Impact of the Frequency of Camps and Target Inventory on Shortage and Wastage

MBB is interested to analyze the impact of different policies on the platelets' shortage and wastage. Suppose that the shelf life of platelets is 7 days, the target inventory is 1400, and the donation cams are held every day. For both supply and demand, 10,000 random observations are provided in Data.csv file.

A) Assume that the target inventory is decreased to 300 units. Calculate the daily average wastage and shortage for the blood bank. What could be the reason for such changes in the wastage and shortage?

Answer A) Assuming the target inventory is decreased to 300 units, then the daily average wastage = 0 and average shortage = 6.435 for the blood bank. Since the target inventory has been rapidly decreased from 1,400 to 300 that is why no such average wastage has been found however, we have seen significant amount of shortage of platelets' due to the less number of target but high demand.

Target inventory	Shelf life				0	1	2	3	4	5	6				
300	7	Period	Demand	Supply	Stock age 0	Stock age 1	Stock age 2	Stock age 3	Stock age 4	Stock age 5	Stock age 6	Wastage	Shortage	Avg Wastage	Avg Shortage
		1	80	170	170	0	0	0	0	0	0	0	0	0	6.425
		2	135	291	210	90	0	0	0	0	0	0	0		
		3	105	225	135	165	0	0	0	0	0	0	0		
(%) of Wastage	(%) of Shortage	4	155	335	105	135	60	0	0	0	0	0	0		
	27.29252918	5	235	511	155	105	40	0	0	0	0	0	0		
		6	155	335	235	65	0	0	0	0	0	0	0		
		7	90	192	155	145	0	0	0	0	0	0	0		
		8	105	225	90	155	55	0	0	0	0	0	0		
		9	80	170	105	90	105	0	0	0	0	0	0		
		10	190	412	80	105	90	25	0	0	0	0	0		
		11	160	346	190	80	30	0	0	0	0	0	0		
		12	140	302	160	140	0	0	0	0	0	0	0		
		13	135	291	140	160	0	0	0	0	0	0	0		
		14	125	269	135	140	25	0	0	0	0	0	0		
		15	90	192	125	135	40	0	0	0	0	0	0		
		16	160	346	90	125	85	0	0	0	0	0	0		

B) MBB is considering to decrease the donation camp's duration by 3, 4, and 8 hours which leads to 10%, 20%, and 60% less supply for each period, respectively. How do the average shortage and wastage change as the supply decreases? Should MBB reduce the donation camp's duration? (When you reduce the daily supply, round down the values that are not integer.)

Answer B) After reducing the supply by 10%, the average wastage = 31.57 (percentage of wastage = 0.18%) and average shortage = 0

After reducing the supply by 20%, the average wastage = 32.79 (percentage of wastage = 5.34%) and average shortage = 0

After reducing the supply by 60%, the average wastage = 0 and average shortage = 23.85 (percentage of wastage = 7.35%)

We have found that after decreasing the supply by 10% and 20%, seen the average wastage of 31.57 and 32.79 respectively but have not found any average shortage. However, after decreasing the supply by 60%, have not found any average wastage rather we have found the average shortage of 23.85 (percentage of wastage = 7.35%). A decrease in supply may decrease the wastage at the expense of more shortage.

Instead of reducing the MBB donation camp's duration, it can hold frequent blood donation camps that will lead to the reduction in average collection per blood donation camp, the blood bank can organize blood donation camps in locations that have low donor potential, Reduce the average inventory held at the blood

bank, which will reduce the amount of capital invested in the inventory, Less space to maintain the products. Also, getting fresh units since the average age of inventory drops, patients are transfused with fresher blood products, Blood products maintain their viability better when transfused fresh.

Reducing the supply by 10%

Target inventory	Shelf life				0	1	2	3	4	5	6				
1400	7	Period	Demand	Supply1-10%	Stock age 0	Stock age 1	Stock age 2	Stock age 3	Stock age 4	Stock age 5	Stock age 6	Wastage	Shortage	Avg Wastage	Avg Shortage
		1	80	136	136	0	0	0	0	0	0	0	0	31.5754	0
		2	135	232	232	56	0	0	0	0	0	0	0		
		3	105	180	180	153	0	0	0	0	0	0	0		
(%) of Wastage	(%) of Shortage	4	155	268	268	180	48	0	0	0	0	0	0		
0.180066095		5	235	408	408	268	73	0	0	0	0	0	0		
		6	155	268	268	408	106	0	0	0	0	0	0		
		7	90	153	153	268	359	0	0	0	0	0	0		
		8	105	180	180	153	268	269	0	0	0	0	0		
		9	80	136	136	180	153	268	164	0	0	0	0		
		10	190	329	329	136	180	153	268	84	0	0	0		
		11	160	276	276	329	136	180	153	162	0	0	0		
		12	140	241	241	276	329	136	180	153	2	0	0		
		13	135	232	223	241	276	329	136	180	15	0	0		
		14	125	215	135	223	241	276	329	136	60	0	0		
		15	90	153	125	135	223	241	276	329	71	0	0		

Reducing the supply by 20%

Target inventory	Shelf life				0	1	2	3	4	5	6				
1400	7	Period	Demand	Supply2- 20%	Stock age 0	Stock age 1	Stock age 2	Stock age 3	Stock age 4	Stock age 5	Stock age 6	Wastage	Shortage	Avg Wastage	Avg Shortage
		1	80	153	153	0	0	0	0	0	0	0	0	32.7992	0
		2	135	261	261	73	0	0	0	0	0	0	0		
		3	105	202	202	199	0	0	0	0	0	0	0		
(%) of Wastage	(%) of Shortage	4	155	301	301	202	94	0	0	0	0	0	0		
5.346304178		5	235	459	459	301	141	0	0	0	0	0	0		
		6	155	301	301	459	207	0	0	0	0	0	0		
		7	90	172	172	301	459	52	0	0	0	0	0		
		8	105	202	202	172	301	421	0	0	0	0	0		
		9	80	153	153	202	172	301	316	0	0	0	0		
		10	190	370	336	153	202	172	301	236	0	0	0		
		11	160	311	190	336	153	202	172	301	46	0	0		
		12	140	271	160	190	336	153	202	172	187	47	0		
		13	135	261	187	160	190	336	153	202	172	37	0		
		14	125	242	172	187	160	190	336	153	202	77	0		
		15	90	172	172	172	187	160	190	336	153	63	0		

Reducing the supply by 60%

Target inventory	Shelf life				0	1	2	3	4	5	6				
1400	7	Period	Demand	Supply3-60%	Stock age 0	Stock age 1	Stock age 2	Stock age 3	Stock age 4	Stock age 5	Stock age 6	Wastage	Shortage	Avg Wastage	Avg Shortage
		1	80	68	68	0	0	0	0	0	0	0	12	0	23.8569
		2	135	116	116	0	0	0	0	0	0	0	19		
		3	105	90	90	0	0	0	0	0	0	0	15		
(%) of Wastage	(%) of Shortage	4	155	134	134	0	0	0	0	0	0	0	21		
	7.350263446	5	235	204	204	0	0	0	0	0	0	0	31		
		6	155	134	134	0	0	0	0	0	0	0	21		
		7	90	76	76	0	0	0	0	0	0	0	14		
		8	105	90	90	0	0	0	0	0	0	0	15		
		9	80	68	68	0	0	0	0	0	0	0	12		
		10	190	164	164	0	0	0	0	0	0	0	26		
		11	160	138	138	0	0	0	0	0	0	0	22		
		12	140	120	120	0	0	0	0	0	0	0	20		
		13	135	116	116	0	0	0	0	0	0	0	19		
		14	125	107	107	0	0	0	0	0	0	0	18		
		15	90	76	76	0	0	0	0	0	0	0	14		

C) MBB is willing to examine the impact of decreasing the frequency of donation camps on the percentage of wastage and shortage. What would happen if the donation camps are held every other day instead of every day? Based on your results, discuss the effect of reducing the frequency of donation camps. In order to determine the supply for each day when the frequency is decreased, you can assume that the supply of day i (i=1,3,5,…) is equal to the supply of day i plus the supply of day i+1 (i=1,2,3,…), and the supply of day i+1 (i=1,2,3,…).

Answer C) If the donation camps are held every other day instead of every day, we would find lesser number of average wastage keeping the same target. We have assumed the supply of the day as (i=1,3,5,…) thus adding up the 2 days' supply into one.

Target inventory	Shelf life				0	1	2	3	4	5	6				
1400	7	Period	Demand	Part C- Supply of Day 1 = Supply of day 1 + Supply of Day2	Stock age 0	Stock age 1	Stock age 2	Stock age 3	Stock age 4	Stock age 5	Stock age 6	Wastage	Shortage	Avg Wastage	Avg Shortage
		1	80	461	461	0	0	0	0	0	0	0	0	29.9685	0
			135	0	0	381	0	0	0	0	0	0	0		
		3	105	560	560	0	246	0	0	0	0	0	0		
(%) of Wastage	(%) of Shortage		155	0	0	560	0	141	0	0	0	0	0		
5.851293859		5	235	846	846	0	546	0	0	0	0	0	0		
			155	0	0	846	0	311	0	0	0	0	0		
		7	90	417	398	0	846	0	156	0	0	0	0		
			105	0	0	398	0	846	0	66	0	0	0		
		9	80	582	195	0	398	0	807	0	0	0	0		
			190	0	0	195	0	398	0	727	0	0	0		
		11	160	648	270	0	195	0	398	0	537	377	0		
			140	0	0	270	0	195	0	398	0	0	0		
		13	135	560	560	0	270	0	195	0	258	123	0		
			125	0	0	560	0	270	0	195	0	0	0		
		15	90	538	500	0	560	0	270	0	70	0	0		

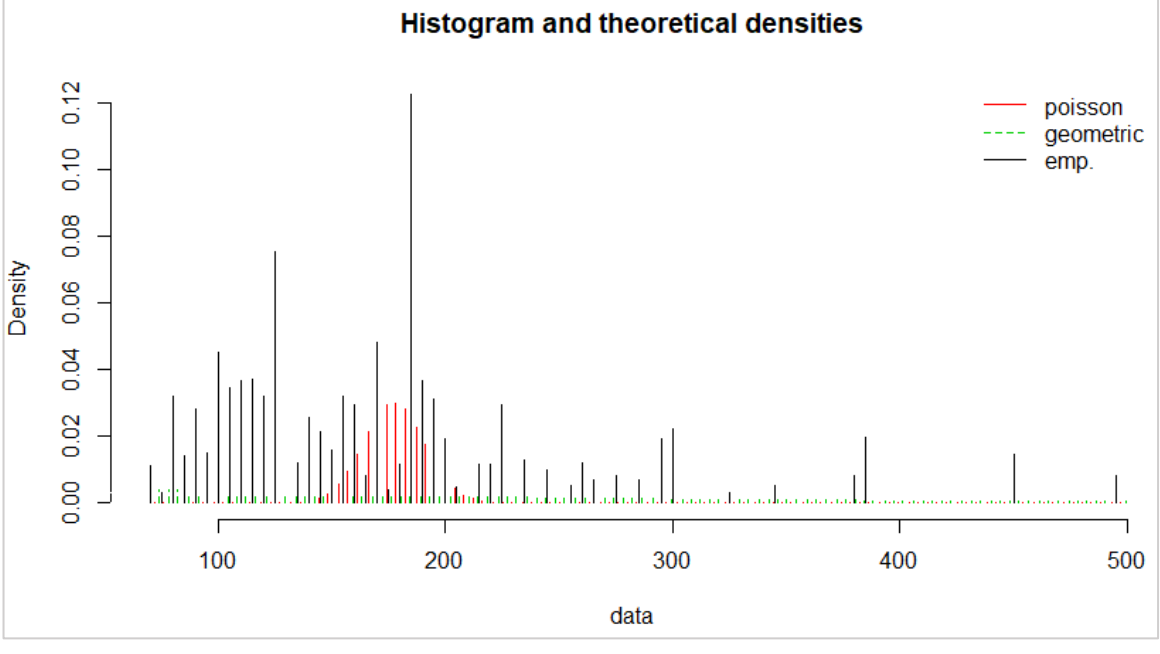

Figure 01: *Histogram and theoretical densities of MBB donation camp's data*