

## CROSS-SECTIONAL ASSESSMENT OF HEMATOLOGICAL AND BIOCHEMICAL PROFILES IN HELICOBACTER PYLORI-POSITIVE INDIVIDUALS

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**Abstract:** *Helicobacter pylori* (*H. pylori*) infection is a prevalent condition known to affect various hematological and biochemical parameters. Understanding its prevalence and associated blood parameter alterations can provide valuable insights into its clinical implications. **Objective:** To determine the prevalence of *H. pylori* infection in District Peshawar KP and its association with complete blood count (CBC) and biochemical parameters to establish a clear relationship between *H. pylori* infection and these variables. **Methods:** A longitudinal investigation involved 300 individuals from District Peshawar KP. Blood samples were collected from positive and negative participants for *H. pylori* infection. These samples were analyzed for various hematological and biochemical parameters, including red blood cell (RBC) count, hemoglobin (Hb) concentration, mean corpuscular volume (MCV), mean corpuscular hemoglobin (MCH), mean corpuscular hemoglobin concentration (MCHC), white blood cell (WBC) count, platelet count (PLT), vitamin D levels, urea, and serum glutamic-pyruvic transaminase (SGPT/ALT) levels. Statistical analysis was performed to identify significant associations. **Results:** The prevalence of *H. pylori* infection was 57.7% (n=173), with 42.3% (n=122) testing negative. Gender distribution showed 39.7% males (n=119) and 60.3% females (n=181). Age distribution included 17.3% (n=52) aged 2-20 years, 48.5% (n=146) aged 21-40 years, 28.3% (n=85) aged 41-60 years, 5% (n=15) aged 61-80 years, and 0.7% (n=2) over 80 years. Hematological parameters were as follows: RBC count  $4 \pm 3.1 \times 10^6/\mu\text{L}$ , Hb concentration  $13.4 \pm 1.64 \text{ g/dL}$ , MCV  $81 \pm 7.8 \text{ fL}$ , MCH  $27 \pm 3.8 \text{ pg}$ , MCHC  $33.9 \pm 24.9 \text{ g/dL}$ , WBC count  $10 \pm 12 \times 10^3/\mu\text{L}$ , and PLT count  $30 \pm 83 \times 10^3/\mu\text{L}$ . Significant relationships ( $p < 0.05$ ) were observed between *H. pylori* infection and alterations in these blood parameters. Vitamin D levels averaged  $39 \pm 21$ , and ALT levels were significantly higher in *H. pylori*-positive cases ( $32.7 \pm 14$ ). **Conclusion:** This study demonstrates a significant prevalence of *H. pylori* infection in District Peshawar KP and its association with various hematological and biochemical parameters. The findings suggest that *H. pylori* infection may have notable effects on blood parameters, highlighting the need for further research to understand the clinical implications and to guide future studies in this area.

**Keywords:** Complete Blood Count, Helicobacter pylori, Vitamin D

### Introduction

The infection attributed to *H. pylori* is a worldwide public health concern that can lead to severe medical issues. It is highly recommended to eradicate the infection unless there are compelling reasons not to do so (1). The increasing antibiotic resistance observed in *H. pylori* has resulted in a decline in the effectiveness of eradication, underscoring the necessity for novel antimicrobial medications. The development of novel antimicrobial treatments for *H. pylori* is hindered by the rise and dissemination of drug-resistant bacteria, necessitating a more comprehensive comprehension. (2, 3). The infection rates differ, with underdeveloped countries demonstrating infection rates beyond 80% while industrialized nations display infection rates below 40% (4). Helicobacter pylorus is a Gram-negative and microaerophilic bacterium that inhabits the stomach mucosa. It is linked to many digestive system diseases and plays a role in the progression of conditions such as gastritis, peptic ulcer disease, gastric cancer, and MALT lymphoma. The helical morphology of *H. pylori* is essential for effective establishment in the stomach and infiltration of viscous mucus. (5) Nevertheless, *H. pylori* can assume alternative morphological configurations, such as

curved or straight rods, filamentous structures, and coccoid shapes. Its morphological diversity enables it to quickly adapt to changing external environments, potentially influencing its ability to survive and altering its pathogenicity. (6). Furthermore, it is essential to note that *H. pylori* infection can also give rise to both intestinal and extra-intestinal manifestations, thus necessitating further investigation into the potential long-term consequences of this widespread infection. (7). *H. pylori* infection compromises the integrity of the stomach and upper small intestine's protective mucous layer, allowing stomach acid to penetrate the vulnerable underlying lining. The interaction between gastric acid and bacteria leads to a gastric ulcer called a stomach lesion. *Helicobacter pylori* infection is a highly prevalent stomach infection worldwide and is strongly associated with many hematological diseases. (8, 9) There was no statistically substantial discrepancy in the prevalence of *H. pylori* among individuals who possessed an average hemoglobin concentration (referred to as Hb Conc.) and packed cell volume percent (referred to as PCV %), as opposed to the individuals with an augmented Hb Conc. and PCV%.

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*Helicobacter pylori*, a spiral, flagellated, Gram-negative bacterium, possesses unique adaptations that enable survival within the gastric lumen. Remarkably, it has emerged as the most triumphant human pathogen, successfully infecting approximately half of the global population. Notably, this organism represents a prevalent and potentially treatable etiology of dyspepsia and peptic ulcer disease. Furthermore, *H. pylori* infection has been implicated as a significant contributor to developing iron deficiency anemia (IDA), particularly in resource-limited settings. However, implementing an *H. pylori* eradication regimen has demonstrated promising efficacy in correcting this condition (10). In recent studies, it has been established that there is a direct correlation between *H.pylori* (HP) infection and alterations in the serum lipid profile. These alterations include a decrease in high-density lipoprotein cholesterol (HDL-C) and triglycerides (TG), while low-density lipoprotein cholesterol (LDL-C) and total cholesterol (TC) levels are elevated (11). The presence of *Helicobacter pylori* infection was identified in 56% of individuals who were diagnosed with vitamin B12 deficiency, thereby suggesting the potential existence of a cause-and-effect relationship between the bacterium *H. pylori* and the malabsorption of food-coalmine (12). (13)Iron deficiency presents a substantial medical issue, irrespective of its link to anemia, which must be accorded due attention. This condition predominantly manifests over an extended period, with a slow and gradual onset, necessitating a considerable number of years for the disruption in iron levels to become firmly established and clinically evident. As such, it is imperative to recognize the gravity of this matter and acknowledge its potential long-term implications on an individual's overall health and well-being. The study aimed to determine the prevalence of *H. pylori* infection and its correlation with CBC and Biochemical Parameters, and it showed that there is an unambiguous relationship between the two variables. Both males and females were included in the study and were willing to provide information and undergo medical tests.

Pregnant individuals may also be excluded due to potential risks. Those who recently had blood transfusions may be excluded as well.

### Methodology

The cross-sectional observational study was conducted at Abasyn University, Alkhidmat Hospital, and Mohmand Lab in Peshawar, involving 300 male and female patients, following ethical approval from the Board of Research Committee of Abasyn University. Stool samples for *H. pylori* detection were collected in sterile containers using aseptic techniques and confirmed with a Merk kit. Vitamin D levels were measured using electro-chemiluminescence binding assays with Elecsys and Cobas immunoassay analyzers, with 3.00 to 70.0 ng/mL and 7.50 to 175 nmol/L, respectively. Vitamin D status was classified as deficient (< 20 ng/mL), insufficient (20 - 30 ng/mL), and sufficient (> 30 ng/mL). Data analysis was performed using RStudio version 4.3.3, employing descriptive statistics and inferential tests to explore the associations between *H. pylori* infection and various hematological and biochemical parameters, with a significance level set at  $p < 0.05$ .

### Results

A total of 300 samples were obtained, with the prevalence of *H. pylori* 57.7% ( $n=173$ ) testing positive and 42.3% ( $n=122$ ) testing negative shown in the figure [2]. The male population accounted for 39.7% ( $n=119$ ), while the female population accounted for 60.3% ( $n=181$ ), as shown in Figure [1]. In this study, different age groups of people were included. Age ranges 2-20 years were 17.3% ( $n=52$ ), 21-40 years were 48.5% ( $n=146$ ), 41-60 years were 28.3% ( $n=85$ ), 61-80 years were 5% ( $n=15$ ), above 80 years were 0.7% ( $n=2$ ) shown in the table [1]. The mean and standard deviation of females is  $36 \pm 15$ , and for males is  $32 \pm 15$ , as shown in the figure [3].

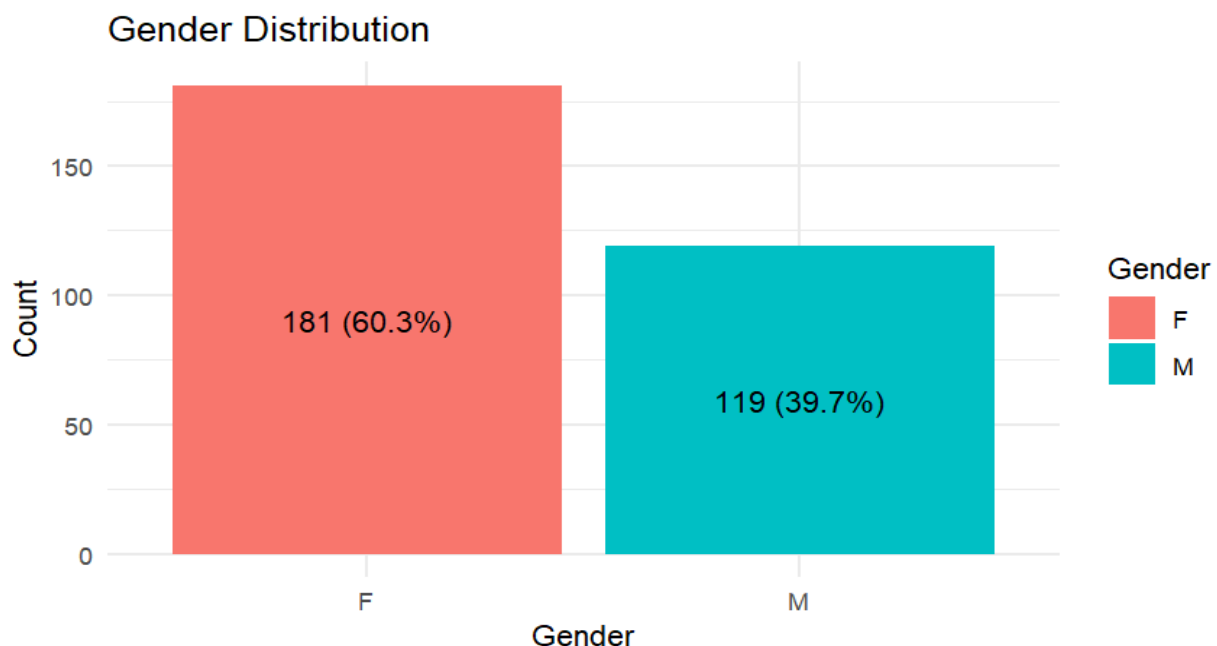


Figure 1

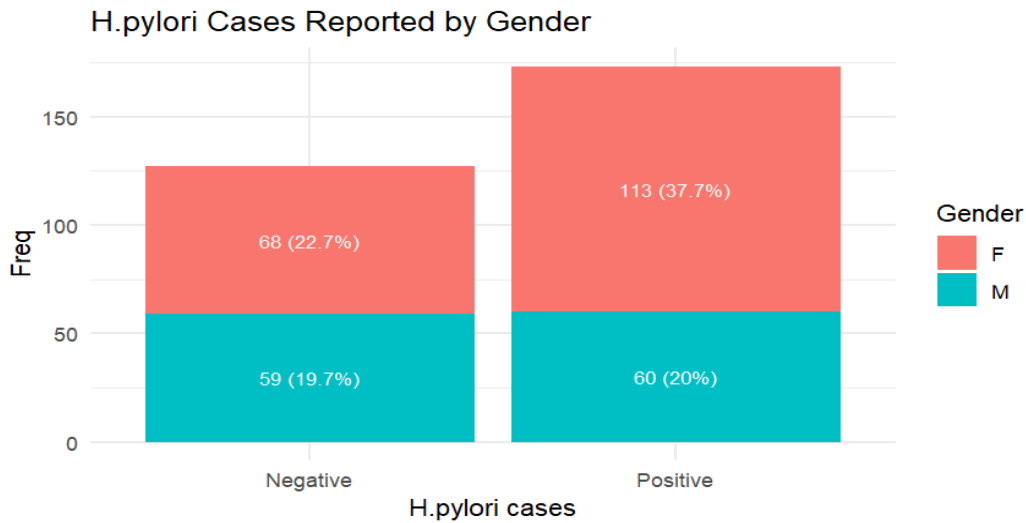


Figure 2

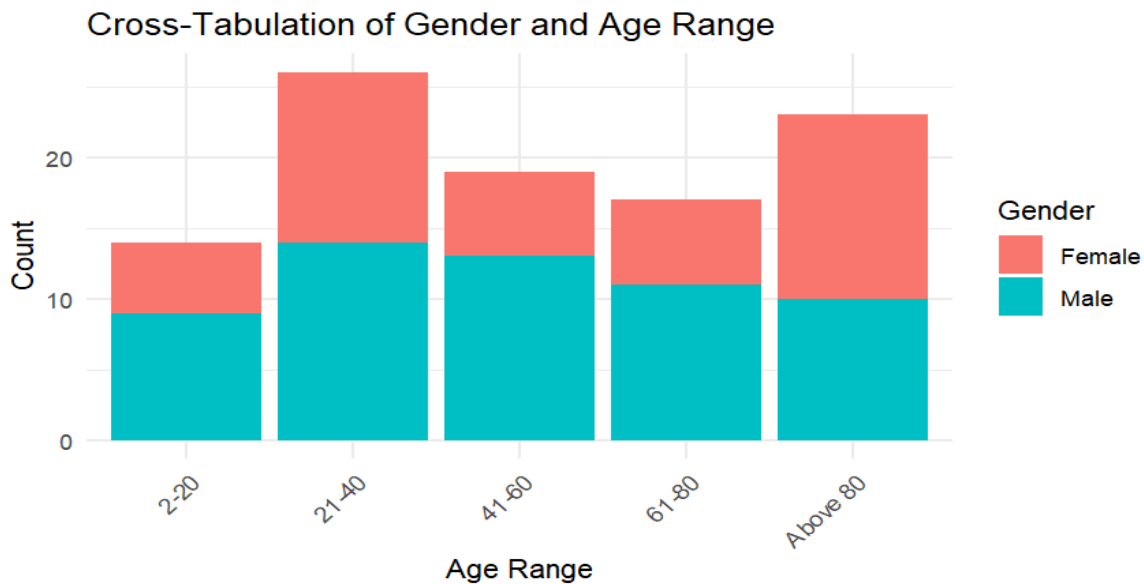


Figure 3

Table 1 Distribution of age among all individuals

Age ranges	Frequency(n)	Percent
2-20	52	17.3
21-40	146	48.6
41-60	85	28.3
61-80	15	5.0
Above then 80	2	0.7
Total	300	100

**Hematological Parameter:**

In our inquiry, regression analysis was employed to assess the effects of various factors on the dependent variable. The coefficient values indicated the average change in the dependent variable that accompanied a one-unit increase in the predictor variable, taking into account the effects of other factors. Standard errors were used to quantify the accuracy of the coefficients, and p-values were used to

determine the statistical significance of the correlations between the predictor and dependent variables. Notably, a statistically significant association that was unlikely to be the product of chance was shown by a p-value of less than 0.05. Age has a coefficient of -0.0023320. This indicates that the expected value of the dependent variable drops by

an average of 0.0023320 for every year that an individual's age increases, as shown in Table 2

**Table 2: Correlation of different predictive factors:**

Predictor	Coefficient	Std. Error	t-value	p-value
(Intercept)	8.6100000	1.4950000	5.758	0.0000
Age	-0.0023320	0.0095540	-0.244	0.8075
TLC	-0.0000011	0.0000130	-0.086	0.9314
RBC	0.0000478	0.0003963	0.121	0.9042
MCV	0.0414800	0.0201100	2.063	0.0408
MCH	0.0690100	0.0403500	1.710	0.0893
MCHC	0.0003705	0.0037590	0.099	0.9216
PLT	-0.0000006	0.0000014	-0.391	0.6961
VITD	0.0065170	0.0033100	1.969	0.0508
urea	-0.0982900	0.1207000	-0.814	0.4168
SGPT	0.0011040	0.0800650	0.137	0.8913

Significance codes: 0 '\*\*\*' 0.001 '\*\*' 0.01 '\*' 0.05 '.' 0.1 ' ' 1

The red blood cell (RBC) count was  $4 \pm 3.1 \times 10^6/\mu\text{L}$ , the hemoglobin (Hb) concentration was  $13.4 \pm 1.64 \text{ g/dL}$ , the mean corpuscular volume (MCV) was  $81 \pm 7.8 \text{ fL}$ , the mean corpuscular hemoglobin (MCH) was  $27 \pm 3.8 \text{ pg}$ , the mean corpuscular hemoglobin concentration (MCHC) was  $33.9 \pm$

$24.9 \text{ g/dL}$ , the white blood cell (WBC) count was  $10 \pm 12 \times 10^3/\mu\text{L}$ , and the platelet (PLT) count was  $30 \pm 83 \times 10^3/\mu\text{L}$ . There is a significant association with a p-value less than  $P < 0.05$ , as indicated in Table (3).

**Table 3 Hematological parameter of the distribution**

Variable	Minimum	Maximum	Mean	SD
TLC ( $\times 10^3/\mu\text{L}$ )	1200	120300	10964	12473
HB (mg/dl)	9	17	13.4	1.64
RBC ( $\times 10^6/\mu\text{L}$ )	3	4.5	4	3.1
MCV (fL)	35.10	103	81	7.8
MCH (pg)	15.8	39.6	27	3.8
MCHC (g/dL)	17.9	33.4	33.9	24.9
PLT ( $\times 10^3/\mu\text{L}$ )	27700	683000	304226	83304

The Pearson correlation coefficient is 0.01 in the Age-TLC association, indicating a weak positive linear relationship. The Bayes Factor is also 21.448, providing substantial evidence to reject the null hypothesis. Similarly, the

correlation in the TLC-HB connection is -0.019, and the Bayes Factor is 20.608, which provides strong evidence against the null hypothesis.

**Biochemical Parameter:**

A Vitamin-D test was conducted on an individual who scored 291 out of 300. The mean and standard deviation for this test were  $39 \pm 21$ . For the Urea test, 214 out of 300 patients were tested, with a mean and standard deviation of  $4.6 \pm 1.01$ . The SGPT (serum glutamic-pyruvic transaminase), also known as ALT (Alanine transaminase), was tested on 222 out of 300 patients; the level of ALT activity was likewise elevated in positive cases with a mean and standard deviation of  $32.7 \pm 14$ .

The study group was divided into three categories based on their vitamin D levels: inadequate, insufficient, and sufficient. Among the 291 participants, 62 individuals (20.7%) were identified as deficient in vitamin D, 71 persons (23.7%) had inadequate levels, and the majority, 158 individuals (52.7%), were found to have appropriate vitamin D levels, as shown in Table 4. There is no direct impact on the SGPT level, as its value remains within the average range, as mentioned above.

**Table 4 Frequency and percentage of distribution of Vit-D**

Study Group	Frequency	Percent
Deficient	62	20.7%
insufficient	71	23.7%
sufficient	158	52.7%
Total	291	97.0%

**Discussion**

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Our study aimed to identify the prevalence of *H. pylori* and its connection with blood parameters and biochemical alterations in KP Peshawar. An overall group of 300 people exhibited a 57.7% incidence rate of *H. pylori* infection. The gender breakdown across different age groups showed that 39.7% were Male and 60.3% were Female. The average and variability of hematological parameters were displayed, demonstrating substantial correlations ( $p < 0.05$ ) for several blood-related variables. The association between Age and TLC exhibited a modest positive linear relationship, but the connection between TLC and HB had a negative correlation. The assessment of vitamin D levels revealed that 20.7% of individuals were deficient, 23.7% were insufficient, and 52.7% were sufficient. An extensive analysis of urea and SGPT levels yielded average values and standard deviations. The alanine aminotransferase (ALT) levels were increased in individuals with positive *Helicobacter pylori* cases.

The precise process by which *H. pylori* infection alters serum lipid profiles remains uncertain. However, a credible hypothesis is that the bacterium's systemic inflammatory response triggers lipid and lipoprotein metabolism modifications. (14) Chronic *H. pylori* infection is believed to alter the lipid profile and promote the development of atherosclerosis. This is thought to occur through the activity of proinflammatory cytokines, including interleukins 1 and 6, interferon-alpha, and tumor necrosis factor-alpha (TNF- $\alpha$ ). These cytokines can impact lipid metabolism through several mechanisms, such as activating lipoprotein lipase in adipose tissue, stimulating the production of fatty acids in the liver, regulating the breakdown of fats, and boosting the activity of hepatic HMG-CoA reductase. (15).

The study determined that an increased white blood cell count, but not red blood cell count, was strongly linked to insulin resistance and glucose metabolism. Insulin resistance is marked by an elevation in pro-inflammatory cytokines, which might lead to leukocytosis. (16). The patients exhibited a substantial rise in white blood cell count and platelet count compared to the control group. However, no significant change was seen in red blood cell count or hemoglobin content. Diabetic individuals exhibited an increase in leukocyte count (leukocytosis) and platelet count (thrombocytosis) (17).

When considering *H. pylori*, the white blood cell count was considerably greater in instances that tested positive than those that tested negative. Leukocytosis was seen in patients infected with *H. pylori*. (18).

Vitamin D reduces the likelihood of several chronic illnesses, including infectious, autoimmune, cardiovascular disorders, and malignancies. (19). Higher vitamin D levels were linked to a reduction in *H. pylori* infection.

As demonstrated, Vitamin D levels were lower in *H. pylori*-positive patients compared to *H. pylori*-negative individuals. (20). Vitamin D insufficiency was linked to reduced rates of *H. pylori* eradication. Vitamin D insufficiency in some groups is regarded as a risk factor for eradicating *H. pylori*, which may necessitate vitamin D treatment before eradication. (21).

The efficacy of vitamin D in combating *H. pylori* infection and its crucial function in eradicating *H. pylori* should be assessed. Vitamin D levels significantly decreased in the *H. pylori*-positive group compared to the opposing group. Conversely, research has shown that a lack of vitamin D is

strongly linked to higher levels of atherogenic lipids and early indicators of cardiovascular disease. (22).

The study conducted in South India revealed that the incidence of *H. pylori* infection among 197 Tibetan patients with dyspeptic symptoms was 30%. In an Italian research undertaken in a community setting, 1033 patients were examined, both with and without dyspeptic symptoms. The results revealed that around 75% of the patients showed no abnormalities during endoscopy. In this investigation, the overall prevalence of *H. pylori* infection was 58%. However, among patients with peptic ulcers, the prevalence of *H. pylori* infection was much higher at 93%. The study also found a higher prevalence of *H. pylori* infection at high elevations than in coastal locations. (23).

## Conclusion

The prevalence of *Helicobacter pylori* (*H. pylori*) infection was assessed by analyzing a sample of 300 persons in this study. Statistically significant relationships ( $p < 0.05$ ) were found, suggesting possible consequences of *H. pylori* infection on blood parameters. The findings provide valuable insights into the frequency of *H. pylori*, connections with blood-related factors, and vitamin D levels among the population under investigation. The study provides useful insights into the prevalence of *H. pylori*, hematological parameters, and vitamin D status in the examined sample, highlighting possible correlations and emphasizing the need for further investigation.

## Recommendation

Through focused health education programs, people should be made more aware of the *H. pylori* condition, especially those who don't get enough vitamin D. A multidisciplinary approach involving gastroenterologists, hematologists, and nutritionists should be encouraged to provide comprehensive care for individuals with *H. pylori* infection. A deeper study of molecular-level diagnosis is needed for better treatment.

## Declarations

### Data Availability statement

All data generated or analyzed during the study are included in the manuscript.

### Ethics approval and consent to participate.

Approved by the department concerned. (IRB.KRPSF/586 dated 10-2-23)

### Consent for publication

Approved

### Funding

This study did not receive any funding from any organization.

## Conflict of interest

The authors declared an absence of conflict of interest.

## Authors Contribution

**AZIZ UR REHMAN**

*Final Approval of version*

**IHTISHAM ULHAQ & SALIH NOOR**



Revisiting Critically

**ABID ALI & UBAID ULLAH**

Data Analysis

**MALIK FAHEEM RAHEEM**

Drafting

**ABDUL HAQ**

Concept & Design of Study

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