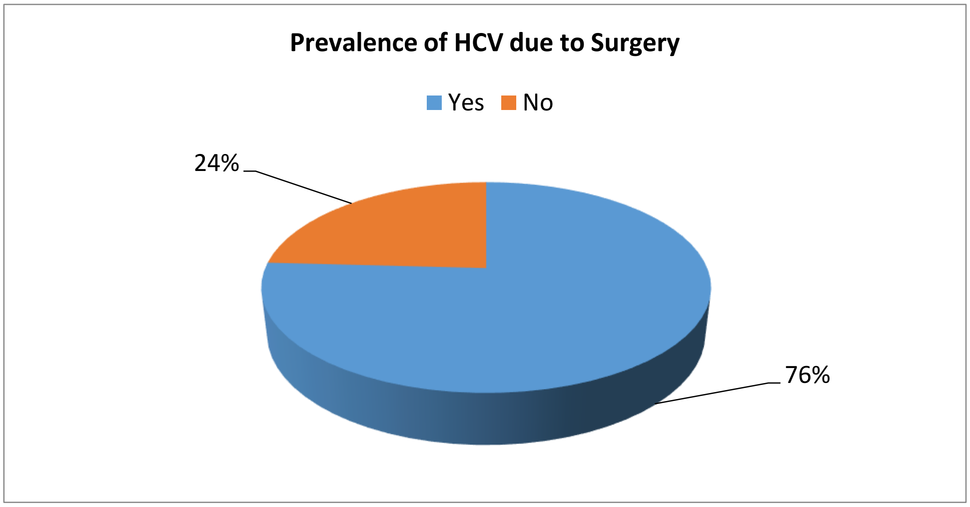

Figure: 5 Prevalence of HCV due to Surgery

Table-4.9 Prevalence of HCV and Street drugs

Street drugs	HCV (Positive)	HCV (Negative)	Total	HCV (Positive)%
Yes	17	63	80	21.2%
No	12	110	122	9.8%
Total	29	173	202	14.4%

In Table 4.9, the data shows a difference in HCV infection rates between patients who use street drugs and those who do not. Among the patients who use street drugs, 17 out of 80 (21.2%) are HCV-infected. On the other hand, among patients who do not use street drugs, 12 out of 122 (9.8%) are HCV-infected. This suggests that compared to individuals without HCV infection, a greater proportion of HCV-infected patients utilize illicit drugs. Drug use may have a role in the propagation of the virus, as seen by the greater infection incidence among drug users, which may be linked to an increased risk of HCV infection.

Conclusion

The study's objectives were to estimate the incidence of the Hepatitis C Virus (HCV) in Tehsil Batkhela and to identify important risk factors for the virus. A questionnaire was used to collect data from 202 individuals. including both medical and personal details. HCV was considered as a binary response variable (1 indicating positive, 0 indicating negative), and a binary logistic regression model was utilized for analysis. The analysis identified age, sex, area, accidents, surgery, and street drugs as the most significant factors influencing HCV incidence. Older individuals, particularly those in the 45-54 and 65 and over age groups, exhibited the highest rates of HCV positivity, indicating that the risk of infection increases with age, possibly due to accumulated exposure or age-related health factors. Additionally, females had a higher percentage of HCV-positive cases (17.5%) compared to males (13.1%), suggesting a greater proportional risk for females despite their smaller population size. This sex-based difference underscores the need for targeted interventions and a deeper investigation into gender-specific risk factors. With an overall infection rate of 14.4% across the total population, the findings suggest a moderate prevalence of HCV in the area. These results emphasize the importance of tailored screening and preventive strategies. Public health efforts should focus on the higher-risk groups identified, such as older adults and females, to effectively manage and reduce HCV infection rates. The study's conclusions highlight important trends in HCV infection rates across different demographics, underscoring the need for targeted public health interventions.

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