CHAPTER FIVE

PERFORMANCE OF METHODS IN SMALL SAMPLES

5.1 Introduction:

In this chapter the performance of the CPM, MIN and RM methods is compared for small sample sizes, namely samples of size 10 and size 20.

In each case, imbalance is studied for single layers as well as total assignment. Tabular and graphical presentations of results are provided. Mean and standard deviation of imbalance are also provided.

This approach will also be adopted when discuss other sample sizes in chapter six and seven.

5.2 Sample of Size 10:

In this section, imbalance of simulation data for the three methods with sample size 10 is shown and discussed. Table (1)

below is given as an example from appendix A to show the imbalance data for three methods for the 1st single layer.

Table (1)

The frequency and percentages of imbalance of CPM, MIN and RM for the 1st single layer when sample size is 10. (Simulation repeated 1000 times)

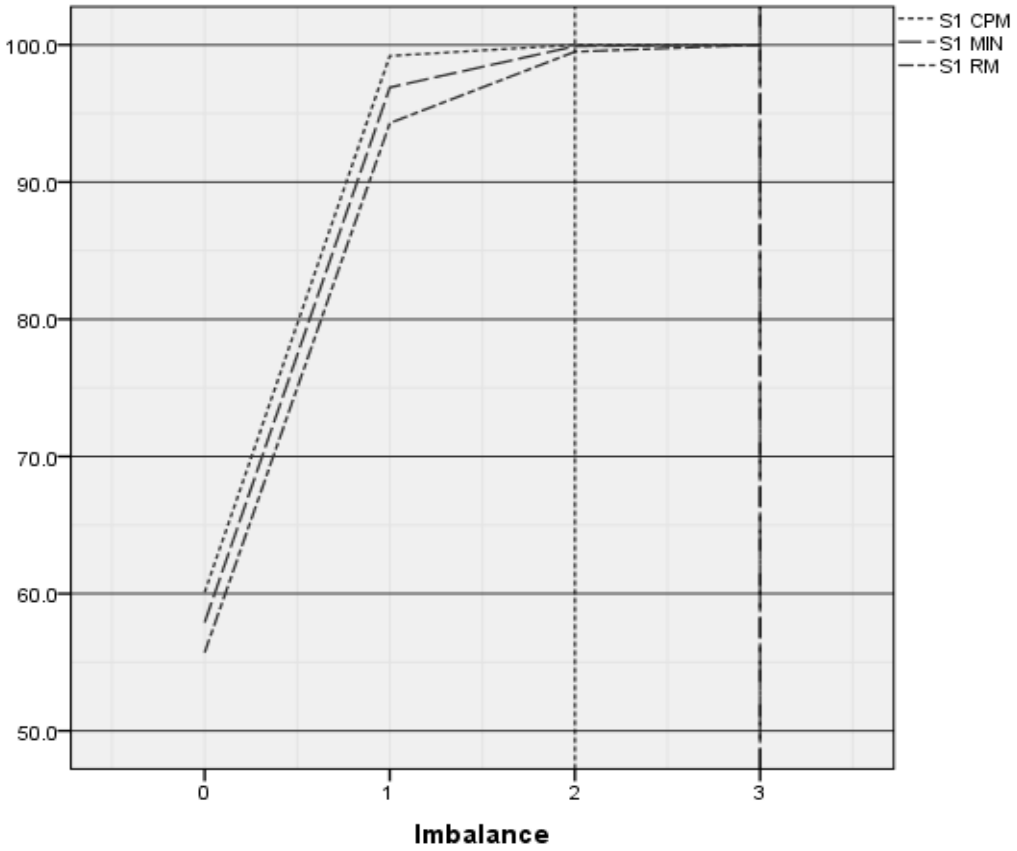
Imbalance	CPM		MIN		RM	
	Freq.	Per.	Freq.	Per.	Freq.	Per.
0	601	60.1	579	57.9	557	55.7
1	391	39.1	390	39.0	386	38.6
2	8	0.8	30	3.0	52	5.2
3	0	0.0	1	0.1	5	0.5

The first column in the table displays the amount of imbalance which starts with zero (no imbalance or full balance) then increases up to 3. The second column displays the frequency and percentages of imbalance from 0 to 3 which produced by critical percentage method. The third column displays the imbalance which produced by minimization method. And the last column displays the

frequency and percentages for the amount of imbalance when randomization method is used.

It is clear from Table (1), that the trials which had full balance from 1000 trials are 60.1% for CPM trials, compared with 57.9% for MIN trials and 55.7% for RM trials. When the amount of imbalance is one, the percentages are 39.1% in CPM, 39.0% in MIN and 38.6% in RM. The maximum imbalance is 2 in CPM compared with 3 in both of MIN and RM.

The following graph displays the imbalance and its cumulative percent for three methods to make the comparison clear.



Graph (5.1): The imbalance for the three randomization methods.

From Table (1) and Graph (5.1), it is clear that CPM has the least amount of imbalance compared with MIN and RM. So, CPM is the best method in this case which achieve the best imbalance.

Tables from (2) to (12) in appendix A show the imbalance data for 2^{nd} to 12^{th} single layers with sample size 10 categorized by randomization method.

In the 2^{nd} single layer, the trials which have full balance are 64.3% in CPM compared by 61.9% in MIN and 58.5% in RM. The

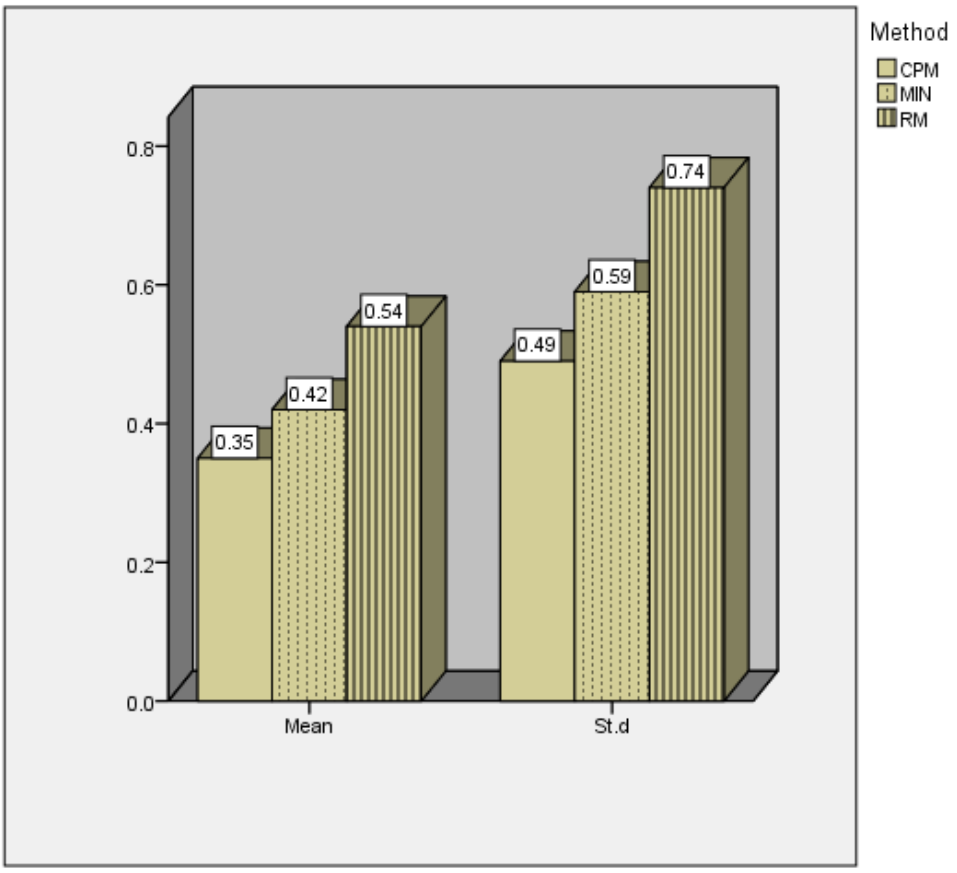
maximum imbalance in CPM and MIN is 2 compared with 3 in RM. In the 3rd single layer 83.5% of CPM trials have full balance while MIN and RM have 83.3% and 82.9% respectively. And the maximum imbalance is 1 in CPM, and 2 for the other methods.

In the 4th single layer, the full balance is 86.2%, 85.8% and 85.2% for CPM, MIN and RM respectively. While the maximum imbalance equal 1 in CPM and 2 for both of MIN and RM. The 5th single layer has 52.6%, 45.9% and 35.5% full balance for CPM, MIN and RM respectively. But the maximum imbalance is a little bit more in this layer for MIN and RM when is 5 and 3 respectively, while is just 2 in CPM. Full balance in the 6th single layer is 48.5% in CPM compared with 41.1% in MIN and 32.2% in RM. As well, maximum imbalance is 2 in CPM, but 3 in MIN and 5 in RM. In the 7th single layer 61.2% of CPM trials have full balance compared with 58.7% for MIN and 54.7% for RM. And the maximum imbalance is 2 for both of CPM and MIN compared with 3 for RM.

In contrast to MIN and RM, CPM has high full balance trials in the 8th single layer when is 61.7% compared with 58.8% and 55.7% in MIN and RM respectively. And the maximum imbalance is 1, 2 and 3 for three methods by the same above ordered. In the 9th single

layer the full balance is 86.4% in CPM, 86.3% in MIN and 86.2% in RM. And the maximum imbalance is 1 in CPM while in MIN similar to RM where is 2. 85.1% of CPM and MIN trials have full balance in the 10^{th} single layer compared with 84.6% in RM. In this layer, the imbalance increased up to 3 in RM trials whilst is 1 in CPM and MIN trials. 49.8% is the percentage of full balance trials in the 11^{th} single layer whereat trials have done by CPM compared with 43.2% in MIN and 33.0% in RM. The maximum imbalance is 2 in CPM, 3 in MIN and 5 in RM. In the last single layer with sample size 10, the differences in full balance between methods are obvious. Whereat is 49.7% in CPM, 40.4% in MIN and 32.8% in RM. And there is no a wide range in maximum imbalance where is 2 in CPM compared with 3 in MIN and 5 in RM.

The following graph displays the mean and stander deviation of imbalance for randomization methods for single layers with sample size 10.



Graph (5.2): The mean and St.d for single layers with sample size 10 by randomization methods.

The following table displays the amount of imbalance with frequency and percentages by randomization methods with sample size 10 for total assigning in treatments A and B.

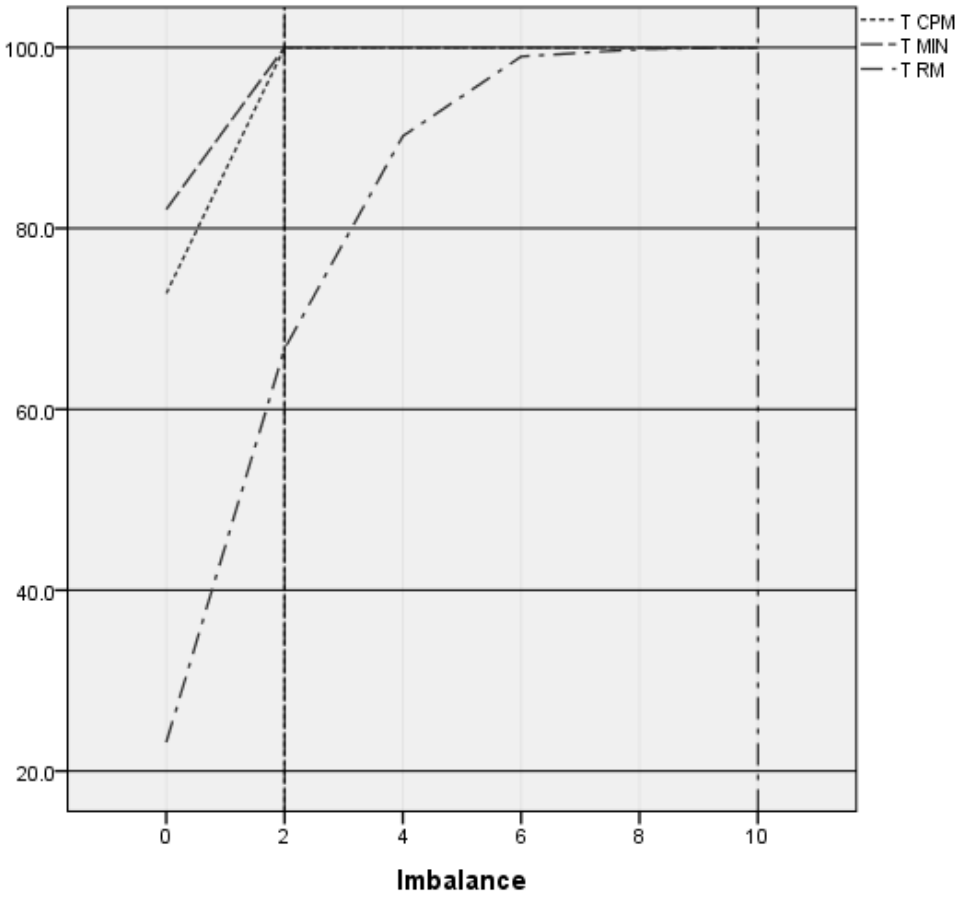
Table (5.1)

The amount of imbalance for total assigning with sample size 10 by randomization methods.

Imbalance	CPM		MIN		RM	
	Freq.	Per.	Freq.	Per.	Freq.	Per.
0	728	72.8	821	82.1	232	23.2
2	272	27.2	179	17.9	435	43.5
4	0	0.0	0	0.0	235	23.5
6	0	0.0	0	0.0	88	8.8
8	0	0.0	0	0.0	8	0.8
10	0	0.0	0	0.0	2	0.2

From table (5.1) above is clear that, the imbalance of total assigning of patients between treatments when sample size is 10 is not more than 2 in both of CPM and MIN while is 10 in RM.

The following graph display above data to be easy in comparison.



Graph (5.3): The amount of imbalance for total assigning with sample size 10 by methods.

The data in this section clearly show that, in all single layers, CPM has the least imbalance in contrast to MIN and RM. On the other hand, in the total assigning, CPM is similar to MIN according to their imbalance. And RM has the maximum imbalance whatever.

5.3 Sample of Size 20:

In this section, imbalance of simulation data for the three methods with sample size 20 is shown and discussed. Table (13) below represented as example from appendix A to show the imbalance data for three methods for the 1st single layer.

Table (13)

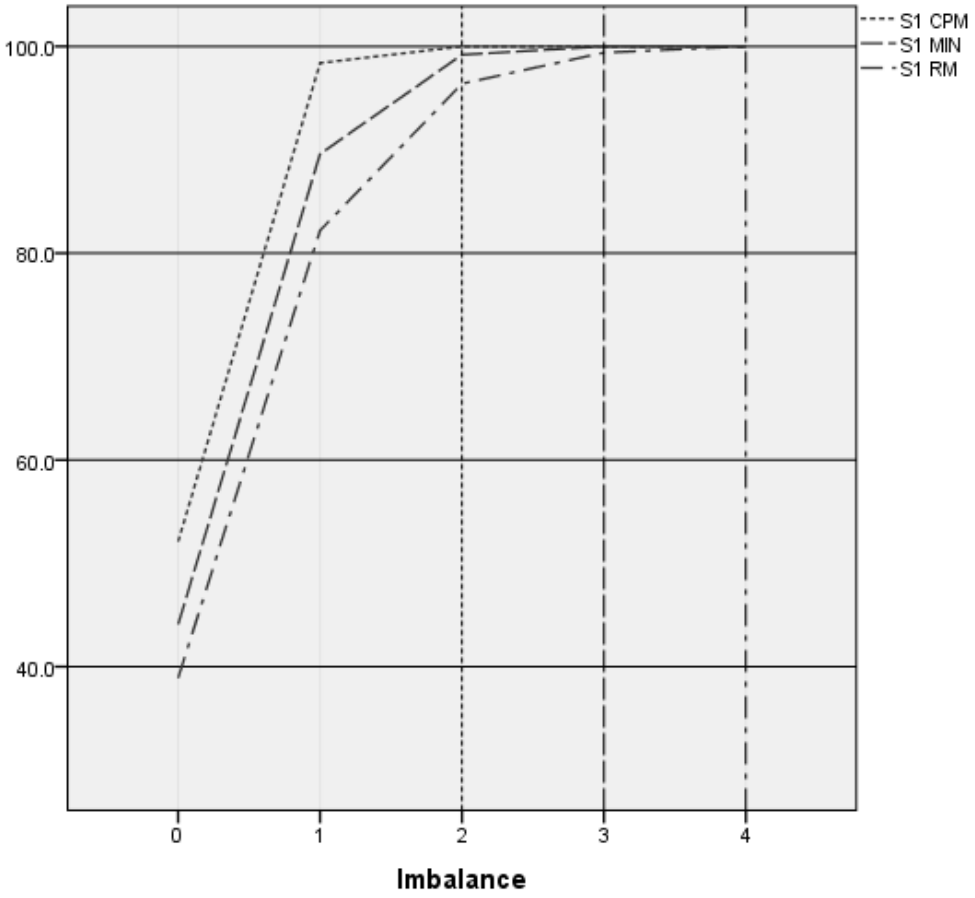
The frequency and percentages of imbalance of CPM, MIN and RM for the 1st single layer when sample size is 20. (Simulation repeated 1000 times)

Imbalance	CPM		MIN		RM	
	Freq.	Per.	Freq.	Per.	Freq.	Per.
0	521	52.1	441	44.1	389	38.9
1	463	46.3	455	45.5	433	43.3
2	16	1.6	96	9.6	142	14.2
3	0	0.0	8	0.8	30	3.0
4	0	0.0	0	0.0	6	0.6

It is clear that from Table (13), the trials which had full balance from 1000 trials are 52.1% of CPM trials, compared with 44.1% of

MIN trials and 38.9% of RM trials. The maximum imbalance is 2 in CPM compared with 3 in MIN and 4 in RM.

The following graph displays the imbalance and its cumulative percent for three methods to make the comparison clear.



Graph (5.4): The imbalance for randomization methods.

From Table (13) and graph (5.4), it is clear that CPM has the least amount of imbalance compared with MIN and RM. So, CPM is the best method in this case which achieve the minimum imbalance.

Tables from (14) to (24) in appendix A show the imbalance data for 2nd to 12th single layers with sample size 20 categorized by randomization method.

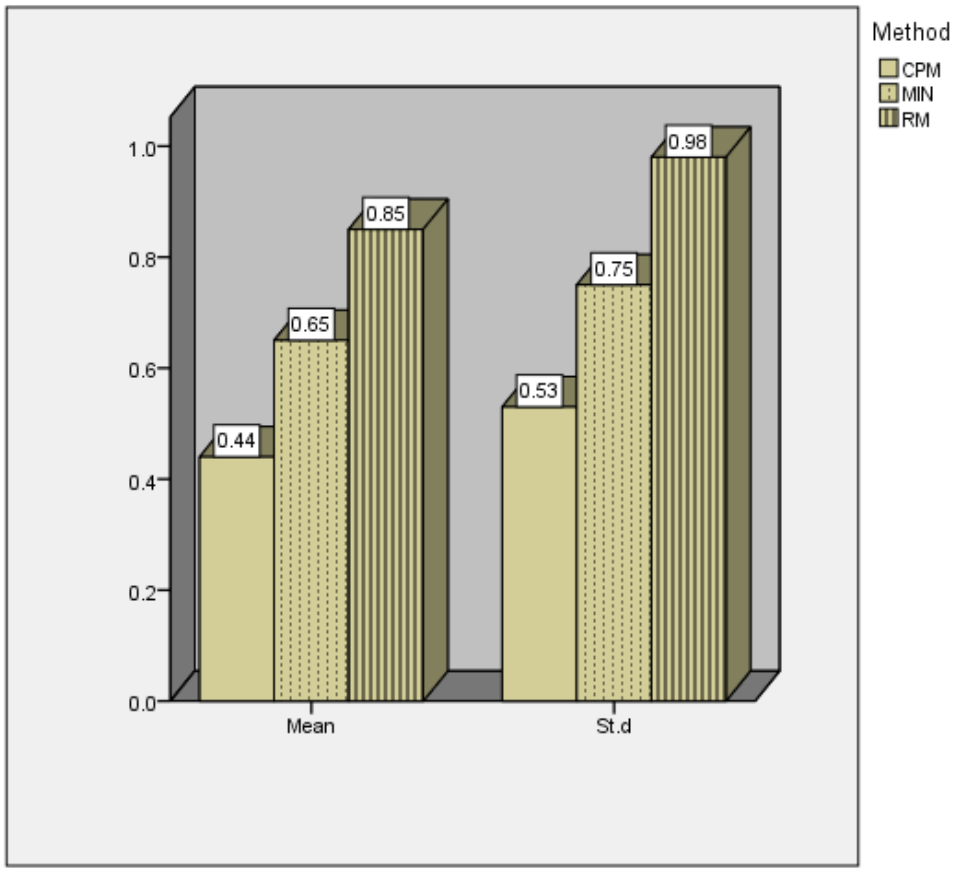
In the 2nd single layer, the trials which have full balance are 52.2% in CPM compared by 43.9% in MIN and 37.6% in RM. The maximum imbalance in CPM is 2 and in MIN is 4 compared with 5 in RM. In the 3rd single layer 75.8% of CPM trials have full balance while MIN has 75.1% and RM has 73.9% full balance trials. And the maximum imbalance is 1 in CPM, and 2 for the other methods.

In the 4th single layer, the full balance is 73.5%, 73.0% and 71.8% for CPM, MIN and RM respectively. While the maximum imbalance equal 2 in both of CPM and MIN compared with 3 in RM. The 5th single layer has 48.7%, 33.2% and 22.7% full balance for CPM, MIN and RM respectively. But the maximum imbalance is a little bit more in this layer for MIN and RM when is 5 and 7 respectively, while is just 3 in CPM. Full balance in the 6th single layer is obviously different between the methods, while is 49.2% in CPM compared with 31.3% in MIN and 24.7% in RM. As well, maximum imbalance is 3 in CPM, but 5 in MIN and 7 in RM. In the 7th single layer 50.8% of CPM trials have full balance compared

with 42.6% for MIN and 36.0% for RM. And the maximum imbalance is 2 for CPM compared with 3 for MIN and 4 for RM.

In contrast to MIN and RM, CPM has high full balance trials in the 8^{th} single layer when is 50.1% compared with 42.2% and 36.7% in MIN and RM respectively. And the maximum imbalance is 2, 3 and 4 for three methods by the same above ordered. In the 9^{th} single layer the full balance is 72.4% in CPM, 71.1% in MIN and 69.9% in RM. And the maximum imbalance is 1 in CPM while is 2 in MIN and 3 in RM. 74.8% of CPM and 74.5% of MIN trials have full balance in the 10^{th} single layer compared with 73.4% in RM. In this layer, the imbalance increased up to 3 in RM trials whilst is 2 in CPM and MIN trials. 46.7% is the percentage of full balance trials in the 11^{th} single layer whereat trials have done by CPM compared with 31.0% in MIN and 22.0% in RM. The maximum imbalance is 3 in CPM, 4 in MIN and 6 in RM. In the last single layer with sample size 20, the differences in full balance between methods are obvious. Whereat is 44.0% in CPM, 25.9% in MIN and 21.3% in RM. And there is a wide range in maximum imbalance where is 2 in CPM compared with 5 in MIN and 7 in RM.

The following graph displays the mean and stander deviation of imbalance for randomization methods for single layers with sample size 20.



Graph (5.5): The mean and St.d for single layers with sample size 20 by randomization methods.

The following table displays the amount of imbalance with frequency and percentages by randomization methods with sample size 20 for total assigning in treatments A and B.

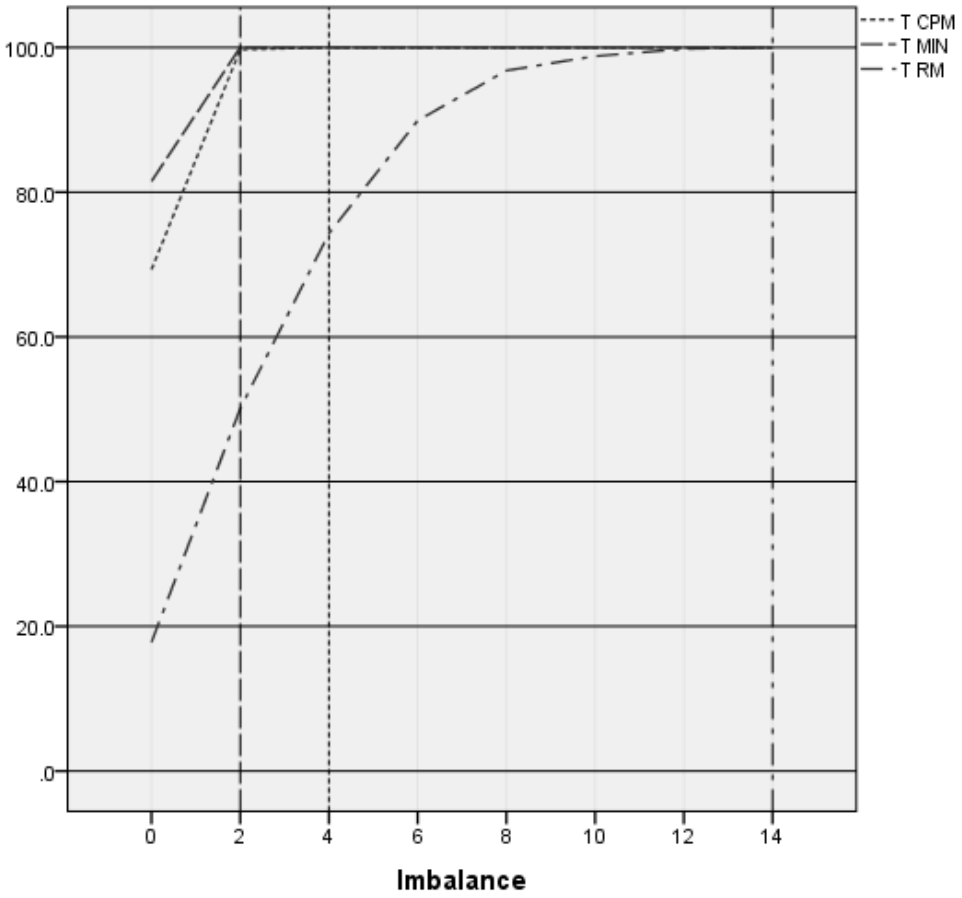
Table (5.2)

The amount of imbalance for total assigning with sample size 20 by randomization methods.

Imbalance	CPM		MIN		RM	
	Freq.	Per.	Freq.	Per.	Freq.	Per.
0	693	69.3	815	81.5	178	17.8
2	304	30.4	185	18.5	323	32.3
4	3	0.3	0	0.0	242	24.2
6	0	0.0	0	0.0	156	15.6
8	0	0.0	0	0.0	69	6.9
10	0	0.0	0	0.0	20	2.0
12	0	0.0	0	0.0	10	1.0
14	0	0.0	0	0.0	2	0.2

From table (5.2) above is clear that, the imbalance of total assigning of patients between treatments when sample size is 20 is not more than 4 in CPM compared with 2 in MIN while is 14 in RM.

The following graph displays above data to be easy in comparison.



Graph (5.6): The amount of imbalance for total assigning with sample size 20 by methods.

The data in this section clearly show that, in all single layers, CPM has the least imbalance in contrast to MIN and RM. On the other hand, in the total assigning, MIN is a bit better than CPM according to their imbalance. And RM has the maximum imbalance whatever.