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Analysis of Blood Donor Deferral Reasons: Smoking and Alcohol in Donation Center

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***Abstract*— Data analysis in the blood bank management system is increasing for the retain of blood donors. Recruitment and retention of blood donors is important to maintain the blood supply for future needs. Records of 13480 donors deferred with smoking and alcohol were considered. Out of which temporarily deferred male were 8718(64.7%) and 4762(35.3%) were females. The number of smokers and consumption of alcohol is increased both in male and female at the age of 49-58 years(P<0.001). The age group 49-58 years are at higher risk of being affected by diseases caused by smoking and alcohol. These temporary deferred donors can be educated and motivated for blood donation to retain the blood supply chain.**

Keywords—Blood donation; blood supply; data analysis; temporary deferred component

I. INTRODUCTION

The blood is very precious for mankind and the demand for the blood is increasing in healthcare due to various surgeries, to treat thalassemia diseases and for other serious life-threatening conditions. Recruitment and retention of the blood donors becomes a challenge for the blood centers as the donation process become very complex and donor loss for deferral and disqualification [1]. Blood donation is safe, but available less [2]. The demand for blood can be accomplished by the voluntary donors. The safest donor are the voluntary and non-remunerated donors in the blood bank sectors [3]. In the blood centers blood donors are classified into permanent and Temporary deferrals. Temporary deferrals can be retained to meet the requirement of blood. The return of temporary deferral is 15 percent likely to return for donation within 6 months [4]. Many of the blood donor deferral are temporary and for short period. The most common reasons for temporary and short period deferral were low hemoglobin, low body weight and alcohol consumption [5]. The temporary deferral weakens the blood donation over the time.

The objective of this study is the analysis of temporary donor deferral for the reasons smoking and alcohol with age group of blood donors, retention of temporary deferral donors for blood donation to meet the demand of blood supply chain and to identify the risk factors associated with the age group of blood donors. The temporary deferral donors are classified into voluntary type and replacement type based on gender. The analysis carried out with the age group of temporary deferral blood donors with gender for the reasons smoking and alcohol consumption.

The paper is organized as follows. In section II brief literature review is described. Section III presents data collection and analysis of data. In section IV results of analysis carried out are described. Lastly Discussion and future research directions are included in section V.

II. LITERATURE REVIEW

Blood donor deferrals play a significant role in blood donation to meet the demand of blood supply in blood banks. According to the study the deferral rate was high in females ,for the age above 31 years for low hemoglobin for temporary deferrals and Hepatitis B for the permanent deferral reason[6].Demographic feature are important in blood donors for the recruitment and retention strategies of donors in blood bank .Pre-donation temporary deferral causes are for intake of medication, low or high blood pressure, low hemoglobin, low weight and high pulse rate[7].A study conducted at blood transfusion department, analysis of the deferrals indicate the most common reason for permanent deferral was hypertension and temporary deferrals were medication, underweight, anemia and other reasons[8].Females were more likely to be deferred than males in the study of three different blood banks. The most common deferral reasons were low hematocrit or hemoglobin, medical diagnoses, and higher-risk behavior [9]. Temporary deferral weakens the future donor behavior which varies with donor experience and reasons for previous deferral [10]. The machine learning clustering techniques are used to identify the risk factors associated with the deferred donors. The results of the cluster indicate most of the donors are men [11]. The deferral reasons in blood donation center can be reduced by educating and creating awareness in donors [12].

III. DATA COLLECTION AND ANALYSIS

The potential donor's dataset is collected from the local blood bank hospitals. The data for the period from 2019 to 2020 considered in the study analysis. After the collection of the blood in the blood bank, the donor selection standard operating procedure are followed and the donors are classified into permanent and deferral donors. The reasons for deferral donors were analyzed. The deferral donors are deferred for

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reasons low hemoglobin, high BP, underweight, alcohol consumption, medicine intake, age-related, and tattooing, smoking, surgery. In the dataset the reasons for the deferral smoking and alcohol considered for the study. For the set of variable relevant to the analysis-donor type, gender, age, smoking and alcohol missing data were analyzed and replaced with the average value of the variable. Chi-square test used to analyze the data. A p value equal to or <0.05 was considered significant. The deferred donors are categorized into namely, voluntary blood donors and replacement blood donors, gender based(male-female), age, smoking and alcohol consumption. The deferral criteria used for classifying the reasons for deferral donors are classified based on the age group 18-28 years,29-38 years,39-48 years ,49-58 years and 59-65 years.

IV. RESULTS

Records of 21000 collected from the deferral dataset in the blood donation bank. From the dataset 13480 donors deferred with smoking and alcohol and the 7520 donors deferred with other reasons at the blood bank. For the study 13480 deferred donors with smoking and alcohol consumption were considered. The donors deferred at the blood bank donation characteristics is summarized in the Table- I.

TABLE I. MALE AND FEMALE DONORS

Gender	Total number of donors	Percentage of donors out of (13480)	Donor Type	Total Number of donor type	Percentage of donor type
Male	8718	64.7	Voluntary	3412/ 8718	39.1
			Replacement	5306 /8718	60.9
Female	4762	35.3	Voluntary	1678/ 4762	35.2
			Replacement	3084/ 4762	64.8

Among the deferred donors 8718 are male and 4762 are female. In other words, male deferred were 64.7% and 35.3% were females. The rate of donor deferred under the donor type, the male voluntary donors were 39.1% (3412/8718), the male replacement donors were 60.9% (5306/8718) and the female voluntary donors were 35.2% (1678/4762), the female replacement donors were 64.8% (3084/4762). Most of the risk associated with donor type in both male and female are replacement donors' type with 60.9% and 64.8%.

Table- II depicts the distribution of male donors who are deferred under smoking and alcohol under the donor type voluntary and replacement. Among the voluntary type donors 61.8% deferred for smoking and 38.2% for alcohol consumption. Among the replacement type donors 60.4% deferred for smoking and 39.6% for alcohol consumption. Most of the male donors deferred due to smoking.

Table- II. Male donors deferred under smoking and alcohol consumption

Donor type	Donor type deferred	Total Number of donor type	Percentage of donor type
Voluntary	Smoking	2108/3412	61.8
	alcohol	1304/3412	38.2
Replacement	Smoking	3203/5306	60.4
	alcohol	2103/5306	39.6

Table- III depicts the distribution of female donors who are deferred under smoking and alcohol under the donor type voluntary and replacement. Among the voluntary type donors 41.8% deferred for smoking and 58.2% for alcohol consumption. Among the replacement type donors 34.5% deferred for smoking and 65.5% for alcohol consumption. The risk associated with female donors is high for alcohol consumption.

Table- III. Female donors deferred under smoking and alcohol consumption

Donor type	Donor type deferred	Total Number of donor type	Percentage of donor type
Voluntary	Smoking	702/1678	41.8
	alcohol	976/1678	58.2
Replacement	Smoking	1065/3084	34.5
	alcohol	2019/3084	65.5

Table- IV depicts the distribution of age and deferred reasons for smoking and alcohol among the male voluntary type donors. Among the deferred donors the maximum donors deferred were among the age group 39-48 years (25.2%) for smoking and age group of 49-58 years (33.8%) for alcohol consumption, next age group 49-58 years (24.8%) for smoking and age group 39-48 years (23.3%) for alcohol, followed by the age group 59-65 years (23.5%) for smoking and (21.6%) for alcohol consumption. The minimum age group deferred were 18-28 years (10.3%) for smoking and (7.8%) for alcohol.

Table-IV. Male donors deferred under voluntary type (3412)

Age group in years	Smoking (in numbers)	% Deferred on smoking out of (2108)	Alcohol (in numbers)	% Deferred on alcohol (1304)
18-28	213	10.3	102	7.8
29-38	344	16.3	174	13.3
39-48	532	25.2	304	23.3
49-58	524	24.8	442	33.8
59-65	495	23.5	282	21.6

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Table-V depicts the distribution of age and deferred reasons for smoking and alcohol among the male replacement type donors. Among the deferred donors the maximum donors deferred were among the age group 49-58 years (38.1%) for smoking and (40.5%) for alcohol consumption, next age group 39-48 years (19.7%) for smoking and (23.6%) for alcohol, followed by the age group 59-65 years (13.7%) for smoking and (13.2%) for alcohol. The minimum age group deferred were 18-28 years (9.5%) for smoking and (10.2%) for alcohol.

Table-V. Male donors deferred under replacement type (5306)

Age group	Smoking (in numbers)	% Deferred on smoking (3203)	Alcohol (in numbers)	% Deferred on alcohol (2103)
18-28	303	9.5	215	10.2
29-38	608	19	262	12.5
39-48	634	19.7	498	23.6
49-58	1219	38.1	851	40.5
59-65	439	13.7	277	13.2

Table-VI depicts the distribution of age and deferred reasons for smoking and alcohol among the female voluntary type donors. Among the deferred donors the maximum donors deferred were among the age group 49-58 years (31.8%) for smoking and age group 39-48 years (28.5%) for alcohol consumption, next age group 39-48 years (31.2%) for smoking and the age group 29-38 years (24.1%) for alcohol, followed by the age group 29-38 years (18.2%) for smoking and the age group for 49-58 years (21.7%) for alcohol. The minimum age group deferred were 59-65 years (5.2%) for smoking and (7.8%) for alcohol.

Table-VI. Female donors deferred under voluntary type (1678)

Age group	Smoking (in numbers)	% Deferred on smoking (702)	Alcohol (in numbers)	% Deferred on alcohol (976)
18-28	96	13.6	174	17.9
29-38	128	18.2	235	24.1
39-48	219	31.2	278	28.5
49-58	223	31.8	212	21.7
59-65	36	5.2	77	7.8

Table-VII depicts the distribution of age and deferred reasons for smoking and alcohol among the female replacement type donors. Among the deferred donors the maximum donors deferred were among the age group 39-48 years (27.3%) for smoking and the age group 49-58 years (46.7%) for alcohol consumption, next age group 49-58 years (26.4%) for smoking and the age group of 39-48 years (24.8%) for alcohol, followed by the age group 29-38 years (23.6%) for smoking and (13.5%) for alcohol. The minimum age group deferred were 59-65 years (5.7%) for smoking and (4.9%) for alcohol.

Table-VII. Female donors deferred under replacement type (3084)

Age group	Smoking (in numbers)	% Deferred on smoking (1065)	Alcohol (In numbers)	% Deferred on alcohol (2019)
18-28	181	17	204	10.1
29-38	252	23.6	272	13.5
39-48	289	27.3	502	24.8
49-58	282	26.4	942	46.7
59-65	61	5.7	99	4.9

V. DISCUSSION

Using data analysis methods, we have identified the deferred donors who are deferred based on gender(male-female) type, age of smoking and alcohol consumption.

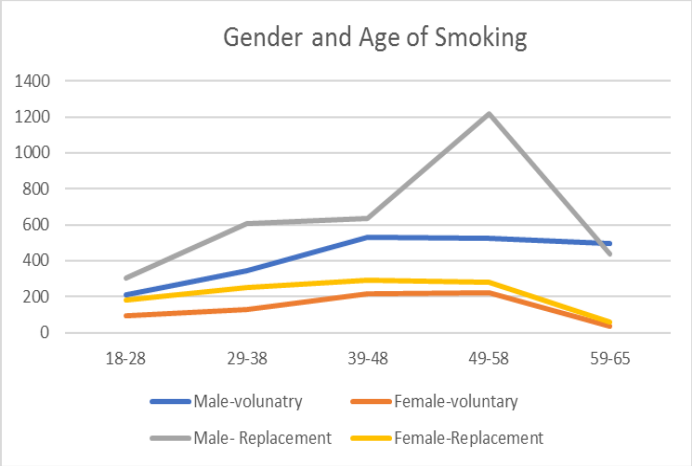

Fig. 1. Donor deferral according to gender and age for smoking

In this study Fig. 1 depicts the overall deferral rate for the age group 39-48 years,49-58 years and 59-65 years smoking was almost constant in male voluntary donor type. However, in male replacement donor type gradually increased for the age group 39-48 years, for the age group 49-58 years the smokers number reached the highest and numbers dropped sharply for the age group 59-65 years. For the female voluntary donor type and replacement donor type for the age group 18-28 years ,29-38 years ,39-48 years the number of smokers remained the same. For the age group 49-58 years the number of smokers were high and the numbers dropped gradually for the age group 59-65 years. Except for the male voluntary donors, the number ($P<0.05$) remained same.

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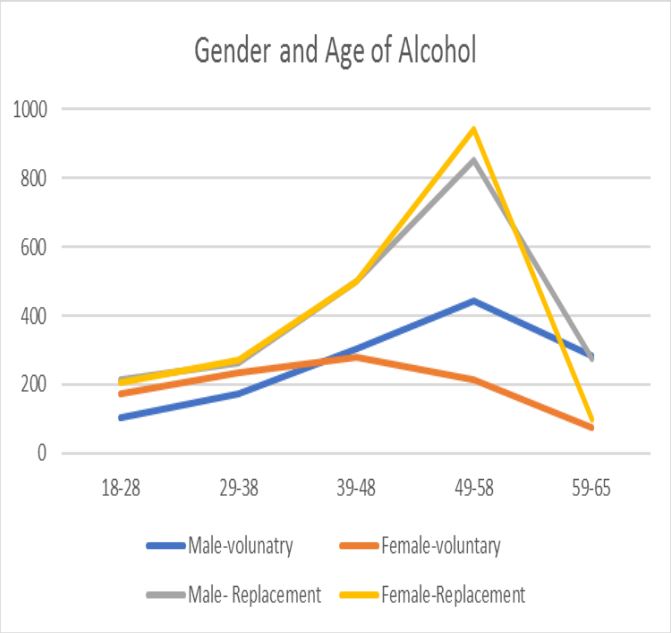

Fig. 2. Donor deferral according to gender and age for alcohol

From Fig. 2 male voluntary donor type and replacement donor type for the age groups 29-38 years ,39-48 years the alcohol consumption increased gradually. At the age group 49-58 years the number of alcohol consumption attained its peak, followed by steady decrease for the age group 59-65 years. For the female voluntary donor type and replacement donor type the alcohol consumption was steady for the age group 18-28 years and 29-39 years. The number of alcohol intake increased for the age groups 39-48 years and 49-58 years in female replacement type and the number alcohol consumption decreased at the age 59-65 years.

The study concluded the deferral rate was significantly higher in the age group 49-58 years for both male and female voluntary and replacement donors' type for the deferred reasons smoking and alcohol. The number of smokers and consumption of alcohol is more both in male and female at the age of 49-58 years. The age group 49-58 years are at higher risk of affected by diseases caused by smoking and alcohol. The focus on the deferred donors for the reasons of smoking and alcohol are important for blood donation management and making them for the return of blood donation due to temporary reasons. In the analysis the deferral rate was significantly higher for the replacement donors' type in male 60.9% and female 64.8% compared with the voluntary donor type in male 39.1% and female 35.2%. The replacement donors are more deferred when compared to voluntary type for smoking and alcohol.

This study shows an example of using data analysis for identifying the deferred reasons for blood donation in the blood bank management system and taking decisions at blood donation centers. The analysis of the donor deferral criteria is important in blood donation center to develop the safe group of blood donors and to bring back the donors who are deferred temporarily to minimize the loss of blood donors and to maintain the availability of blood during the requirement. Voluntary blood donors are most important by educating and creating awareness among them can improve the retention of blood donors. There is a need for the analysis of deferred blood donors for smoking and alcohol consumption to educate them about the disease's lung cancer, chronic obstructive pulmonary disease, heart disease, stroke asthma, reproductive effects in women, diabetes likely to affect them. Analysis of deferral helps in providing efficient blood transfusion services and provides information on health status of the population. In future work more data analysis can be performed for other organizations.

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