

## ORIGINAL ARTICLE

# PREVALENCE OF BLOOD DONOR DEFERRAL AND ITS DISTRIBUTION BY SEX, TYPE OF DEFERRAL AND CAUSES IN POPULATION OF KARACHI, PAKISTAN

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## ABSTRACT

**Background:** Donor selection is an important step for safe blood transfusion. The objectives of this study were to determine prevalence of blood donor deferral and its distribution by sex, type of deferral and causes in population of Karachi, Pakistan.

**Materials & Methods:** This cross-sectional study was conducted at Department of Pathology, Hamdard University, Karachi, Pakistan from July 1, 2019 to June 30, 2020. Hamdard University Hospital, Karachi is assumed to cater 1.5 million population. With 1% donors, population at risk was 15,000. With 10% donor deferral, 1.073% margin of error and 95% confidence interval, sample size was calculated as 2,503. The technique was consecutive non-probability. Sex, age in years, weight, temperature, blood pressure and pulse were noted. Tests for CBC, blood grouping, hepatitis B, Hepatitis C, HIV, malaria and syphilis were done. Donor selection criteria included age range 18-60 years, weight  $\geq 50$  kg, pulse rate 60-100/ min, systolic blood pressure 101-150 mmHg, diastolic blood pressure 60-100 mmHg, temperature  $\leq 99^{\circ}\text{F}$ , hemoglobin  $\geq 13.0$  g/dl for men and  $\geq 12.5$ g/dl for women. All categorical variables were analyzed by count and percentage with 80%CI.

**Results:** Out of 2,503 donors, 2,493 (99.7%) were men and 10 (0.3%) women. Frequency of deferral was 139 (5.5533%), including 129 (5.1538%) men and 10 (0.3995%) women and 58 (2.3172%) temporary and 81 (3.2361%) permanent. Causes of temporary deferral were; anemia 33 (1.3184%), low weight 8 (0.3196%), acute infection and on medication each 5 (0.1998%), donation of blood in last 8 weeks 4 (0.1598%) and hypotension 3 (0.1198%) cases. Causes of permanent deferral were; HCV 32 (1.2784%), HBV 30 (1.1985%), syphilis 17 (0.6792%), HIV and diabetes mellitus each one (0.04%) case.

**Conclusion:** Prevalence of blood donor deferral was 5.55% in our study, which is almost half of all the cited studies here from global, regional, national and local populations. Prevalence in men was many times higher than women and prevalence of permanent causes was higher than temporary causes. Anemia and HCV were the two major causes of deferral in our study. Proper donor selection is a key of safe blood transfusion. Appropriate measures are needed to prevent causes of deferral.

**KEY WORDS:** Blood Donors; Blood Donation; Blood Transfusion; Anemia; Hepatitis B; Hepatitis C; Syphilis; Hypotension; Diabetes Mellitus.

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## 1. INTRODUCTION

**1.1 Background:** Blood transfusion is an important life-saving procedure; therefore donor selection is

an essential step in transfusion practice.<sup>1</sup> Safe blood transfusion is a sign of quality blood banks.<sup>2</sup> The criteria of donor selection are important for health of both the donor and the recipient.<sup>3</sup> Donor should be screened according to national guidelines. Donor screening encompasses medical history, physical examination and serological testing for transfusion transmitted infections in order to protect the recipient from the blood related infections. Obtaining accurate and complete answers of donors in assessing transfusion transmitted infections is a key to safe blood transfusion.

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According to WHO, worldwide collection of blood is 81 million units per year.<sup>4</sup> Approximately 1.5 million pints of blood is collected per year in Pakistan and majority blood donors are replacement donors.<sup>5</sup> Less number of voluntary donors is due to misconceptions and fear regarding blood donation.<sup>6</sup>

Deferral could be temporary or permanent on the basis of confirmed or suspicion infectious, hematological disease or any other medical condition that will influence the health of donor or recipient.<sup>7</sup> All deferred donors should be counseled properly about the reason of deferral in confidential manner.<sup>8</sup> In most cases, the donated blood is used to correct anemia as in thalassemia, hematological malignancy and to compensate losses due to trauma, surgery or obstetric complications.<sup>9</sup>

Zou, et al.<sup>10</sup> from Rockvilli, Maryland, USA reported the data from American Red Cross Blood Services for years 2001 through 2006, showing 47,814,370 donors, with the frequency of deferral as 6,120,240 (6,120,240\*100/47,814,370=12.8000%).

Shah, et al.<sup>11</sup> reported 586,159 voluntary donors from American Red Cross Southern Region in the metropolitan Atlanta area in 2004 to 2008, with the frequency of deferral as 79,214 (79,214\*100/586,159=13.5140%).

Charles, et al.<sup>12</sup> from National Blood Transfusion Centre, Port of Spain, Trinidad and Tobago, reported 11,346 donors, with frequency of deferral as 4043 (35.6337%).

Valerian, et al.<sup>7</sup> reported 14,377 donors from Tanzania for the year 2016, including 11,377 (79.1333%) men and 3,000 (20.8667%) women. The frequency of deferral was 1,829 (1,829\*100/14,377=12.7217%), including 1,361 (1,361\*100/14,377=9.4665%) men and 468 (468\*100/14,377=3.2552%) women, and 927 (927\*100/14,377=6.4478%) temporary and 902 (902\*100/14,377=6.2739%) permanent deferrals. Some causes of temporary deferral were; anemia 162 (162\*100/14,377=1.1267%), syphilis 149 (149\*100/14,377=1.0363%) and medications 84 (0.5842%). Some causes of permanent deferral were; HBV positive 489 (489\*100/14,377=3.4012%), HIV positive 198 (198\*100/14,377=1.3771) and HCV positive 31 (31\*100/14,377=0.2156%).

Okoroiwu, et al.<sup>8</sup> reported 1,886 donors from Southern Nigeria for the year 2016, including 1,853 men (98.2502%) and 33 women (1.7808%). The frequency of deferral was 164 (164\*100/1886=8.6956%), including 153 (153\*100/1886=8.1124%) men and 11 (11\*100/1886=0.5832%) women and 51 (51\*100/1886=2.7041%) temporary and 113 (113\*100/1886=5.9915%) permanent deferrals. Causes of temporary deferral were; anemia 36 (36\*100/1886=1.9088%) and syphilis 15 (15\*100/1886=0.7953%). Causes of permanent deferral were; HBV positive

52 (52\*100/1886=2.7571%), HCV positive 31 (31\*100/1886=1.6436%) and HIV positive 31 (31\*100/1886=1.6436%).

Birjandi, et al.<sup>13</sup> from Isfahan, Iran reported 197,757 volunteer donors who presented between March 20, 2007 and March 19, 2008. These included 188,977 (188,977\*100/197,757=95.5602%) male and 8,780 (8,780\*100/197,757=4.4398%) female donors. The frequency of deferral was 50,727 (50,727\*100/197,757=25.6511%), including 45,929 (45,929\*100/197,757=23.2249%) males and 4,798 (4,798\*100/197,757=2.4262%) females, and 44,920 (44,920\*100/197,757=22.7147%) temporary and 5,807 (5,807\*100/197,757=2.9364%) permanent. Few causes were; medication 4625 (4625\*100/197,757=2.3387%), anemia 4238 (4238\*100/197,757=2.1430%), low weight 164 (164\*100/197,757=0.0829) and blood donation interval of 3 months 137 (137\*100/197,757=0.0692%).<sup>13</sup>

Kasraian, et al.<sup>14</sup> from Shiraz, Iran reported 141,820 volunteer donors from March 21, 2009 to March 21, 2010, including 132,950 (132,950\*100/141,820=93.7456%) men and 8,870 (8,870\*100/141,820=6.2544%) women. The frequency of deferral was 43,839 (43,839\*100/141,820=30.9117%), including 41,866 (41,866\*100/141,820=29.5205%) temporary and 1,973 (1,973\*100/141,820=1.3912%) permanent deferrals.<sup>14</sup>

Rehman, et al.<sup>4</sup> reported 53,950 donors from Aligarh, India for the duration from 2007-2011, including 51,266 men (95.0250%) and 2,684 women (4.9750%). The frequency of deferral was 6,690 (6,690\*100/53,950=12.4003%), including 4,262 (4,262\*100/53,950=7.8999%) temporary and 2,428 (2,428\*100/53,950=4.5004%) permanent deferrals, and 6,142 (6,142\*100/53,950=11.3846%) men and 548 (548\*100/53,950=1.0157%) women. Some causes were; anemia 765 (765\*100/53,950=1.4179%), malaria in last 3 months 505 (0.9360%), weight <45 kg 454 (0.8415%), syphilis for 1 month 164 (164\*100/53,950=0.3039%), HBV positive 1,571 (1,571\*100/53,950=2.9119%), HCV positive 169 (169\*100/53,950=0.3132%) and HIV positive 196 (196\*100/53,950=0.3629%).

Sundar, et al.<sup>15</sup> from Bangalore, India reported 16,706 donors from Jan. 2005 to Dec. 2007, including 14,822 (14,822\*100/16,706=88.7226%) men and 1,884 (1,884\*100/16,706=11.2774%) women donors. The frequency of deferral was 976 (976\*100/16,706=5.8422%), including 602 (602\*100/16,706=3.6035%) men and 374 (374\*100/16,706=2.2387%) women, and 820 (820\*100/16,706=4.9084%) temporary and 156 (156\*100/16,706=0.9338%) permanent deferrals. Some causes of deferral were; anemia 224 (224\*100/16,706=1.3408%), underweight 115 (115\*100/16,706=0.6883%) and hypertension &

cardiac problems 112 ( $112 \times 100 / 16,706 = 0.6704\%$ ). Agnihotri<sup>16</sup> reported 6,357 donors from Chinchwad, Pune, Maharashtra, India from Jan. 2008 to June 2009, including 5,723 men (90.0267%) and 634 women (9.9733%). The frequency of deferral was 736 (11.5777%), including 397 ( $397 \times 100 / 6,357 = 6.2450\%$ ) men and 339 ( $339 \times 100 / 6,357 = 5.3327\%$ ) women. Some causes were; anemia 6.5%, underweight 0.3%, antibiotics & other medications 0.8%, previous donation within three months 0.2% and history of jaundice/ HBV/HCV 0.1%.

Shahtaj, et al.<sup>17</sup> for the years 2009 to 2011 from Peshawar, Pakistan reported 3,617 donors, inclusion 3,554 (98.2582%) men and 63 (1.7417%) women. The frequency of deferral was 315 ( $315 \times 100 / 3,617 = 8.7088\%$ ), including 256 temporary ( $256 \times 100 / 3,617 = 7.0776\%$ ) and 59 ( $59 \times 100 / 3,617 = 1.6311\%$ ) permanent deferrals, and 270 ( $270 \times 100 / 3,617 = 7.4647\%$ ) men and 45 women ( $45 \times 100 / 3,617 = 1.2441\%$ ). Major causes of deferral were; hypotension 70 ( $70 \times 100 / 3,617 = 1.9353\%$ ), anemia 42 ( $42 \times 100 / 3,617 = 1.1611\%$ ), hypertension 35 ( $35 \times 100 / 3,617 = 0.9676\%$ ), blood donation in last 3 months 26 ( $26 \times 100 / 3,617 = 0.7188\%$ ), low weight 19 ( $19 \times 100 / 3,617 = 0.5252\%$ ) and diabetes mellitus 2 ( $2 \times 100 / 3,617 = 0.0552\%$ ).

Tufail, et al.<sup>2</sup> reported in 2013 from Islamabad, Pakistan 1,833 donors. The frequency of deferrals was 249 ( $249 \times 100 / 1,833 = 13.5842\%$ ); including 238 (12.9841%) men ( $238 \times 100 / 1,833 = 8.9470\%$ ) and 11 (0.6001%) women ( $11 \times 100 / 1,833 = 0.6001\%$ ), and 164 (8.9470%) temporary ( $164 \times 100 / 1,833 = 8.9470\%$ ) and 85 (4.6372%) permanent ( $85 \times 100 / 1,833 = 4.6372\%$ ) deferrals. Some causes were; anemia 90 ( $90 \times 100 / 1,833 = 4.9099\%$ ), HCV positive 57 (3.1096%), thrombocytopenia 34 (1.8548%), HBsAg positive 15 (0.8183%), acute infection 12 (0.6546%), HIV positive 3 ( $3 \times 100 / 1,833 = 0.1636\%$ ) and underweight 2 (0.1091%).

Khalid, et al.<sup>18</sup> reported 4,225 donors from Islamabad, Pakistan from Oct. 1, 2016 to March 31, 2017, including 4,199 (99.3846%) men and 26 (0.6154%) women. The frequency of deferral was 410 ( $410 \times 100 / 4,225 = 9.7041\%$ ). Some causes were; anemia 141 ( $141 \times 100 / 4,225 = 3.3372\%$ ), within three months of previous donation 10 ( $10 \times 100 / 4,225 = 0.2366\%$ ), underweight 7 ( $7 \times 100 / 4,225 = 0.1656\%$ ), HBV 70 ( $70 \times 100 / 4,225 = 1.6568\%$ ), HCV 66 ( $66 \times 100 / 4,225 = 1.5621\%$ ) and HIV 5 ( $5 \times 100 / 4,225 = 0.1183\%$ ) cases.

Iqbal, et al.<sup>1</sup> reported for the year 2019 from Multan, Pakistan 433 (13.9330%) cases of deferrals from a sample of 3,348; including 427 ( $427 \times 100 / 3,348 = 12.7538\%$ ) men and 6 ( $6 \times 100 / 3,348 = 0.1792\%$ ) women. Some causes were; anemia 218 ( $218 \times 100 / 3,348 = 6.5113\%$ ), HCV

positive 83 (2.4790%), HBsAg positive 49 (1.4635%), syphilis 36 (1.0752), thrombocytopenia 15 (0.4480) and acute infection 14 ( $14 \times 100 / 3,348 = 0.4181\%$ ) cases, with no case of HIV positive.

Khurram, et al.<sup>19</sup> reported for the years 2012-2014 from Karachi, Pakistan 25,901 donors, including 25,679 (99.1428%) men and 222 (0.8571%) women. The frequency of deferral was 3,156 ( $3156 \times 100 / 25901 = 12.1848\%$ ), including 2,876 ( $2876 \times 100 / 25901 = 11.1038\%$ ) temporary and 280 ( $280 \times 100 / 25901 = 1.0810\%$ ) permanent. Common causes of deferral were; anemia 971 ( $971 \times 100 / 25901 = 3.7488\%$ ), HBV positive 147 ( $147 \times 100 / 25,901 = 0.5675\%$ ), thrombocytopenia 611 ( $611 \times 100 / 25,901 = 2.3589\%$ ) and previous history of jaundice 192 ( $192 \times 100 / 25,901 = 0.7412\%$ ).

Sultan, et al.<sup>20</sup> reported for the period from Jan. 2014 to Dec. 2015 from Karachi, Pakistan 3,103 (8.3969%) cases of deferrals from a sample of 36,954; including 2,612 ( $2612 \times 100 / 36,954 = 7.0682\%$ ) men and 491 ( $491 \times 100 / 3,348 = 1.3287\%$ ) women, with anemia as most common cause in 2,445 ( $2445 \times 100 / 36,954 = 6.6163\%$ ) cases.

## 1.2 Research Problems (RPs), Knowledge Gaps (KGs), Research Questions (RQs) & Rationale:

We don't know the recent prevalence of blood donor deferral and its distribution by sex, type of deferral and causes in population of Karachi, Pakistan. This unawareness of four pieces of information are our four RPs. Literature didn't explored these information. These are our four KGs. What would be the recent prevalence of blood donor deferral and its distribution by sex, type of deferral and causes in population of Karachi, Pakistan are our four RQs. To answer these four RQs, to fill these four KGs and to solve these four RPs is the rationale of our project.

**1.3 Research Objectives (ROs):** The four objectives of this study were;

**RQ 1:** to determine the prevalence of blood donor deferral in population of Karachi, Pakistan.

**RQ 2-4:** to determine the distribution of blood donor deferral by sex, type of deferral and causes in population of Karachi, Pakistan.

**1.4 Significance:** Having burden of a problem (disease/ health related state) in hand, one can optimally allocate required and available resources to combat that problem. Having cause of a problem in hand, one can plan for intervention to prevent and control that problem. We will go for both these epidemiological enquiries in our project.

## 2. MATERIALS AND METHODS

**2.1 Design, Setting & Duration:** This cross-sectional study was conducted at the Department of Pathology, Hamdard University, Karachi, Pakistan from July 1, 2019 to June 30, 2020. The data was collected from Hamdard University Hospital Blood Bank, Taj

Medical Complex, MA Jinnah Road, Karachi.

**2.2 Population, Sample Size & Technique and Sample Selection:**

Karachi is most populous city of Pakistan, with estimated population of 15,741,000 for the year 2019. Out of this, our hospital is assumed to provide medical services to some 1.5 million population. With one percent (1%) donors in 1.5 million population; the population of donors/ population at risk will be 15,000. With 15,000 population at risk, 10% prevalence of donor deferral, 1.073% margin of error and 95% confidence interval, the sample size was calculated as 2,503, using Raosoft<sup>®</sup> online sample size calculator. The technique was consecutive non-probability.

Selection criteria of donors were according to the standard operating procedures which were based on national guidelines. Donor selection criteria included age ranges 18-60 years, weight of  $\geq 50$  Kg, pulse rate 60-100/min, systolic blood pressure 100-150 mmHg and diastolic blood pressure 60-100 mmHg, Temperature  $\leq 99^{\circ}\text{F}$ , hemoglobin  $\geq 13.0$  g/dl for men and  $\geq 12.5$ g/dl for women.<sup>21</sup>

**2.3 Conduct of Procedure:** All donors who had come for blood donation were interviewed and donors were assured that all information would be kept confidential. Age in years, sex, weight in kg, temperature, blood pressure and pulse were noted. Tests for CBC, blood grouping, hepatitis B, hepatitis C, HIV, malaria and syphilis were done. CBC was performed on automated hematology analyzer Sysmex XP 300 (Japan), blood grouping was done by tube method, HBsAg, Anti HCV and Anti HIV was performed by chemiluminescence method on Roche e411 (Switzerland), malaria and syphilis was performed by ICT method manufactured by Acro Biotech Inc., (USA).

**2.4 Data Collection & Analysis Plan:** Sex, age in years, type of deferral and presence of deferral

were four variables. Continuous/ numeric variable such as age was analyzed by mean, minimum, maximum, range and SD. All the categorical variables were analyzed by count and percentage for the sample and by 80% CI as estimated parameters for the population using Wilson score interval. The interpretation for the confidence interval is that if it calculated over an infinite number of samples with a sample size of 2,503; 80% of the intervals will contain the true population parameter. The comparison for prevalence/ distribution between the attributes/ groups is based on CIs. If the CIs overlap, there is no difference, otherwise different (higher or lower). Data was analyzed on an online statistical calculator "Statistics Kingdom".<sup>22</sup>

**3. RESULTS**

Out of 2,503 donors, 2,493 (99.7%) were men and 10 (0.3%) women. The mean age of the sample was  $32.0 \pm 7.2$  (18-60, range 42) years. Out of these 2,503 donors, the frequency of deferral was 139 ( $139 \times 100 / 2,503 = 5.5533\%$ ) (80% CI 4.9953%-6.1696%).

The distribution of 139 deferred donors by sex was; 129 (5.1538%) men and 10 (0.3995%) women. Here the prevalence in men was many times higher than women. (Table 1)

The distribution of 139 deferred donors by type of deferral was; 58 (2.3172%) donors were temporarily deferred and 81 (3.2361%) were permanently deferred. Here the prevalence of permanent deferrals was higher than temporary deferrals. (Table 1)

Anemia was the most common cause of temporary deferral in 33 ( $33 \times 100 / 2,503 = 1.3184\%$ ) cases, while hepatitis C positivity was the most common cause of permanent deferral in 32 ( $32 \times 100 / 2,503 = 1.2784\%$ ) cases. (Table 2)

**Table 1: Distribution of 139 cases of blood donor deferral by sex and type in population of Karachi, Pakistan (n=139/2,503)**

| Variable         | Attributes | Sample statistics |                                     | 80% CI for proportion |        |
|------------------|------------|-------------------|-------------------------------------|-----------------------|--------|
|                  |            | Count             | Percentage                          | Lower                 | Upper  |
| Sex              | Men        | 129               | $129 \times 100 / 2,503 = 5.1538\%$ | 4.6160                | 5.7501 |
|                  | Women      | 10                | $10 \times 100 / 2,503 = 0.3995\%$  | 0.2672                | 0.5967 |
| Type of deferral | Temporary  | 58                | $58 \times 100 / 2,503 = 2.3172\%$  | 1.9619                | 2.7350 |
|                  | Permanent  | 81                | $81 \times 100 / 2,503 = 3.2361\%$  | 2.8126                | 3.7209 |
| Total            |            | 139               | $139 \times 100 / 2,503 = 5.5533\%$ | 4.9953                | 6.1697 |

**Table 2: Distribution of 139 cases of blood donor deferral by causes deferral in population of Karachi, Pakistan (n=139/2,503)**

| Causes of deferral            | Sample statistics |                | 80% CI for proportion |                |
|-------------------------------|-------------------|----------------|-----------------------|----------------|
|                               | Count             | Percentage     | Lower                 | Upper          |
| <b>A. Temporary causes</b>    | <b>58</b>         | <b>2.3172</b>  | <b>1.9619</b>         | <b>2.7350</b>  |
| Anemia                        | 33                | 1.3184         | 1.0565                | 1.6441         |
| Low weight                    | 08                | 0.3196         | 0.2040                | 0.5003         |
| Acute infection               | 05                | 0.1998         | 0.1135                | 0.3513         |
| On medications                | 05                | 0.1998         | 0.1135                | 0.3513         |
| Donated blood in last 8 weeks | 04                | 0.1598         | 0.0851                | 0.2998         |
| Hypotension                   | 03                | 0.1198         | 0.0581                | 0.2470         |
| <b>B. Permanent causes</b>    | <b>81</b>         | <b>3.2361</b>  | <b>2.8126</b>         | <b>3.7209</b>  |
| HCV positive                  | 32                | 1.2784         | 1.0209                | 1.5998         |
| HBsAg positive                | 30                | 1.1985         | 0.9501                | 1.5111         |
| Syphilis positive             | 17                | 0.6792         | 0.4987                | 0.9243         |
| HIV positive                  | 01                | 0.0400         | 0.0119                | 0.1334         |
| Diabetes mellitus             | 01                | 0.0400         | 0.0119                | 0.1334         |
| <b>Total cases deferred</b>   | <b>139</b>        | <b>5.5533</b>  | <b>4.9953</b>         | <b>6.1697</b>  |
| <b>Cases not deferred</b>     | <b>2,364</b>      | <b>94.4467</b> | <b>93.8303</b>        | <b>95.0047</b> |
| <b>Total</b>                  | <b>2,503</b>      | <b>100</b>     | Population parameters |                |

## 4. DISCUSSION

### 4.1 Prevalence of blood donor deferral

The prevalence of blood donor deferral was 5.5533% (80% CI 4.9953%-6.1696%) in our population.

Higher prevalence than our study (higher than upper limit of our confidence interval) was reported in sixteen studies from different local, national, regional and global populations/ studies as follow; 12.18% by Khurram, et al.<sup>19</sup> & 8.39% by Sultan, et al.<sup>20</sup> from Karachi, Pakistan, 13.93% by Iqbal, et al.<sup>1</sup> from Multan, Pakistan, 8.94% by Tufail, et al.<sup>2</sup> & 9.70% by Khalid, et al.<sup>18</sup> from Islamabad, Pakistan, 8.70% by Shahtaj, et al.<sup>17</sup> from Peshawar, Pakistan, 12.40% by Rehman, et al.<sup>4</sup> from Aligarh, India, 11.27% by Sundar, et al.<sup>15</sup> from Bungalow, India, 11.57% by Agnihotri<sup>16</sup> from Chinchwad, Pune, Maharashtra, India, 25.65% by Birjandi, et al.<sup>13</sup> from Isfahan, Iran & 30.91% by Kasraian, et al.<sup>14</sup> from Shiraz, Iran, 8.69% by Okoroiwu, et al.<sup>8</sup> from Sokoto, northwestern Nigeria, 12.72% by Valerian, et al.<sup>7</sup> from Moshi, Tanzania, 35.63% by Charles, et al.<sup>12</sup> from Port of Spain, Islands of Trinidad and Tobago, 12.80% by Zou, et al.<sup>10</sup> from Rockvill, Maryland, USA and 13.51% by Shah, et al.<sup>11</sup> from Atlanta, USA.

The difference in prevalence may be due to difference in selection criteria.

No studies could be retrieved with similar or lower prevalence than our study.

### 4.2 Distribution of blood donor deferral by sex

The prevalence of blood donor deferral was higher in men 5.1538% (80% CI 4.6160-5.7501) than women 0.3995% (80% CI 0.2672-0.5967) in our population. (Table 1)

Similar higher prevalence for men than women was reported by Khurram, et al.<sup>19</sup> from Karachi, Pakistan as 12.04% vs. 0.13%, Sultan, et al.<sup>20</sup> from Karachi as 7.06% vs. 1.32%, Iqbal, et al.<sup>1</sup> from Multan, Pakistan as 12.75% vs. 0.17%, Tufail, et al.<sup>2</sup> from Islamabad, Pakistan as 12.98% vs. 0.60%, Shahtaj, et al.<sup>17</sup> from Peshawar, Pakistan as 8.70% vs. 1.24%, Rehman, et al.<sup>4</sup> from Aligarh, India as 11.38% vs. 1.01%, Sundar, et al.<sup>15</sup> from Bungalow, India as 3.60% vs. 2.23%, Agnihotri<sup>16</sup> from Chinchwad, Pune, Maharashtra, India as 6.24% vs. 5.33%, Birjandi, et al.<sup>13</sup> from Isfahan, Iran as 23.22% vs. 2.43%, Okoroiwu, et al.<sup>8</sup> from Sokoto, Nigeria as 8.11% vs. 0.58%, and Valerian, et al.<sup>7</sup> from Moshi, Tanzania as 9.47% vs. 3.25%.

Higher prevalence of deferral for men than women may be explained by the erroneous belief that men are healthier than women. Likewise fear of developing anemia, fear of weakness, pregnancy, breast feeding and false beliefs about blood donation may restrict many women from donating blood.<sup>23</sup> Difficult vein in women may also be a problem in donating blood.<sup>24</sup>

No studies could be retrieved with similar prevalence for men and women or higher prevalence for women than men.

### **4.3 Distribution of blood donor deferral by type of deferral**

The prevalence of permanent blood donor deferral 3.2361% (80% CI 2.8126-3.7209) was higher than temporary deferral 2.3172% (80% CI 1.9619-2.7350) in our population. (Table 1)

Similar to our study, Okoroiwu, et al.<sup>8</sup> from Sokoto, Nigeria reported higher prevalence for permanent 5.99% than temporary deferrals 2.70%.

Equal prevalence was reported by Valerian, et al.<sup>7</sup> from Moshi, Tanzania as 6.45% temporary vs. 6.27% permanent.

Contrary to our findings, higher prevalence for temporary versus permanent deferrals was reported by Khurram, et al.<sup>19</sup> from Karachi, Pakistan as 11.10% vs. 1.08%, by Tufail, et al.<sup>2</sup> from Islamabad, Pakistan as 8.94% vs. 4.64%, by Khalid, et al.<sup>18</sup> from Islamabad, Pakistan as 6.36% vs. 3.33%, by Shahtaj, et al.<sup>17</sup> from Peshawar, Pakistan as 7.07% vs. 1.08%, by Sundar, et al.<sup>15</sup> from Bungalow, India as 4.90% vs. 0.93%, by Birjandi, et al.<sup>13</sup> from Isfahan, Iran as 22.71% vs. 2.93%, by Kasraian, et al.<sup>14</sup> from Shiraz, Iran as 29.52% vs. 1.39%, by Rehman, et al.<sup>4</sup> from Aligarh, India as 7.90% vs. 7.50%.

### **4.4 Distribution of blood donor deferral by causes of deferral**

Prevalence of anemia in blood donors was 1.3184% (80% CI 1.05%-1.64%) in our population. (Table 2)

Similar prevalence of anemia to our study was reported by Shahtaj, et al.<sup>17</sup> from Peshawar, Pakistan as 1.16% & by Rehman, et al.<sup>4</sup> from Aligarh, India as 1.41%. Higher prevalence than our study (higher than upper limit of our confidence interval) was reported in six studies as follows; 3.74% by Khurram, et al.<sup>19</sup> & 6.61% by Sultan, et al.<sup>20</sup> from Karachi, Pakistan, 6.51% by Iqbal, et al.<sup>1</sup> from Multan, Pakistan, 4.90% by Tufail, et al.<sup>2</sup> & 3.33% by Khalid, et al.<sup>18</sup> from Islamabad, Pakistan and 6.5% by Agnihotri<sup>16</sup> from Chinchwad, Pune, Maharashtra, India. No studies could be retrieved with lower prevalence of anemia than our study.

Prevalence of low weight was 0.3196% (80% CI 0.20%-0.50%) in our population. (Table 2)

Similar prevalence of 0.3% was reported by Agnihotri<sup>16</sup> from Chinchwad, Pune, Maharashtra, India. Higher prevalence than our study was reported from different studies as; 0.57% by Khurram, et al.<sup>19</sup> from Karachi, Pakistan, 0.52% by Shahtaj, et al.<sup>17</sup> from Peshawar, Pakistan, 0.84% by Rehman, et al.<sup>4</sup> from Aligarh, India and 0.68% by Sundar, et al.<sup>15</sup> from Bungalow, India. Lower prevalence than our study was reported from different studies as; 0.10% by Tufail, et al.<sup>2</sup> & 0.16% by Khalid, et al.<sup>18</sup> from Islamabad and 0.08% by

Birjandi, et al.<sup>13</sup> from Isfahan, Iran.

Prevalence of donor deferred due to medication was 0.1998% (80% CI 0.11%-0.35%) in our population. (Table 2)

Higher prevalence was reported as 0.52% by Khurram, et al.<sup>19</sup> from Karachi, Pakistan, 0.51% by Rehman, et al.<sup>4</sup> from Aligarh, India. 0.8% by Agnihotri<sup>16</sup> from India and 0.73% by Valerian, et al.<sup>7</sup> from Moshi, Tanzania. Lower prevalence than our study was reported 0.10% by Tufail, et al.<sup>2</sup> and 0.11% by Khalid, et al.<sup>18</sup> from Islamabad, Pakistan.

Prevalence of donor deferred due to infection was 0.1998% (80% CI 0.11%-0.35%) in our population. (Table 2)

High prevalence was reported in different studies as; 0.36% by Khurram, et al.<sup>19</sup> from Karachi, Pakistan, 0.41% by Iqbal, et al.<sup>1</sup> from Multan, Pakistan, 0.65% by Tufail, et al.<sup>2</sup>, 0.46% by Rehman, et al.<sup>4</sup> from Aligarh, India, 1.01% by Sundar, et al.<sup>15</sup> from Bungalow, India, 0.8% by Agnihotri<sup>16</sup> from India and 0.34% by Valerian, et al.<sup>7</sup> from Moshi, Tanzania. No studies could be retrieved with similar to or lower prevalence than our study.

Prevalence of low blood pressure was 0.1198% (80% CI 0.05%-0.24%) in our population.

Higher prevalence was reported by Shahtaj, et al.<sup>17</sup> from Peshawar, Pakistan 1.95%. No studies could be retrieved with similar to or lower prevalence than our study.

Prevalence of donor deferred due to Hepatitis C virus was 1.0209% (80% CI 1.02%-1.59%) in our population. (Table 2)

Similar prevalence was reported as 1.56% by Khalid, et al.<sup>18</sup> from Islamabad, Pakistan. Higher prevalence than our study was reported in four studies as follow; 2.47% by Iqbal, et al.<sup>1</sup> from Multan, Pakistan, 3.10% by Tufail, et al.<sup>2</sup> from Islamabad, Pakistan, 3.10% by Rehman, et al.<sup>4</sup> from Aligarh, India, 1.64% by Okoroiwu, et al.<sup>8</sup> from Sokoto, northwestern Nigeria. Lower prevalence than our study was reported as 0.21% by Valerian, et al.<sup>7</sup> from Moshi, Tanzania.

Prevalence of donor deferred due to Hepatitis B virus was 1.19% (80% CI 1.02%-1.59%) in our population. (Table 2)

Similar prevalence was reported as 1.46% by Iqbal, et al.<sup>1</sup> from Multan, Pakistan. Higher prevalence than our study was reported in four studies as follow; 1.65% by Khalid, et al.<sup>18</sup> from Islamabad, Pakistan, 2.91% by Rehman, et al.<sup>4</sup> from Aligarh, India, 2.75% by Okoroiwu, et al.<sup>8</sup> from Sokoto, northwestern Nigeria and 3.40% by Valerian, et al.<sup>7</sup> from Moshi, Tanzania. Lower prevalence than our study was reported as 0.56% by Khurram, et al.<sup>19</sup> from Karachi, Pakistan and 0.81% by Tufail, et al.<sup>2</sup> from Islamabad, Pakistan.

Prevalence of syphilis was 0.67% (80% CI 0.49%-0.92%) in our population.

Similar prevalence was reported as 0.91% by Sultan, et al.<sup>20</sup> from Karachi and 0.79% by Okoroiwu, et al.<sup>8</sup> from Sokoto, northwestern Nigeria. Higher prevalence was reported as 1.07% by Iqbal, et al.<sup>1</sup> from Multan, Pakistan and 1.03% by Valerian, et al.<sup>7</sup> from Moshi, Tanzania. Lower prevalence than our study 0.30% was reported by Rehman, et al.<sup>4</sup> from Aligarh and India.

Prevalence of donor deferred due to HIV was 0.119% (80% CI 0.01%-0.13%) in our population. (Table 2)

Similar prevalence of 0.02% was shown by Iqbal, et al.<sup>1</sup> from Multan, Pakistan and 0.11% by Khalid, et al.<sup>18</sup> from Islamabad, Pakistan. Higher prevalence was reported as 0.16% by Tufail, et al.<sup>2</sup> from Islamabad, Pakistan, 1.59% by Okoroiwu, et al.<sup>8</sup> from Sokoto, northwestern Nigeria and 1.37% by Valerian, et al.<sup>7</sup> from Moshi, Tanzania.

Prevalence of donor deferred due to diabetes was 0.119% (80% CI 0.01%-0.13%) in our population. (Table 2)

Similar prevalence of 0.05% was reported by Shahtaj, et al.<sup>17</sup> from Peshawar, Pakistan.

**4.5 Important Note:** We have adapted the organization and format of “Marwat’s Logical Trajectory of Research Process”.<sup>25-26</sup> We have also adopted the calculation for distribution of a disease from here. All 16 studies cited in our study have calculated percentages for distribution with number of positive cases as denominator. But in any cross-sectional study, the sample size (including both the disease positive and negative cases) must be taken as denominator for calculation of frequency and distribution both. Hence for all these 16 studies, we have calculated their frequency and distribution taking sample size as denominator. Of course, our results shown here for these 16 studies are different from those given in these studies.

## CONCLUSION

Prevalence of blood donor deferral was 5.55% in our study, which is almost half of all the cited studies here from global, regional, national and local populations. Prevalence in men was many times higher than women and prevalence of permanent causes was higher than temporary causes. Anemia and HCV were the two major causes of deferral in our study. Proper donor selection is a key of safe blood transfusion. Appropriate measures are needed to prevent causes of deferral.

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#### CONFLICT OF INTEREST

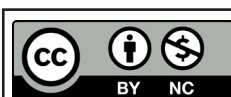
Authors declare no conflict of interest.  
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None declared.

#### AUTHORS' CONTRIBUTION

The following authors have made substantial contributions to the manuscript as under:

|                                                  |                |
|--------------------------------------------------|----------------|
| Conception or Design:                            | SK             |
| Acquisition, Analysis or Interpretation of Data: | SK, RT, JQ, FS |
| Manuscript Writing & Approval:                   | SK, RT, JQ, FS |

All the authors agree to be accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved.



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