

# Changing donors improves outcomes of second transplantation in patients who experienced graft failure after first allogeneic stem cell transplantation

Rui Ma,<sup>1\*</sup> Xiao-Yu Zhu,<sup>2\*</sup> Yue Lu,<sup>3\*</sup> Jia Chen,<sup>4\*</sup> Li Xuan,<sup>5</sup> Hai-Long Yuan,<sup>6</sup> Yang Cao,<sup>7</sup> Wei-Jie Cao,<sup>8</sup> Xiao-Sheng Fang,<sup>9</sup> Kou-Rong Miao,<sup>10</sup> Xiao-Xia Hu,<sup>11</sup> Hai Yi,<sup>12</sup> Yan-Min Zhao,<sup>13</sup> Yuan-Bin Wu,<sup>14</sup> Ting Yang,<sup>15</sup> Hong-Tao Wang,<sup>16</sup> Yue Yin,<sup>17</sup> Zhong-Ming Zhang,<sup>18</sup> Xiao-Hui Zhang,<sup>1</sup> Lan-Ping Xu,<sup>1</sup> Yu Wang,<sup>1</sup> Kai-Yan Liu,<sup>1</sup> Xiao-Jun Huang<sup>1,19</sup> and Yu-Qian Sun<sup>1</sup>

<sup>1</sup>Peking University People's Hospital, Peking University Institute of Hematology, National Clinical Research Center for Hematologic Disease, Beijing Key Laboratory of Cell and Gene Therapy for Hematologic Malignancies, Peking University, Beijing; <sup>2</sup>Department of Hematology, the First Affiliated Hospital, Division of Life Sciences and Medicine, University of Science and Technology of China, Hefei; <sup>3</sup>Beijing Lu Daopei Hospital, Beijing; <sup>4</sup>National Clinical Research Center for Hematologic Diseases, Jiangsu Institute of Hematology, The First Affiliated Hospital of Soochow University, Suzhou; <sup>5</sup>Department of Hematology, Nanfang Hospital, Southern Medical University, Guangzhou; <sup>6</sup>The First Affiliated Hospital of Xinjiang Medical University, Urumqi; <sup>7</sup>Department of Hematology, Tongji Hospital, Tongji Medical College, Huazhong University of Science and Technology, Wuhan; <sup>8</sup>Department of Hematology, The First Affiliated Hospital of Zhengzhou University, Zhengzhou; <sup>9</sup>Department of Hematology, Shandong Provincial Hospital Affiliated to Shandong First Medical University, Jinan; <sup>10</sup>People's Hospital of Jiangsu Province, Suzhou; <sup>11</sup>Ruijin Hospital, Shanghai; <sup>12</sup>Department of Hematology, The General Hospital of Western Theater Command, Chengdu; <sup>13</sup>Bone Marrow Transplantation Center, The First Affiliated Hospital, Zhejiang University School of Medicine, Hangzhou; <sup>14</sup>Department of Hematology, The First Affiliated Hospital, Fujian Medical University, Fuzhou; <sup>15</sup>Department of Hematology, Shengjing Hospital of China Medical University, Shenyang; <sup>16</sup>Peking University First Hospital, Beijing; <sup>17</sup>Department of Hematology, The First Affiliated Hospital of Guangxi Medical University, Nanning and <sup>18</sup>Peking-Tsinghua Center for Life Sciences, Academy for Advanced Interdisciplinary Studies, Peking University, Beijing, P.R. China

*\*RM, X-YZ, YL and JC contributed equally as first authors.*

**Correspondence:** Y.-Q. Sun  
[sunyuqian83@hotmail.com](mailto:sunyuqian83@hotmail.com)

X.-J. Huang  
[huangxiaojun@bjmu.edu.cn](mailto:huangxiaojun@bjmu.edu.cn)

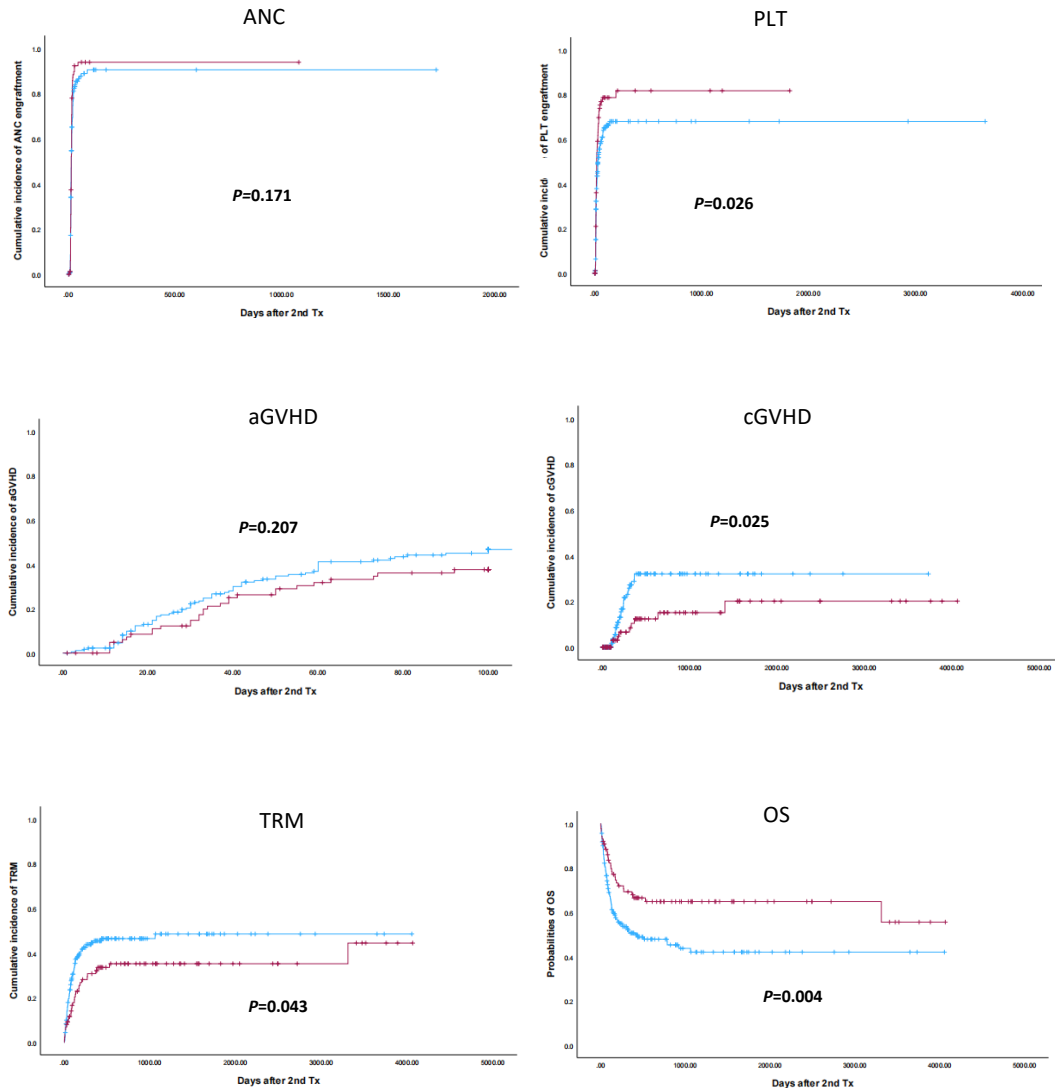
**Received:** February 20, 2025.  
**Accepted:** July 9, 2025.  
**Early view:** July 17, 2025.

<https://doi.org/10.3324/haematol.2025.287554>

©2026 Ferrata Storti Foundation

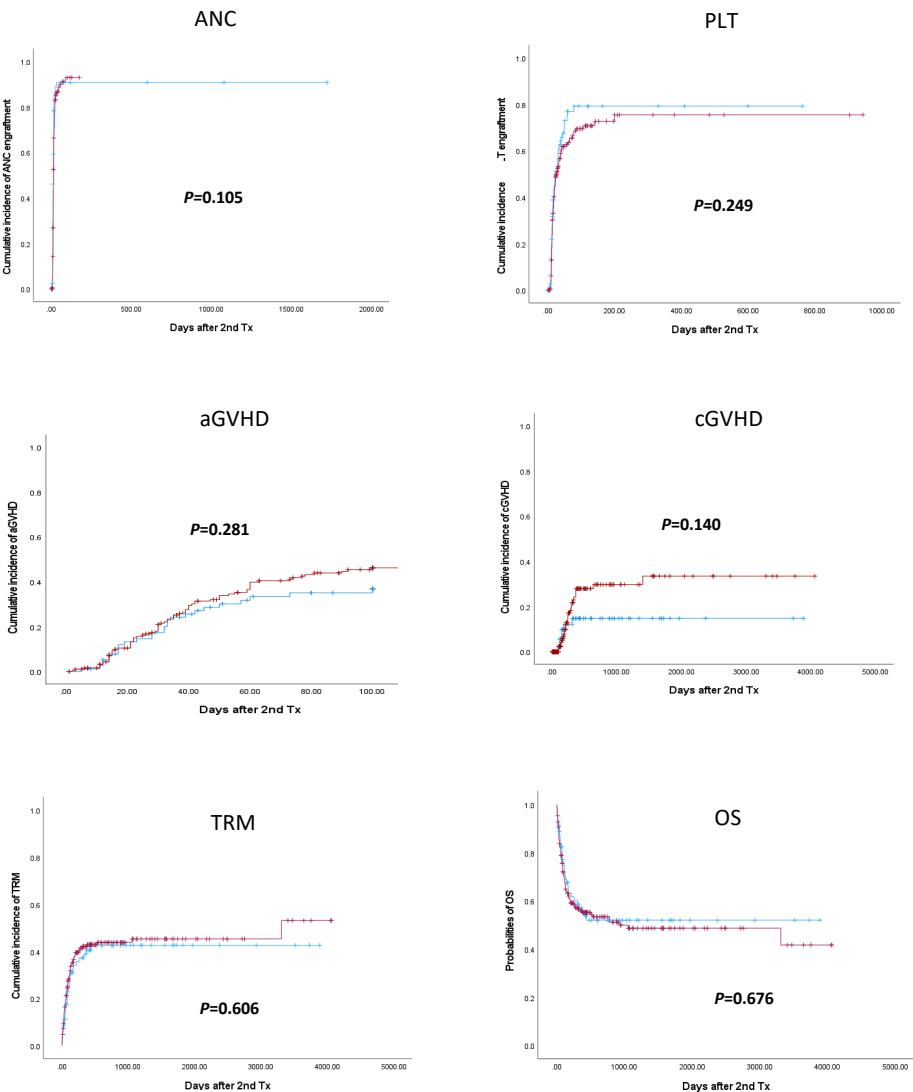
Published under a CC BY-NC license





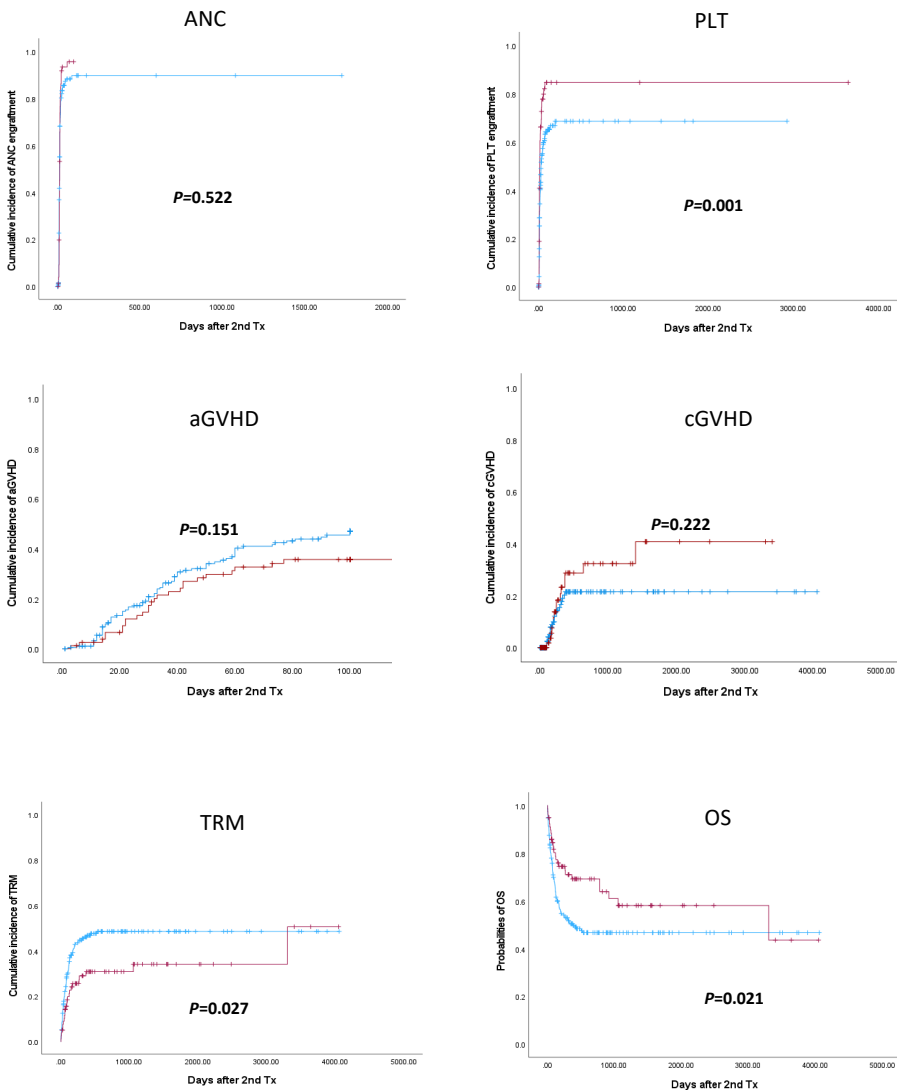
**Supplementary Figure 1. Outcomes of 2nd transplantation in patients with AA and hematopoietic malignancies.**

Red line: AA; blue line: hematopoietic malignancies.

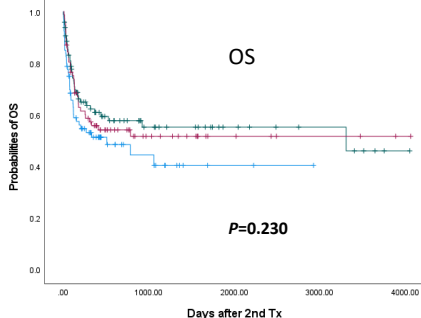
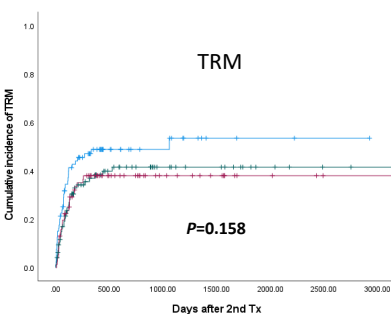
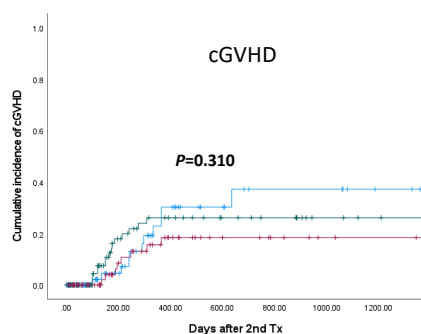
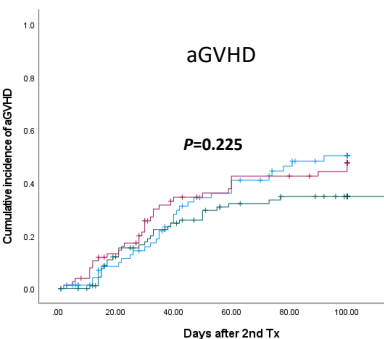
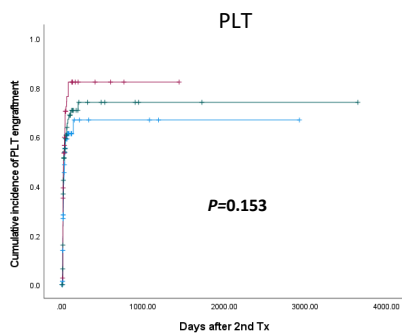
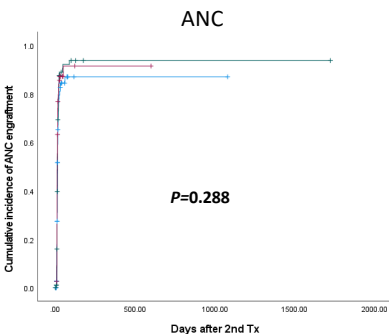


**Supplementary Figure 2. Outcomes of 2nd transplantation in patients grafted from CB and other donor types for the 1st transplantation.**

Red line: other donor types including MRD, URD, and HID; blue line: CB.

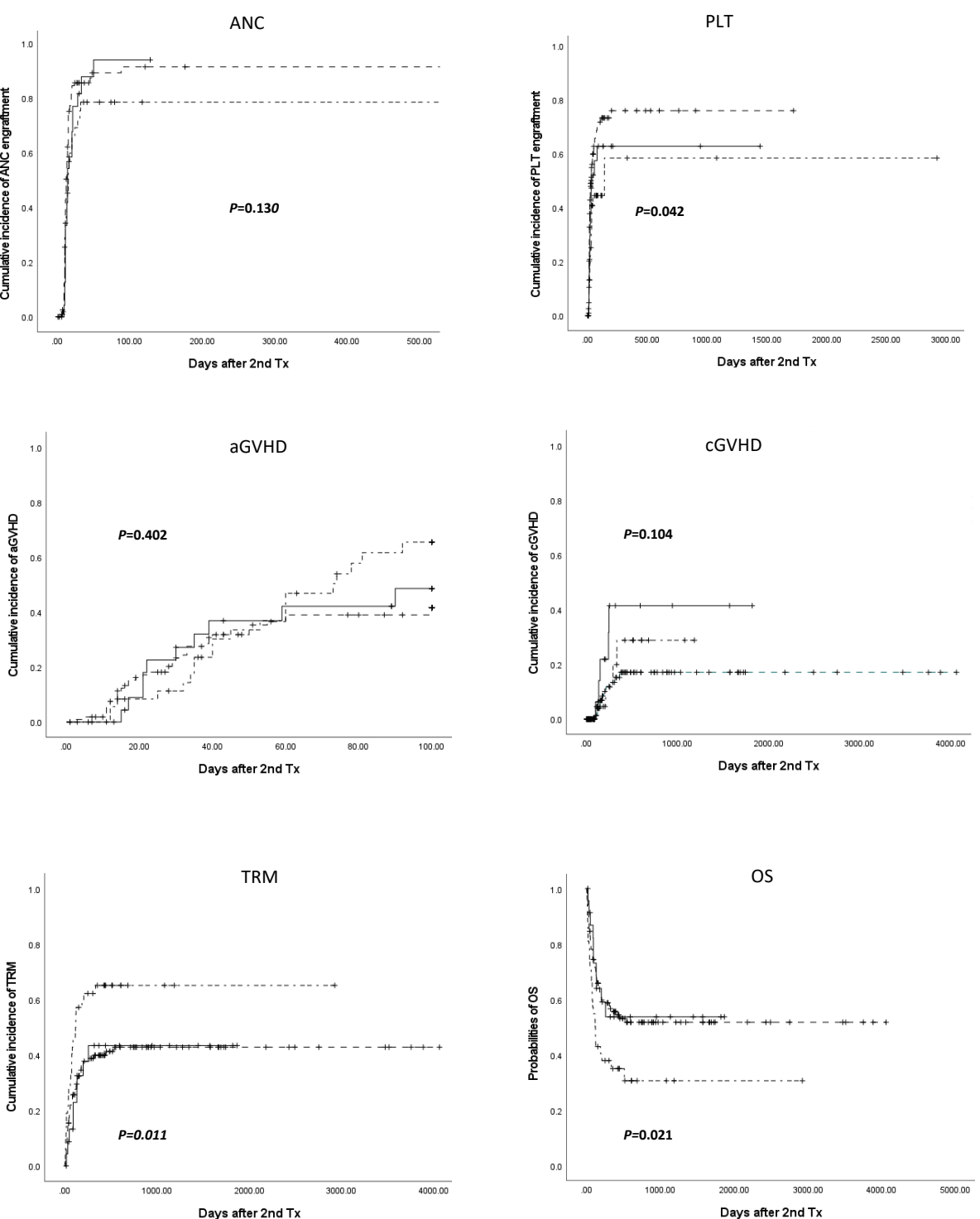


**Supplementary Figure 3. Outcomes of 2nd transplantation in patients experiencing primary or secondary graft failures after the 1st transplantation.**  
Red line: secondary GF; blue line: primary GF.



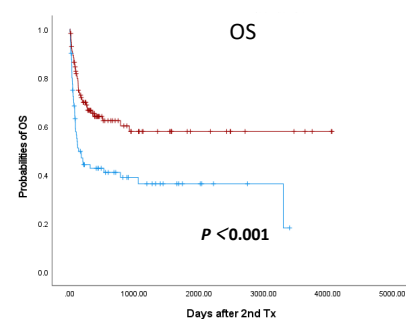
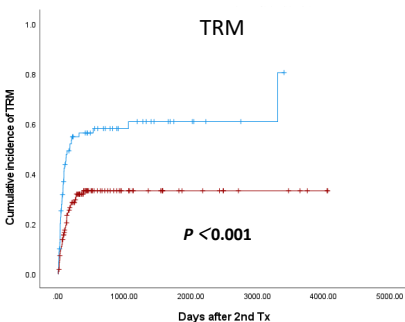
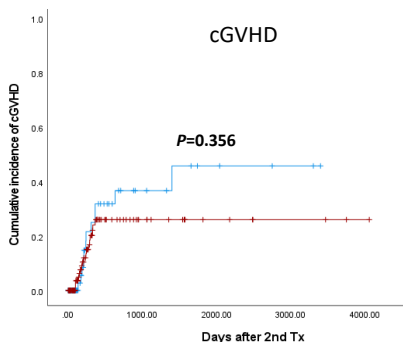
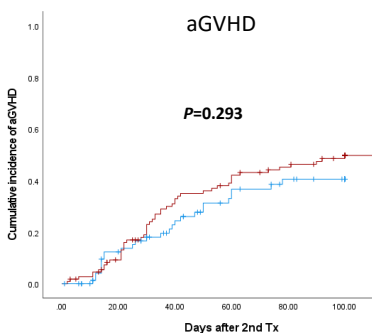
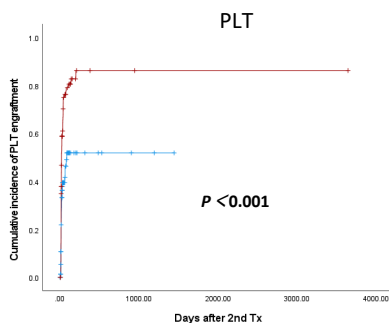
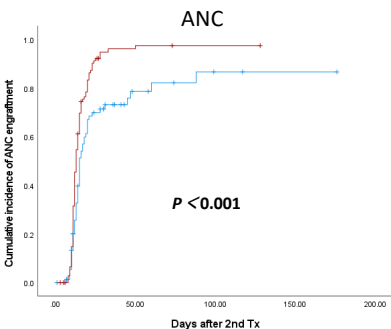
**Supplementary Figure 4. Outcomes of 2nd transplantation in patients with different chimerism status after the 1st transplantation.**

Red line: full recipient; blue line: full donor; green line: mixed.



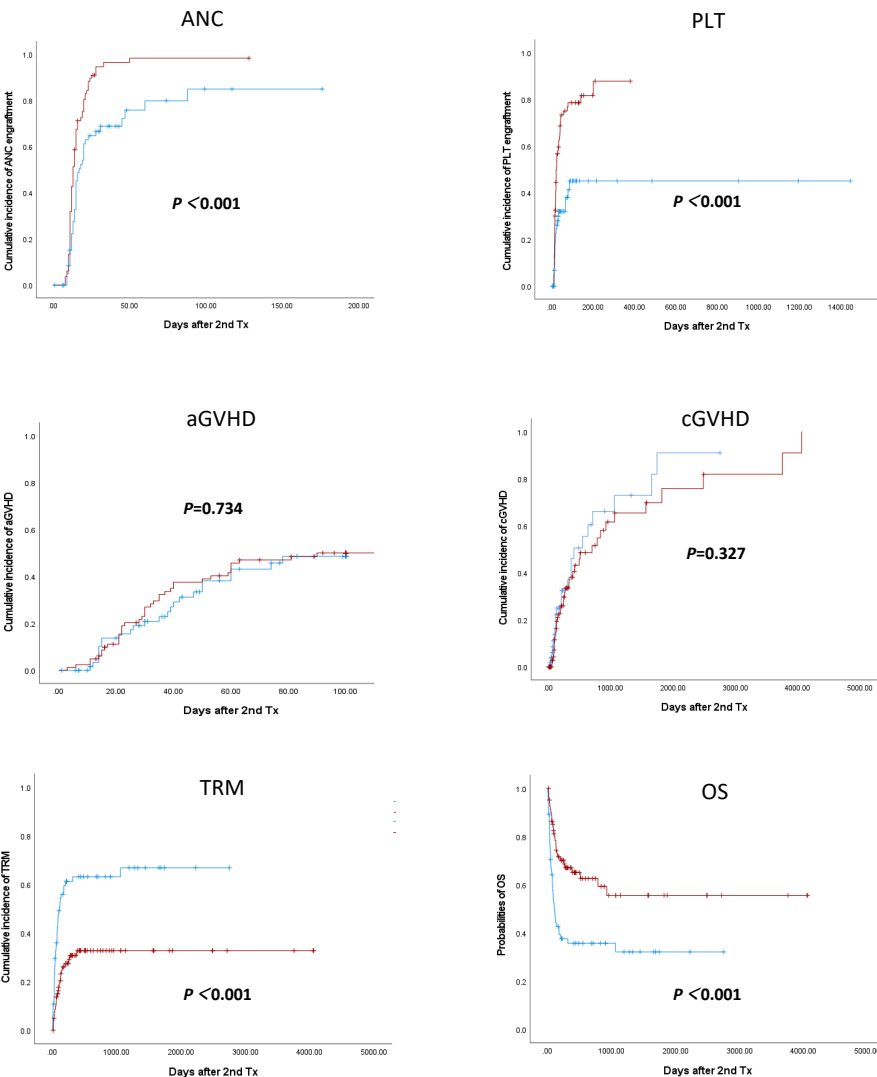
**Supplementary Figure 5. Outcomes of 2nd transplantation in primary graft failure patients with various etiologies.**

Solid line: group A; dashed line: group B; dash-dot line: group C.



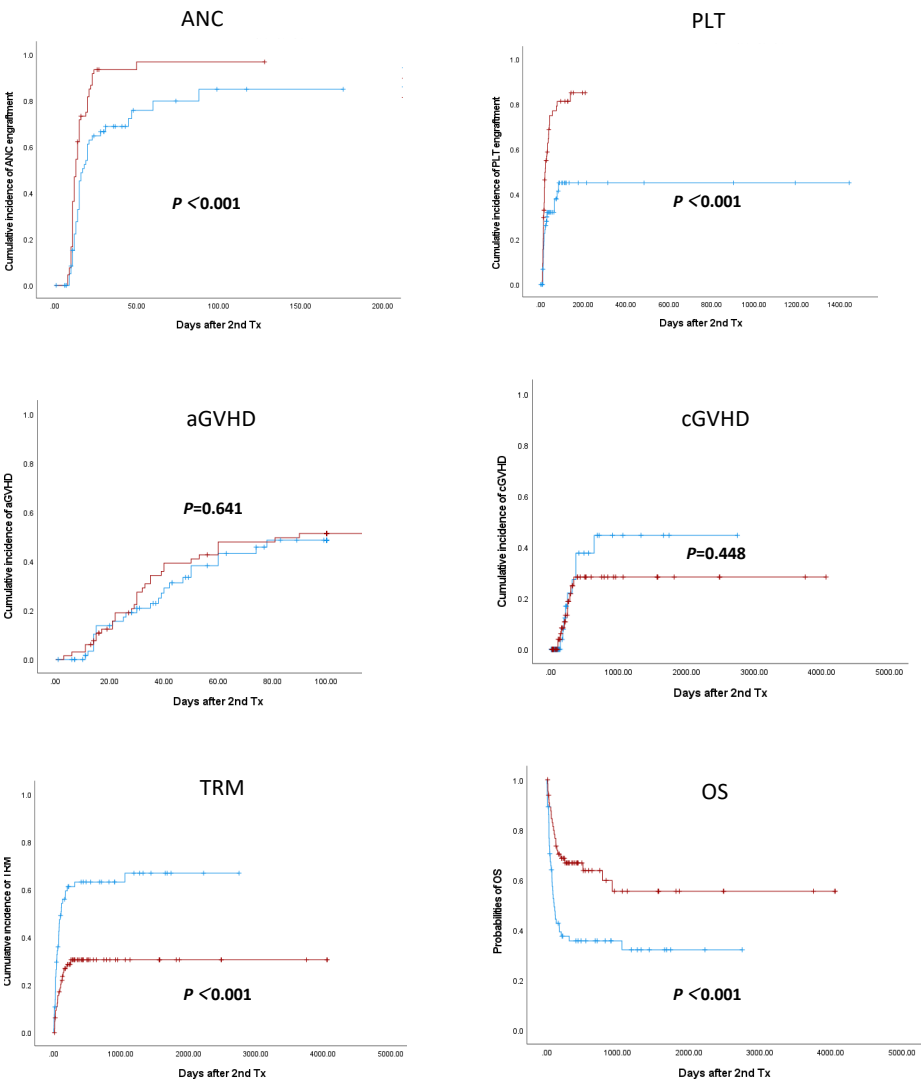
**Supplementary Figure 6. Comparison of 2nd transplant outcomes in using the different or the same donor in patients who received grafts from MRDs, URDs, and HIDs.**

Red line: using a different donor; blue line: using the same donor.



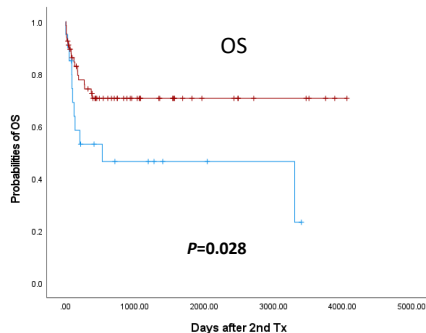
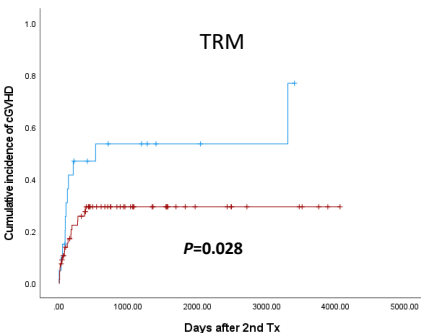
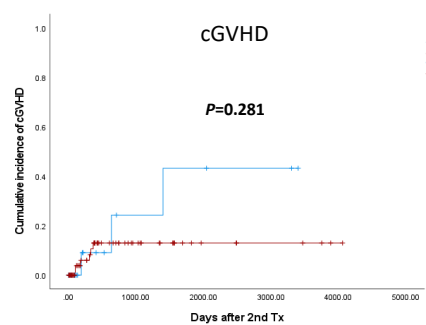
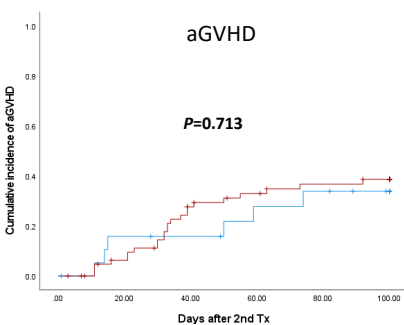
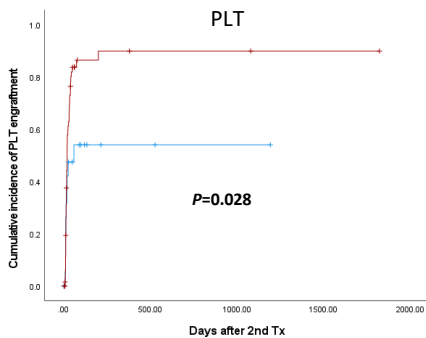
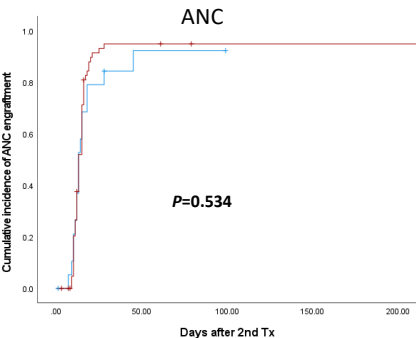
**Supplementary Figure 7. Comparison of 2nd transplant outcomes in patients who used the different or the same donor and received grafts from HIDs for the 1st transplantation.**

Red line: using a different donor; blue line: using the same donor.



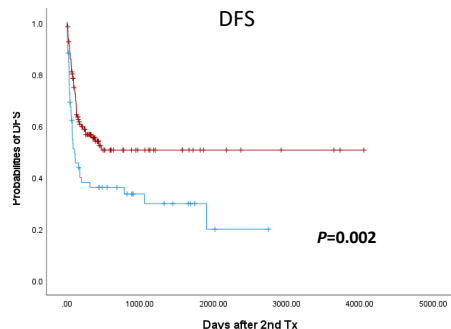
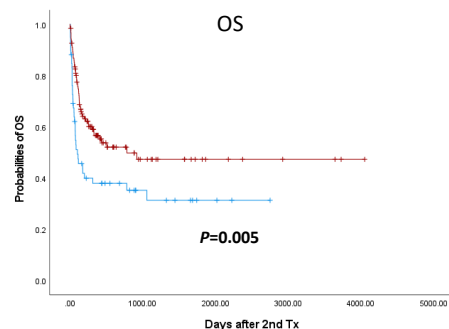
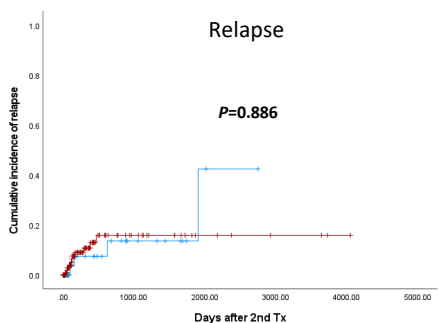
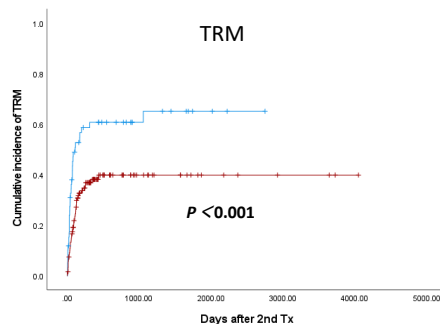
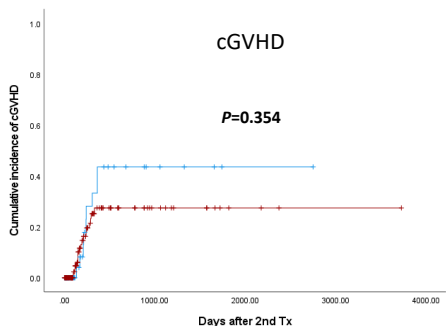
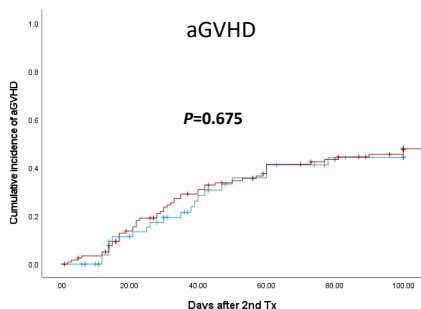
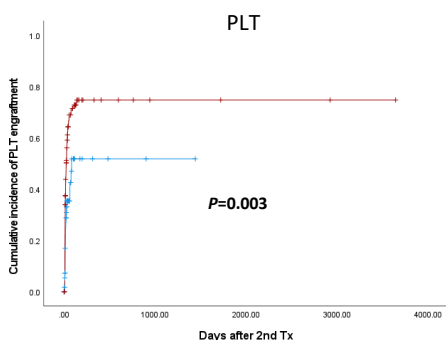
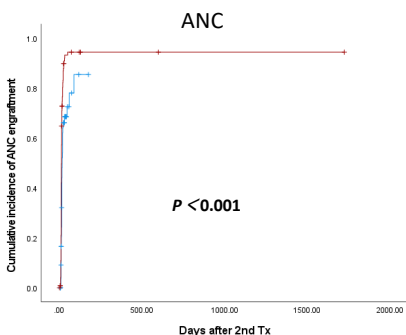
**Supplementary Figure 8. Comparison of 2nd transplant outcomes in patients who used the different or the same donor and received grafts from HIDs for both transplantations.**

Red line: using a different donor; blue line: using the same donor.

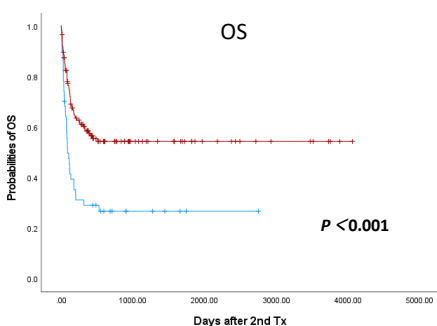
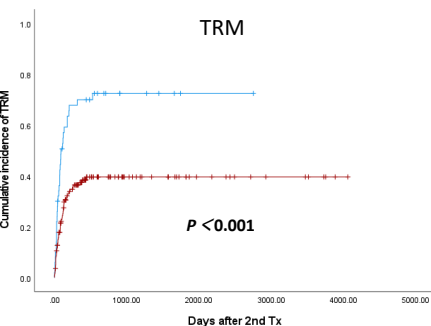
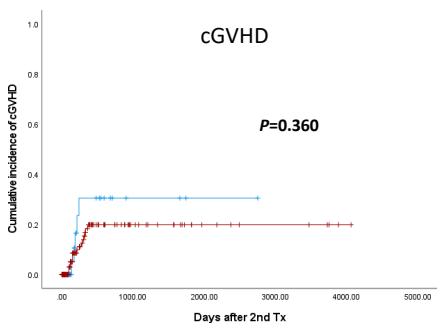
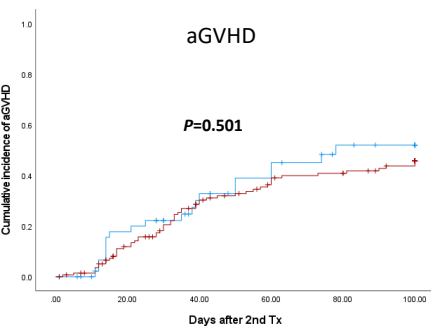
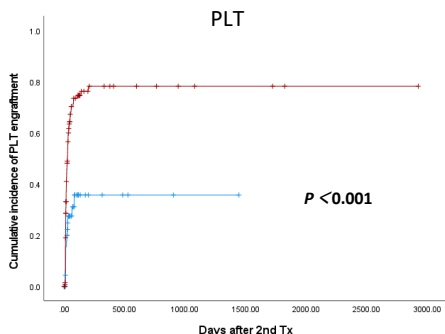
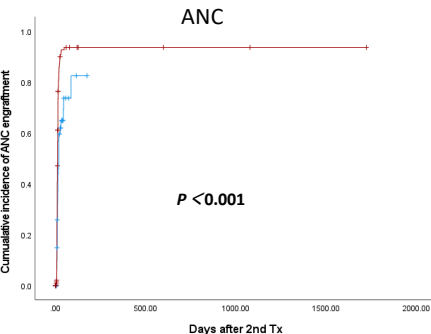


**Supplementary Figure 9. Comparison of 2nd transplant outcomes in AA patients who used the different or the same donor.**

Red line: using a different donor; blue line: using the same donor.

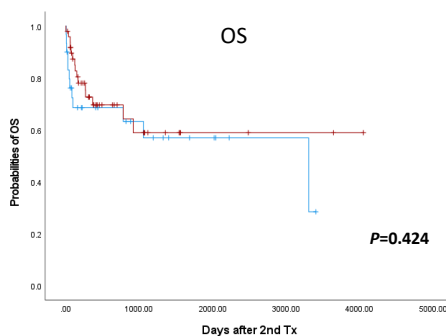
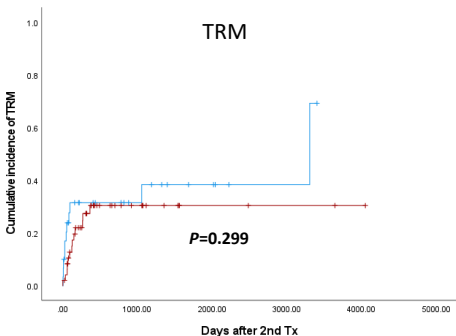
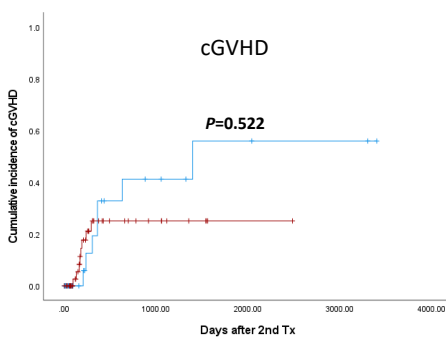
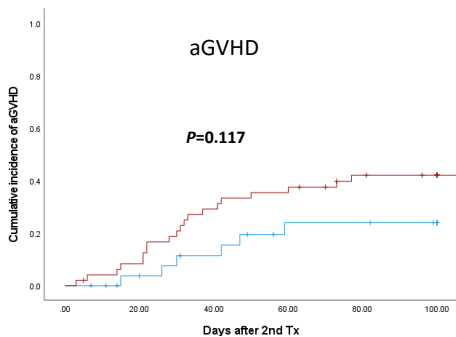
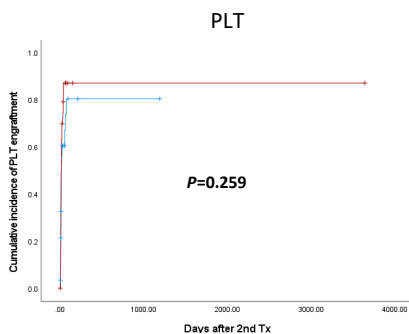
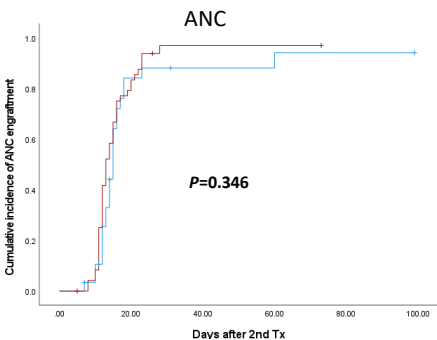


**Supplementary Figure 10. Comparison of 2nd transplant outcomes in patients with hematopoietic malignancies who used the different or the same donor.**  
 Red line: using a different donor; blue line: using the same donor.



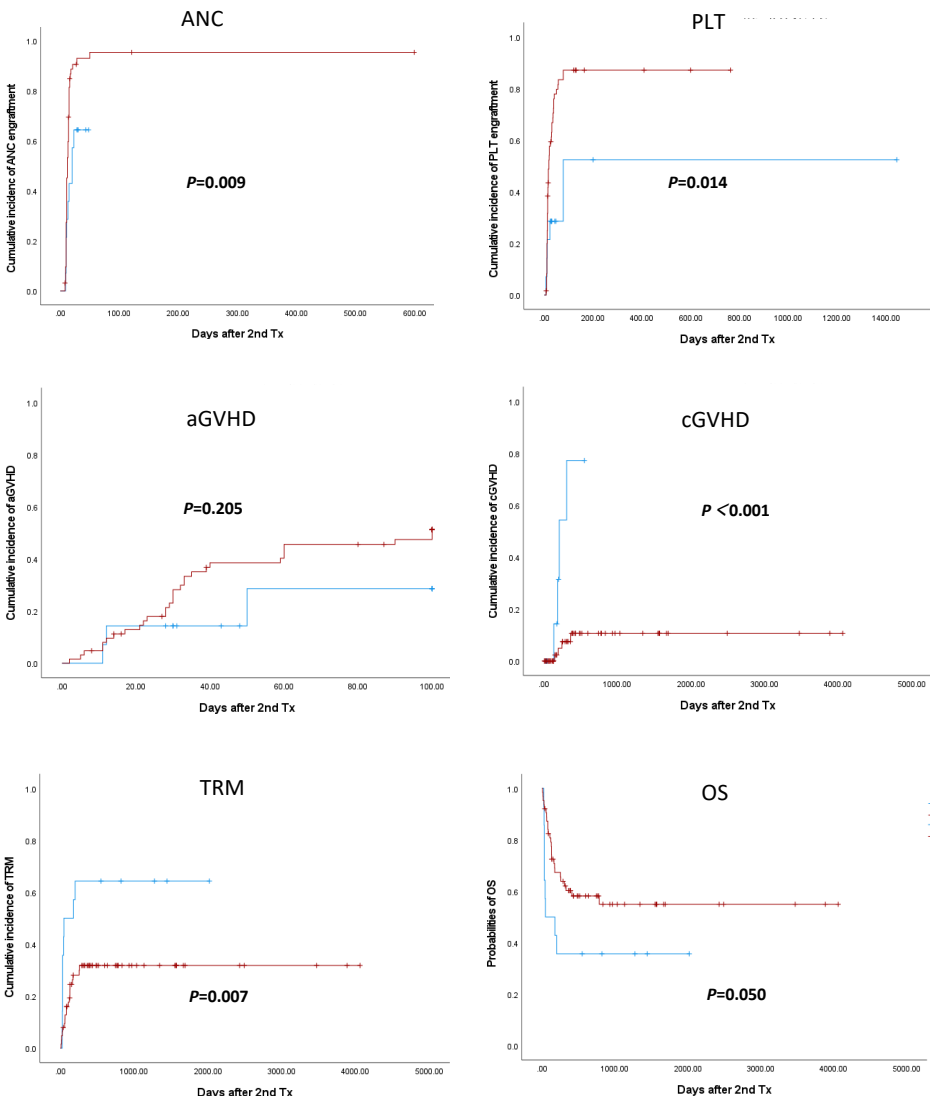
**Supplementary Figure 11. Comparison of 2nd transplant outcomes in patients with primary GF who used the different or the same donor.**

Red line: using a different donor; blue line: using the same donor.



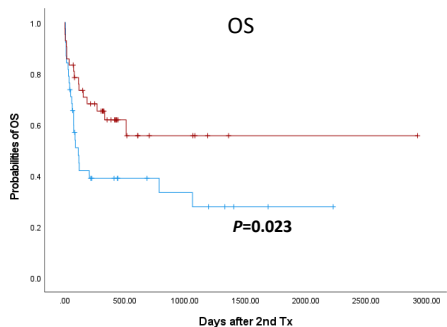
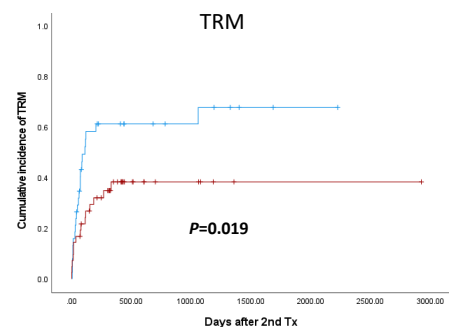
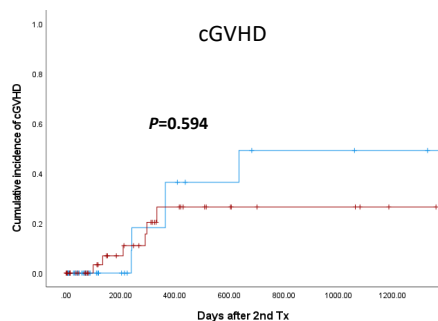
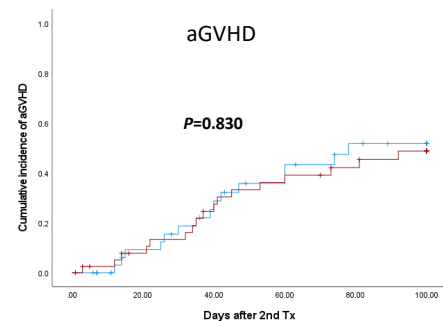
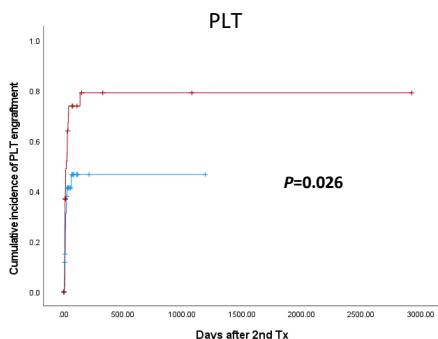
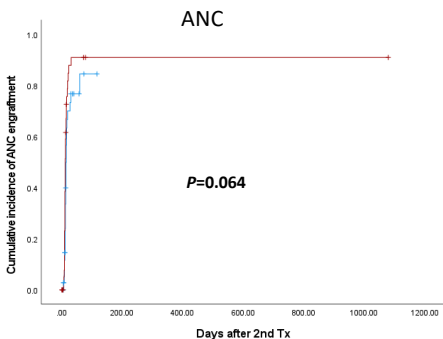
**Supplementary Figure 12. Comparison of 2nd transplant outcomes in patients with secondary GF who used the different or the same donor.**

Red line: using a different donor; blue line: using the same donor.



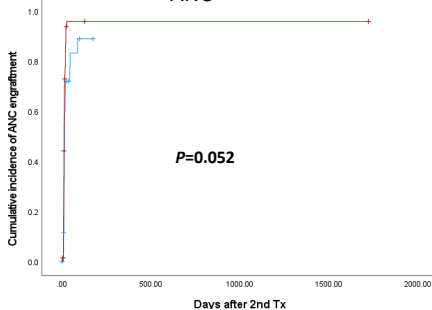
**Supplementary Figure 13. Comparison of 2nd transplant outcomes in patients with full recipient chimerism who used the different or the same donor.**

Red line: using a different donor; blue line: using the same donor.

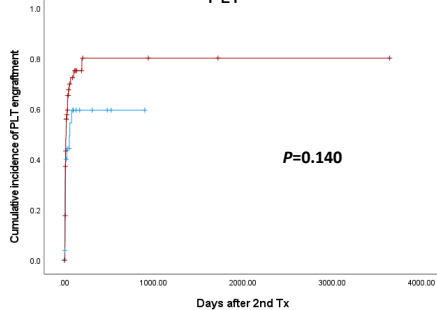


**Supplementary Figure 14. Comparison of 2nd transplant outcomes in patients with full donor chimerism who used the different or the same donor.**  
Red line: using a different donor; blue line: using the same donor.

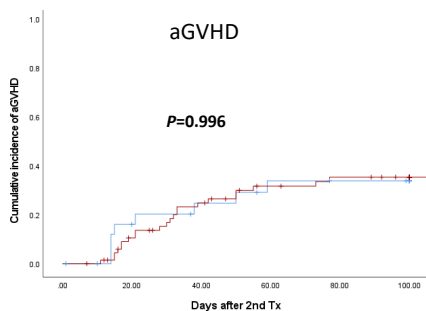
ANC



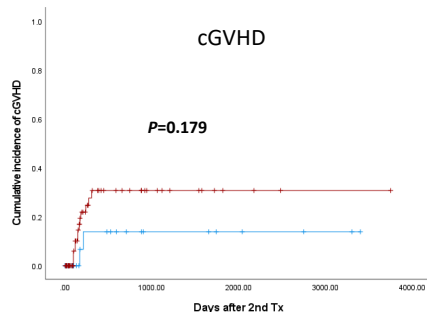
PLT



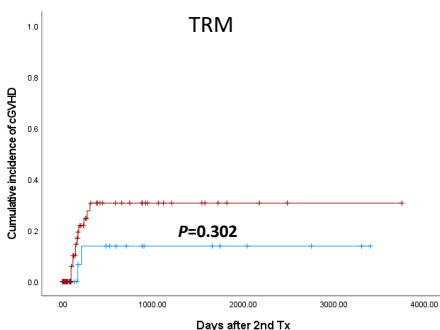
aGVHD



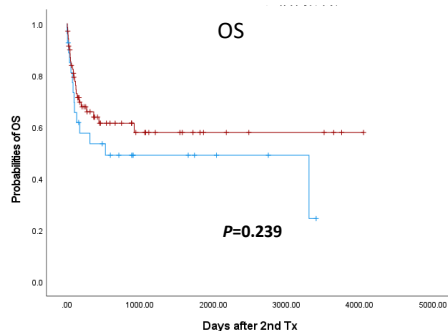
cGVHD



TRM



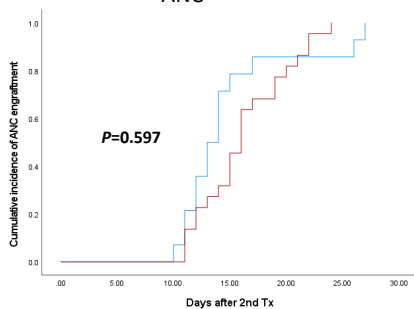
OS



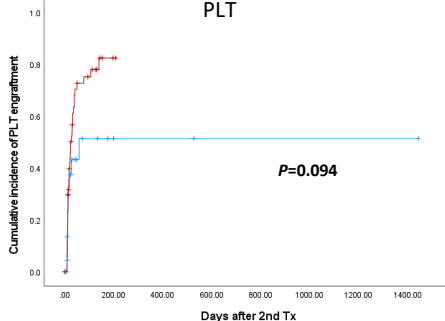
**Supplementary Figure 15. Comparison of 2nd transplant outcomes in patients with mixed chimerism who used the different or the same donor.**

Red line: using a different donor; blue line: using the same donor.

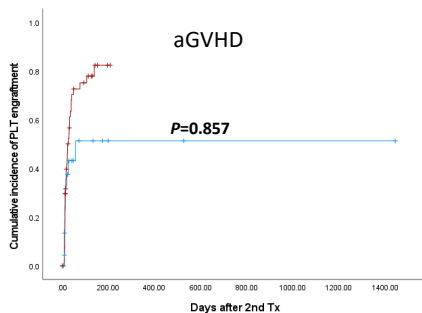
ANC



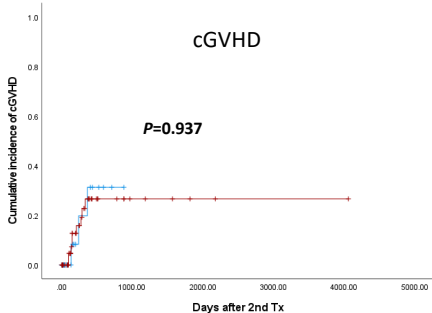
PLT



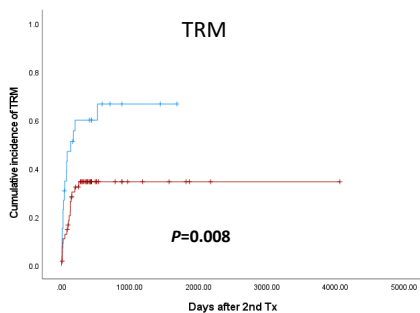
aGVHD



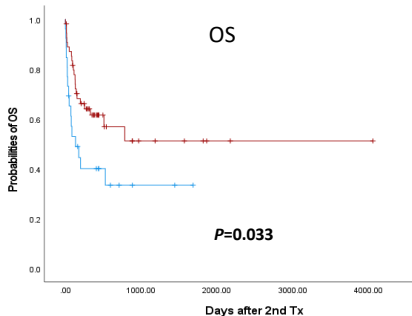
cGVHD



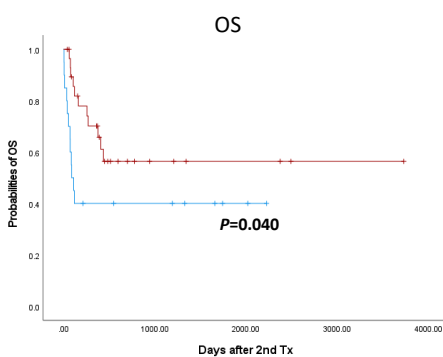
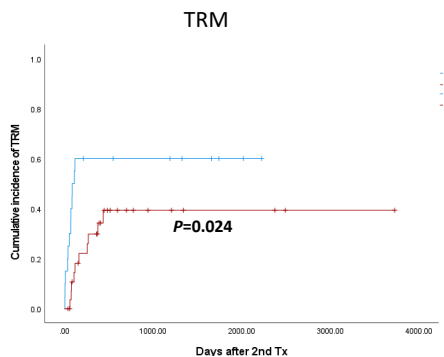
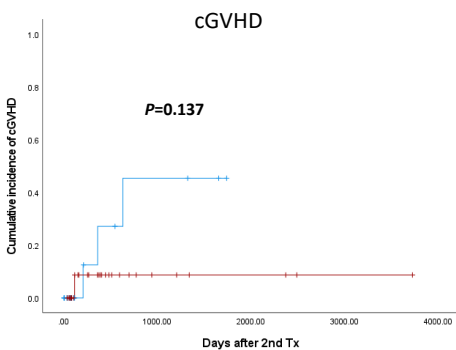
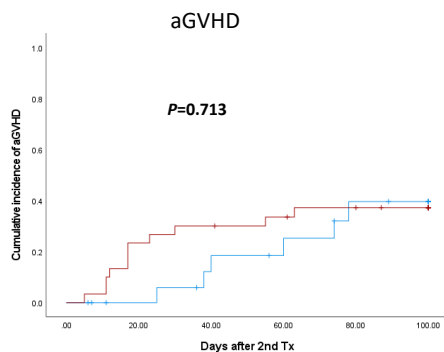
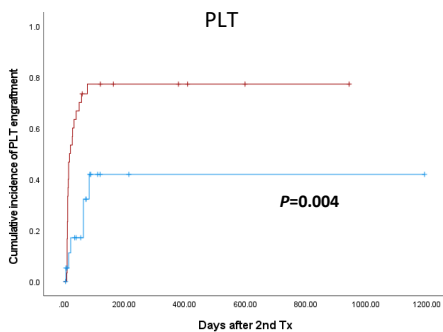
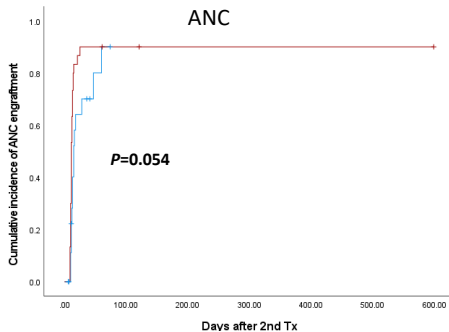
TRM



OS



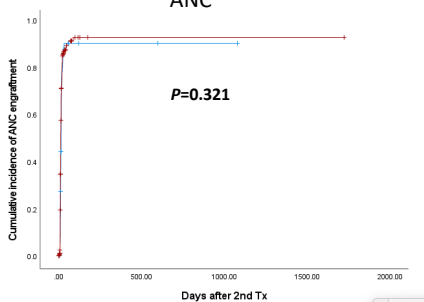
**Supplementary Figure 16. Comparison of 2nd transplant outcomes in patients receiving FC as conditioning regimen who used the different or the same donor. Red line: using a different donor; blue line: using the same donor.**



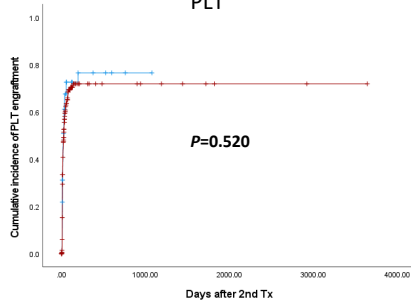
**Supplementary Figure 17. Comparison of 2nd transplant outcomes in patients receiving TBI-based conditioning regimen who used the different or the same donor.**

Red line: using a different donor; blue line: using the same donor.

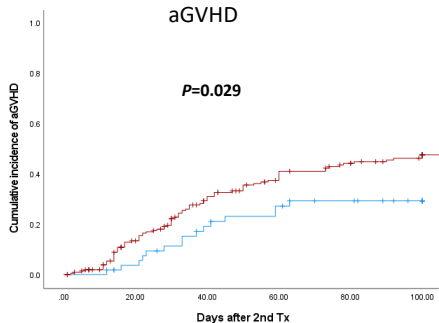
ANC



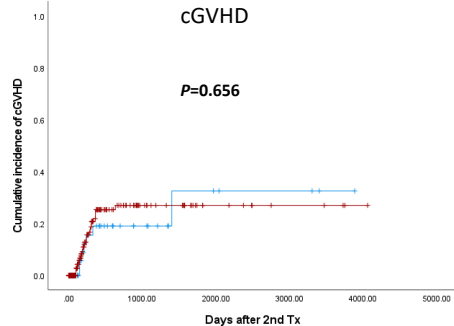
PLT



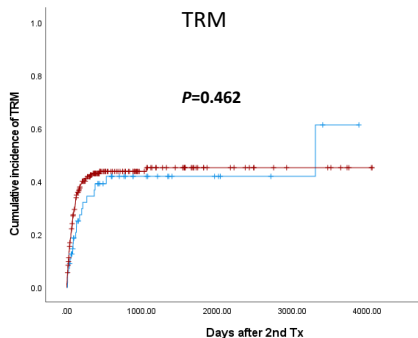
aGVHD



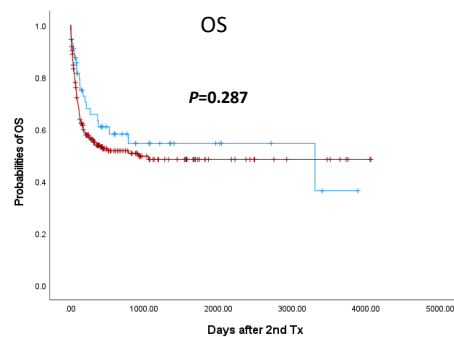
cGVHD



TRM



OS



**Supplementary Figure 18. Outcomes of 2nd transplantation in patients receiving grafts from haploidentical donors and other donors for the 2nd transplantation.**

Red line: using haploidentical donors; blue line: using other donors.

| Cause                            | All patients (n=272) |
|----------------------------------|----------------------|
| Death by Infection               | 65                   |
| Death by Multi-organ dysfunction | 14                   |
| Death by GVHD                    | 11                   |
| Death by Relapse                 | 11                   |
| Death by Hemorrhage              | 9                    |
| Death by Graft failure           | 7                    |
| Death by TMA                     | 6                    |

**Supplementary Table 1. Causes of Death.**

GVHD, graft versus host disease; TMA, thrombotic microangiopathy.

| Donor of Tx1 to Tx2 | Number |
|---------------------|--------|
| Haplo-Haplo         | 66     |
| CB-Haplo            | 59     |
| URD-Haplo           | 17     |
| CB-CB               | 14     |
| Haplo-URD           | 10     |
| MRD-Haplo           | 9      |
| CB-MRD              | 4      |
| CB-URD              | 4      |
| Haplo-CB            | 4      |
| Haplo-MRD           | 2      |
| MRD-MRD             | 1      |
| MRD-URD             | 1      |
| URD-URD             | 1      |

**Supplementary Table 2. Donors of the first and the second transplantations.**

| Variables                                                                  | Outcomes | ANC Engraftment |        |              |       | Platelet Engraftment |        |              |       | aGVHD      |       |              |   | cGVHD      |       |              |   | TRM        |        |              |       | OS    |        |  |  |
|----------------------------------------------------------------------------|----------|-----------------|--------|--------------|-------|----------------------|--------|--------------|-------|------------|-------|--------------|---|------------|-------|--------------|---|------------|--------|--------------|-------|-------|--------|--|--|
|                                                                            |          | Univariate      |        | Multivariate |       | Univariate           |        | Multivariate |       | Univariate |       | Multivariate |   | Univariate |       | Multivariate |   | Univariate |        | Multivariate |       |       |        |  |  |
|                                                                            |          | HR              | P      | HR           | P     | HR                   | P      | HR           | P     | HR         | P     | HR           | P | HR         | P     | HR           | P | HR         | P      | HR           | P     | HR    | P      |  |  |
| Recipient Gender (Male vs Female)                                          |          | 1.101           | 0.548  |              |       | 0.933                | 0.715  |              |       | 0.862      | 0.522 |              |   | 1.307      | 0.471 |              |   | 1.214      | 0.394  |              |       | 1.233 | 0.335  |  |  |
| Recipient Age (<Median vs ≥Median)                                         |          | 1.038           | 0.817  |              |       | 0.766                | 0.156  |              |       | 0.956      | 0.843 |              |   | 1.771      | 0.128 |              |   | 0.662      | 0.069  |              |       | 0.636 | 0.037  |  |  |
| Disease (AA vs Other)                                                      |          | 0.770           | 0.132  |              |       | 0.704                | 0.075  |              |       | 1.135      | 0.622 |              |   | 0.357      | 0.026 |              |   | 0.622      | 0.072  |              |       | 0.531 | 0.015  |  |  |
| 1st Donor Type                                                             |          |                 |        |              |       |                      |        |              |       |            |       |              |   |            |       |              |   |            |        |              |       |       |        |  |  |
| MRD                                                                        |          | 1.000           |        |              |       | 1.000                |        |              |       | 1.000      |       |              |   | 1.000      |       |              |   | 1.000      |        | 1.000        |       | 1.000 |        |  |  |
| URD                                                                        |          | 1.058           | 0.865  |              |       | 1.577                | 0.213  |              |       | 3.171      | 0.039 |              |   | 0.573      | 0.495 |              |   | 2.077      | 0.147  | 3.841        | 0.018 | 2.072 | 0.125  |  |  |
| Haplo                                                                      |          | 1.675           | 0.025  |              |       | 2.096                | 0.003  |              |       | 2.923      | 0.021 |              |   | 1.015      | 0.975 |              |   | 2.071      | 0.068  | 1.787        | 0.177 | 2.047 | 0.056  |  |  |
| GF Type (Primary vs Secondary)                                             |          | 1.231           | 0.201  |              |       | 2.009                | <0.001 |              |       | 0.644      | 0.069 |              |   | 1.153      | 0.701 |              |   | 1.908      | 0.009  |              |       | 1.859 | 0.008  |  |  |
| Chimerism                                                                  |          |                 |        |              |       |                      |        |              |       |            |       |              |   |            |       |              |   |            |        |              |       |       |        |  |  |
| Full donor                                                                 |          | 1.000           |        |              |       | 1.000                |        |              |       | 1.000      |       |              |   | 1.000      |       |              |   | 1.000      |        |              |       | 1.000 |        |  |  |
| Mixed                                                                      |          | 1.091           | 0.639  |              |       | 0.911                | 0.674  |              |       | 0.769      | 0.334 |              |   | 0.482      | 0.101 |              |   | 0.629      | 0.075  |              |       | 0.615 | 0.054  |  |  |
| Full recipient                                                             |          | 1.001           | 0.997  |              |       | 0.816                | 0.427  |              |       | 1.153      | 0.635 |              |   | 0.766      | 0.578 |              |   | 0.759      | 0.360  |              |       | 0.850 | 0.561  |  |  |
| Time from 1st Tx to 2nd Tx (<Median vs ≥Median)                            |          | 1.243           | 0.177  |              |       | 1.715                | 0.005  |              |       | 0.691      | 0.113 |              |   | 0.896      | 0.768 |              |   | 1.244      | 0.333  |              |       | 1.222 | 0.350  |  |  |
| DSA prior to 2nd Tx (Neg. vs Pos.)                                         |          | 0.501           | 0.016  |              |       | 0.497                | 0.042  |              |       | 0.698      | 0.415 |              |   | 0.640      | 0.552 |              |   | 0.815      | 0.633  |              |       | 0.825 | 0.630  |  |  |
| Disease Status prior to 2nd Tx (Relapse vs CR)                             |          | 1.086           | 0.810  |              |       | 1.321                | 0.497  |              |       | 0.600      | 0.403 |              |   | 0.037      | 0.312 |              |   | 1.112      | 0.843  |              |       | 1.046 | 0.927  |  |  |
| Change donor (No vs Yes)                                                   |          | 1.815           | <0.001 | 1.583        | 0.034 | 2.183                | <0.001 | 1.905        | 0.035 | 1.287      | 0.298 |              |   | 0.708      | 0.360 |              |   | 2.353      | <0.001 | 2.336        | 0.008 | 2.088 | <0.001 |  |  |
| 2nd Donor Age (<Median vs ≥Median)                                         |          | 0.860           | 0.364  |              |       | 0.768                | 0.170  |              |       | 1.139      | 0.588 |              |   | 1.008      | 0.983 |              |   | 0.762      | 0.244  |              |       | 0.737 | 0.171  |  |  |
| 2nd Donor Gender (Male vs Female)                                          |          | 1.097           | 0.568  |              |       | 0.985                | 0.936  |              |       | 0.920      | 0.719 |              |   | 0.795      | 0.540 |              |   | 0.919      | 0.796  |              |       | 0.925 | 0.717  |  |  |
| 2nd Donor Type                                                             |          |                 |        |              |       |                      |        |              |       |            |       |              |   |            |       |              |   |            |        |              |       |       |        |  |  |
| MRD                                                                        |          | 1.000           |        |              |       | 1.000                |        |              |       | 1.000      |       |              |   | 1.000      |       |              |   | 1.000      |        |              |       | 1.000 |        |  |  |
| URD                                                                        |          | 0.897           | 0.785  |              |       | 0.982                | 0.966  |              |       | 9.347      | 0.041 |              |   | 0.565      | 0.622 |              |   | 0.717      | 0.630  |              |       | 0.636 | 0.505  |  |  |
| CB                                                                         |          | 0.475           | 0.152  |              |       | 4.831                | 0.038  |              |       | 20.06      | 0.007 |              |   | 0.100      | 0.978 |              |   | 1.535      | 0.535  |              |       | 1.392 | 0.626  |  |  |
| Haplo                                                                      |          | 0.674           | 0.151  |              |       | 1.852                | 0.039  |              |       | 10.23      | 0.021 |              |   | 1.213      | 0.752 |              |   | 1.218      | 0.621  |              |       | 1.195 | 0.632  |  |  |
| ABO of 2nd Tx (Matched/Minor mismatched vs Major/Bidirectional mismatched) |          | 0.651           | 0.228  |              |       | 0.486                | 0.219  |              |       | 0.716      | 0.326 |              |   | 1.112      | 0.694 |              |   | 0.441      | 0.278  |              |       | 0.658 | 0.439  |  |  |
| Conditioning Regimen of 2nd Tx (FC vs Other)                               |          | 0.800           | 0.183  |              |       | 1.193                | 0.374  |              |       | 1.107      | 0.944 |              |   | 0.812      | 0.593 |              |   | 1.037      | 0.676  |              |       | 1.125 | 0.598  |  |  |
| Graft Source of 2nd Tx                                                     |          |                 |        |              |       |                      |        |              |       |            |       |              |   |            |       |              |   |            |        |              |       |       |        |  |  |
| PB+BM                                                                      |          | 1.000           |        | 1.000        |       | 1.000                |        |              |       | 1.000      |       |              |   | 1.000      |       |              |   | 1.000      |        |              |       | 1.000 |        |  |  |
| PB                                                                         |          | 1.855           | <0.001 | 1.538        | 0.031 | 1.531                | 0.025  |              |       | 0.648      | 0.069 |              |   | 1.176      | 0.664 |              |   | 1.567      | 0.057  |              |       | 1.440 | 0.101  |  |  |
| CB                                                                         |          | 2.257           | 0.057  | 2.410        | 0.055 | 4.219                | 0.046  |              |       | 2.071      | 0.127 |              |   | 0.100      | 0.978 |              |   | 2.113      | 0.161  |              |       | 1.867 | 0.238  |  |  |
| Infused MNCs (<Median vs ≥Median)                                          |          | 1.414           | 0.032  |              |       | 1.677                | 0.007  |              |       | 0.983      | 0.940 |              |   | 1.434      | 0.353 |              |   | 1.656      | 0.027  |              |       | 1.517 | 0.053  |  |  |
| Infused CD34 cells (<Median vs ≥Median)                                    |          | 1.361           | 0.074  |              |       | 1.879                | 0.002  |              |       | 0.712      | 0.175 |              |   | 1.546      | 0.286 |              |   | 1.462      | 0.138  |              |       | 1.634 | 0.046  |  |  |
| GVHD Prophylaxis for 2nd Tx (Other vs Intensified)                         |          | 1.732           | 0.004  |              |       | 2.265                | 0.001  |              |       | 1.108      | 0.659 |              |   | 0.597      | 0.178 |              |   | 2.203      | <0.001 |              |       | 2.110 | <0.001 |  |  |

**Supplementary Table 3. Univariate and multivariate analysis for 2nd transplant outcomes in patients grafted with MRDs, URDs, and HDs in the 1st transplantation.**

Abbreviations: AA, aplastic anemia; GF, graft failure; MRD, matched related donor; URD, unrelated donor; CB, cord blood; Haplo, haploidentical transplantation; Tx, transplantation; DSA, Donor specific antibody; CR, complete remission; FC, fludarabine/cyclophosphamide; BM, bone marrow; PB, peripheral blood; MNCs, mononucleated cells; GVHD, graft versus host disease.

| Variables                                                                  | Outcomes |       | ANC Engraftment |        |              |       | Platelet Engraftment |        |              |       | aGVHD      |       |              |   | cGVHD      |       |              |   | TRM        |        |              |       | OS         |        |              |       |
|----------------------------------------------------------------------------|----------|-------|-----------------|--------|--------------|-------|----------------------|--------|--------------|-------|------------|-------|--------------|---|------------|-------|--------------|---|------------|--------|--------------|-------|------------|--------|--------------|-------|
|                                                                            |          |       | Univariate      |        | Multivariate |       | Univariate           |        | Multivariate |       | Univariate |       | Multivariate |   | Univariate |       | Multivariate |   | Univariate |        | Multivariate |       | Univariate |        | Multivariate |       |
|                                                                            |          |       | HR              | P      | HR           | P     | HR                   | P      | HR           | P     | HR         | P     | HR           | P | HR         | P     | HR           | P | HR         | P      | HR           | P     | HR         | P      | HR           | P     |
| Recipient Gender (Male vs Female)                                          |          |       | 1.199           | 0.321  |              |       | 1.032                | 0.887  |              |       | 0.913      | 0.721 |              |   | 1.606      | 0.292 |              |   | 1.231      | 0.406  |              |       | 1.218      | 0.409  |              |       |
| Recipient Age (<Median vs ≥Median)                                         |          |       | 1.009           | 0.963  |              |       | 0.698                | 0.105  |              |       | 1.249      | 0.386 |              |   | 1.756      | 0.200 |              |   | 0.554      | 0.023  | 0.508        | 0.034 | 0.566      | 0.021  |              |       |
| Disease (AA vs Other)                                                      |          |       | 0.828           | 0.377  |              |       | 0.866                | 0.570  |              |       | 1.000      | 1.000 |              |   | 3.300      | 0.057 |              |   | 0.585      | 0.106  |              |       | 0.506      | 0.039  |              |       |
| GF Type (Primary vs Secondary)                                             |          |       | 1.236           | 0.270  |              |       | 1.665                | 0.025  | 3.445        | 0.010 | 0.731      | 0.262 |              |   | 0.811      | 0.650 |              |   | 1.919      | 0.027  |              |       | 1.859      | 0.030  |              |       |
| Chimerism                                                                  |          |       |                 |        |              |       |                      |        |              |       |            |       |              |   |            |       |              |   |            |        |              |       |            |        |              |       |
| Full donor                                                                 |          |       | 1.000           |        |              |       | 1.000                |        |              |       | 1.000      |       |              |   | 1.000      |       |              |   | 1.000      |        |              |       | 1.000      |        |              |       |
| Mixed                                                                      |          |       | 0.861           | 0.482  |              |       | 1.075                | 0.782  |              |       | 0.742      | 0.332 |              |   | 0.599      | 0.332 |              |   | 0.700      | 0.231  |              |       | 0.723      | 0.259  |              |       |
| Full recipient                                                             |          |       | 0.801           | 0.376  |              |       | 1.224                | 0.488  |              |       | 1.168      | 0.650 |              |   | 0.869      | 0.801 |              |   | 0.924      | 0.807  |              |       | 1.032      | 0.918  |              |       |
| Time from 1st Tx to 2nd Tx (<Median vs ≥Median)                            |          |       | 1.252           | 0.221  |              |       | 1.256                | 0.307  |              |       | 0.621      | 0.067 |              |   | 0.847      | 0.704 |              |   | 1.164      | 0.544  |              |       | 0.882      | 0.602  |              |       |
| DSA prior to 2nd Tx (Neg. vs Pos.)                                         |          |       | 0.547           | 0.039  |              |       | 0.569                | 0.109  |              |       | 0.662      | 0.361 |              |   | 0.559      | 0.446 |              |   | 0.893      | 0.798  |              |       | 0.909      | 0.817  |              |       |
| Disease Status prior to 2nd Tx (Relapse vs CR)                             |          |       | 1.074           | 0.854  |              |       | 2.580                | 0.046  |              |       | 0.391      | 0.205 |              |   | 0.035      | 0.378 |              |   | 1.845      | 0.411  |              |       | 1.399      | 0.588  |              |       |
| Change donor (No vs Yes)                                                   |          | 1.703 | 0.025           |        |              |       | 2.743                | <0.001 | 4.751        | 0.013 | 1.092      | 0.736 |              |   | 0.631      | 0.298 |              |   | 2.801      | <0.001 | 2.075        | 0.047 | 2.387      | <0.001 |              |       |
| 2nd Donor Age (<Median vs ≥Median)                                         |          |       | 0.952           | 0.799  |              |       | 1.045                | 0.849  |              |       | 1.194      | 0.512 |              |   | 0.650      | 0.328 |              |   | 0.945      | 0.830  |              |       | 0.901      | 0.677  |              |       |
| 2nd Donor Gender (Male vs Female)                                          |          |       | 1.252           | 0.227  |              |       | 1.296                | 0.248  |              |       | 0.852      | 0.535 |              |   | 0.654      | 0.322 |              |   | 1.092      | 0.729  |              |       | 1.101      | 0.689  |              |       |
| 2nd Donor Type                                                             |          |       |                 |        |              |       |                      |        |              |       |            |       |              |   |            |       |              |   |            |        |              |       |            |        |              |       |
| MRD                                                                        |          |       | 1.000           |        |              |       | 1.000                |        |              |       | 1.000      |       |              |   | 1.000      |       |              |   | 1.000      |        |              |       | 1.000      |        |              |       |
| URD                                                                        |          |       | 1.919           | 0.396  |              |       | 1.477                | 0.622  |              |       | 5.665      | 0.914 |              |   | 0.517      | 0.520 |              |   | 0.164      | 0.202  |              |       | 0.155      | 0.188  |              |       |
| CB                                                                         |          |       | 3.497           | 0.138  |              |       | 9.009                | 0.029  |              |       | 1.573      | 0.904 |              |   | 3.862      | 0.985 |              |   | 0.839      | 0.890  |              |       | 0.804      | 0.851  |              |       |
| Haplo                                                                      |          |       | 2.695           | 0.169  |              |       | 3.676                | 0.072  |              |       | 8.562      | 0.910 |              |   | 2.465      | 0.813 |              |   | 0.742      | 0.768  |              |       | 0.793      | 0.767  |              |       |
| ABO of 2nd Tx (Matched/Minor mismatched vs Major/Bidirectional mismatched) |          |       | 0.802           | 0.413  |              |       | 0.644                | 0.123  |              |       | 0.903      | 0.697 |              |   | 1.125      | 0.881 |              |   | 0.471      | 0.237  |              |       | 0.548      | 0.336  |              |       |
| Conditioning Regimen of 2nd Tx (FC vs Other)                               |          |       | 0.769           | 0.165  |              |       | 0.993                | 0.976  |              |       | 0.939      | 0.813 |              |   | 0.509      | 0.136 |              |   | 0.945      | 0.826  |              |       | 0.996      | 0.986  |              |       |
| Graft Source of 2nd Tx                                                     |          |       |                 |        |              |       |                      |        |              |       |            |       |              |   |            |       |              |   |            |        |              |       |            |        |              |       |
| PB+BM                                                                      |          |       | 1.000           |        |              |       | 1.000                |        |              |       | 1.000      |       |              |   | 1.000      |       |              |   | 1.000      |        |              |       | 1.000      |        |              |       |
| PB                                                                         |          |       | 2.198           | <0.001 |              |       | 1.730                | 0.015  |              |       | 0.691      | 0.164 |              |   | 0.990      | 0.982 |              |   | 1.786      | 0.033  |              |       | 1.604      | 0.064  |              |       |
| CB                                                                         |          |       | 2.299           | 0.055  | 1.653        | 0.062 | 1.724                | 0.242  |              |       | 1.844      | 0.208 |              |   | 3.862      | 0.985 |              |   | 2.090      | 0.177  |              |       | 1.816      | 0.269  |              |       |
| Infused MNCs (<Median vs ≥Median)                                          |          |       | 1.681           | 0.005  | 3.597        | 0.018 | 2.154                | <0.001 |              |       | 1.004      | 0.987 |              |   | 1.642      | 0.292 |              |   | 1.821      | 0.019  |              |       | 1.555      | 0.068  |              |       |
| Infused CD34 cells (<Median vs ≥Median)                                    |          |       | 1.319           | 0.158  |              |       | 2.204                | 0.001  |              |       | 0.886      | 0.664 |              |   | 2.111      | 0.131 |              |   | 2.208      | 0.008  |              |       | 2.415      | 0.002  | 2.208        | 0.017 |
| GVHD Prophylaxis for 2nd Tx (Other vs Intensified)                         |          |       | 1.230           | 0.270  |              |       | 1.885                | 0.004  |              |       | 1.059      | 0.827 |              |   | 2.724      | 0.178 |              |   | 2.469      | <0.001 |              |       | 2.262      | <0.001 |              |       |

Supplementary Table 4. Univariate and multivariate analysis for 2nd transplant outcomes in patients grafted from HIDs in the 1st transplantation.

Abbreviations: AA, aplastic anemia; GF, graft failure; MRD, matched related donor; URD, unrelated donor; CB, cord blood; Haplo, haploidentical transplantation; Tx, transplantation; DSA, Donor specific antibody; CR, complete remission; FC, fludarabine/cyclophosphamide; BM, bone marrow; PB, peripheral blood; MNCs, mononucleated cells; GVHD, graft versus host disease.

| Variables                                                                  | Outcomes |  | ANC Engraftment |       |              |       | Platelet Engraftment |       |              |       | aGVHD      |       |              |   | cGVHD      |       |              |   | OS         |       |              |       |
|----------------------------------------------------------------------------|----------|--|-----------------|-------|--------------|-------|----------------------|-------|--------------|-------|------------|-------|--------------|---|------------|-------|--------------|---|------------|-------|--------------|-------|
|                                                                            |          |  | Univariate      |       | Multivariate |       | Univariate           |       | Multivariate |       | Univariate |       | Multivariate |   | Univariate |       | Multivariate |   | Univariate |       | Multivariate |       |
|                                                                            |          |  | HR              | P     | HR           | P     | HR                   | P     | HR           | P     | HR         | P     | HR           | P | HR         | P     | HR           | P | HR         | P     | HR           | P     |
| Recipient Gender (Male vs Female)                                          |          |  | 1.230           | 0.394 |              |       | 0.929                | 0.783 |              |       | 1.258      | 0.548 |              |   | 0.023      | 0.185 |              |   | 1.008      | 0.984 |              |       |
| Recipient Age (<Median vs ≥Median)                                         |          |  | 0.883           | 0.590 |              |       | 0.860                | 0.554 |              |       | 0.567      | 0.134 |              |   | 1.398      | 0.618 |              |   | 0.539      | 0.114 |              |       |
| 1st Donor Type                                                             |          |  |                 |       |              |       |                      |       |              |       |            |       |              |   |            |       |              |   |            |       |              |       |
| MRD                                                                        |          |  | 1.000           |       |              |       | 1.000                |       |              |       | 1.000      |       |              |   | 1.000      |       |              |   | 1.000      |       |              |       |
| URD                                                                        |          |  | 1.302           | 0.565 |              |       | 1.517                | 0.394 |              |       | 0.503      | 0.368 |              |   | 0.959      | 0.973 |              |   | 1.578      | 0.519 |              |       |
| CB                                                                         |          |  | 1.414           | 0.324 |              |       | 1.786                | 0.117 |              |       | 0.876      | 0.844 |              |   | 0.812      | 0.820 |              |   | 1.184      | 0.776 |              |       |
| Haplo                                                                      |          |  | 7.518           | 0.591 |              |       | 2.421                | 0.020 |              |       | 0.437      | 0.193 |              |   | 0.716      | 0.716 |              |   | 1.217      | 0.737 |              |       |
| GF Type (Primary vs Secondary)                                             |          |  | 0.985           | 0.949 |              |       | 1.179                | 0.535 |              |       | 0.560      | 0.182 |              |   | 1.472      | 0.567 |              |   | 1.131      | 0.759 |              |       |
| Chimerism                                                                  |          |  |                 |       |              |       |                      |       |              |       |            |       |              |   |            |       |              |   |            |       |              |       |
| Full donor                                                                 |          |  | 1.000           |       |              |       | 1.000                |       |              |       | 1.000      |       |              |   | 1.000      |       |              |   | 1.000      |       | 1.000        |       |
| Mixed                                                                      |          |  | 0.960           | 0.896 |              |       | 0.624                | 0.187 |              |       | 1.845      | 0.183 |              |   | 1.210      | 0.827 |              |   | 0.946      | 0.899 | 0.951        | 0.922 |
| Full recipient                                                             |          |  | 0.664           | 0.204 |              |       | 0.408                | 0.015 |              |       | 1.721      | 0.253 |              |   | 0.476      | 0.462 |              |   | 0.266      | 0.028 | 0.185        | 0.042 |
| Time from 1st Tx to 2nd Tx (<Median vs ≥Median)                            |          |  | 0.717           | 0.149 |              |       | 0.856                | 0.541 |              |       | 0.614      | 0.192 |              |   | 1.768      | 0.421 |              |   | 1.104      | 0.793 |              |       |
| DSA prior to 2nd Tx (Neg. vs Pos.)                                         |          |  | 0.556           | 0.227 |              |       | 0.377                | 0.182 |              |       | 0.643      | 0.667 |              |   | 0.045      | 0.688 |              |   | 0.368      | 0.199 |              |       |
| Change donor (No vs Yes)                                                   |          |  | 1.171           | 0.571 |              |       | 2.091                | 0.034 |              |       | 1.183      | 0.714 |              |   | 0.475      | 0.283 |              |   | 2.273      | 0.032 | 2.500        | 0.047 |
| 2nd Donor Age (<Median vs ≥Median)                                         |          |  | 0.552           | 0.020 | 0.418        | 0.006 | 0.850                | 0.563 |              |       | 1.963      | 0.106 |              |   | 1.074      | 0.919 |              |   | 0.499      | 0.109 |              |       |
| 2nd Donor Gender (Male vs Female)                                          |          |  | 1.140           | 0.584 |              |       | 1.124                | 0.652 |              |       | 0.666      | 0.315 |              |   | 1.085      | 0.904 |              |   | 1.447      | 0.362 |              |       |
| 2nd Donor Type                                                             |          |  |                 |       |              |       |                      |       |              |       |            |       |              |   |            |       |              |   |            |       |              |       |
| MRD                                                                        |          |  | 1.000           |       |              |       | 1.000                |       | 1.000        |       | 1.000      |       |              |   | 1.000      |       |              |   | 1.000      |       |              |       |
| URD                                                                        |          |  | 1.493           | 0.374 |              |       | 0.855                | 0.744 | 1.672        | 0.528 | 0.635      | 0.921 |              |   | 2.800      | 0.405 |              |   | 1.123      | 0.887 |              |       |
| CB                                                                         |          |  | 4.630           | 0.006 |              |       | 5.435                | 0.011 | 9.709        | 0.028 | 1.127      | 0.925 |              |   | 0.200      | 0.989 |              |   | 1.838      | 0.459 |              |       |
| Haplo                                                                      |          |  | 3.636           | 0.693 |              |       | 1.572                | 0.203 | 4.016        | 0.055 | 1.282      | 0.926 |              |   | 1.433      | 0.741 |              |   | 1.374      | 0.609 |              |       |
| ABO of 2nd Tx (Matched/Minor mismatched vs Major/Bidirectional mismatched) |          |  | 0.772           | 0.359 |              |       | 0.407                | 0.218 |              |       | 0.924      | 0.876 |              |   | 1.034      | 0.519 |              |   | 0.312      | 0.227 |              |       |
| Conditioning Regimen of 2nd Tx (FC vs Other)                               |          |  | 0.978           | 0.939 |              |       | 1.443                | 0.290 |              |       | 2.082      | 0.229 |              |   | 2.666      | 0.405 |              |   | 1.316      | 0.549 |              |       |
| Graft Source of 2nd Tx                                                     |          |  |                 |       |              |       |                      |       |              |       |            |       |              |   |            |       |              |   |            |       |              |       |
| PB+BM                                                                      |          |  | 1.000           |       |              |       | 1.000                |       |              |       | 1.000      |       |              |   | 1.000      |       |              |   | 1.000      |       |              |       |
| PB                                                                         |          |  | 1.235           | 0.385 |              |       | 1.385                | 0.230 |              |       | 1.429      | 0.387 |              |   | 2.292      | 0.217 |              |   | 1.175      | 0.685 |              |       |
| CB                                                                         |          |  | 3.663           | 0.007 |              |       | 4.505                | 0.013 |              |       | 0.933      | 0.912 |              |   | 0.200      | 0.989 |              |   | 1.523      | 0.507 |              |       |
| Infused MNCs (<Median vs ≥Median)                                          |          |  | 1.528           | 0.077 |              |       | 1.554                | 0.107 |              |       | 0.878      | 0.732 |              |   | 0.456      | 0.268 |              |   | 1.786      | 0.130 |              |       |
| Infused CD34 cells (<Median vs ≥Median)                                    |          |  | 1.777           | 0.026 |              |       | 1.785                | 0.039 |              |       | 1.423      | 0.374 |              |   | 5.567      | 0.112 |              |   | 2.110      | 0.085 |              |       |
| GVHD Prophylaxis for 2nd Tx (Other vs Intensified)                         |          |  | 1.556           | 0.140 |              |       | 2.723                | 0.010 |              |       | 1.686      | 0.332 |              |   | 1.226      | 0.848 |              |   | 2.070      | 0.083 |              |       |

**Supplementary Table 5. Univariate and multivariate analysis for 2nd transplant outcomes in AA patients.**  
Abbreviations: AA, aplastic anemia; GF, graft failure; MRD, matched related donor; URD, unrelated donor; CB, cord blood; Haplo, haploidentical transplantation; Tx, transplantation; DSA, Donor specific antibody; CR, complete remission; FC, fludarabine/cyclophosphamide; BM, bone marrow; PB, peripheral blood; MNCs, mononucleated cells; GVHD, graft versus host disease.

| Variables                                                                  | Outcomes |  | ANC Engraftment |        |              |       | Platelet Engraftment |        |              |       | aGVHD      |       |              |   | cGVHD      |       |              |   | TRM        |        |              |       | Relapse    |       |              |       | OS         |       |              |       | DFS        |       |              |       |
|----------------------------------------------------------------------------|----------|--|-----------------|--------|--------------|-------|----------------------|--------|--------------|-------|------------|-------|--------------|---|------------|-------|--------------|---|------------|--------|--------------|-------|------------|-------|--------------|-------|------------|-------|--------------|-------|------------|-------|--------------|-------|
|                                                                            |          |  | Univariate      |        | Multivariate |       | Univariate           |        | Multivariate |       | Univariate |       | Multivariate |   | Univariate |       | Multivariate |   | Univariate |        | Multivariate |       | Univariate |       | Multivariate |       | Univariate |       | Multivariate |       | Univariate |       | Multivariate |       |
|                                                                            |          |  | 1.429           | P      | HR           | P     | HR                   | P      | HR           | P     | HR         | P     | HR           | P | HR         | P     | HR           | P | HR         | P      | HR           | P     | HR         | P     | HR           | P     | HR         | P     | HR           | P     | HR         | P     | HR           | P     |
| Recipient Gender (Male vs Female)                                          |          |  | 1.067           | 0.696  |              |       | 0.869                | 0.480  |              |       | 0.736      | 0.200 |              |   | 1.754      | 0.159 |              |   | 1.332      | 0.211  |              |       | 1.429      | 0.502 |              |       | 1.284      | 0.238 |              |       | 1.326      | 0.179 |              |       |
| Recipient Age (<Median vs ≥Median)                                         |          |  | 0.997           | 0.987  |              |       | 0.776                | 0.202  |              |       | 0.859      | 0.519 |              |   | 2.109      | 0.062 |              |   | 0.735      | 0.175  |              |       | 0.815      | 0.693 |              |       | 0.746      | 0.165 |              |       | 0.779      | 0.234 |              |       |
| 1st Donor Type                                                             |          |  |                 |        |              |       |                      |        |              |       |            |       |              |   |            |       |              |   |            |        |              |       |            |       |              |       |            |       |              |       |            |       |              |       |
| MRD                                                                        |          |  | 1.000           |        |              |       | 1.000                |        |              |       | 1.000      |       |              |   | 1.000      |       |              |   | 1.000      |        |              |       | 1.000      |       |              |       | 1.000      |       |              |       | 1.000      |       |              |       |
| URD                                                                        |          |  | 1.212           | 0.710  |              |       | 1.538                | 0.451  |              |       | 4.967      | 0.056 |              |   | 0.451      | 0.476 |              |   | 2.157      | 0.314  |              |       | 1.504      | 0.774 |              |       | 2.036      | 0.290 |              |       | 1.591      | 0.512 |              |       |
| CB                                                                         |          |  | 1.045           | 0.901  |              |       | 1.502                | 0.311  |              |       | 2.903      | 0.154 |              |   | 0.368      | 0.158 |              |   | 1.907      | 0.299  |              |       | 1.819      | 0.585 |              |       | 1.791      | 0.282 |              |       | 1.932      | 0.223 |              |       |
| Haplo                                                                      |          |  | 0.736           | 0.359  |              |       | 1.724                | 0.149  |              |       | 3.421      | 0.089 |              |   | 0.818      | 0.716 |              |   | 2.426      | 0.136  |              |       | 1.442      | 0.731 |              |       | 2.217      | 0.145 |              |       | 2.220      | 0.123 |              |       |
| GF Type (Primary vs Secondary)                                             |          |  | 1.149           | 0.446  |              |       | 2.131                | <0.001 |              |       | 0.812      | 0.437 |              |   | 1.443      | 0.349 |              |   | 1.832      | 0.035  | 2.028        | 0.038 | 0.935      | 0.902 |              |       | 1.770      | 0.030 | 1.727        | 0.045 | 1.580      | 0.070 | 1.818        | 0.050 |
| Chimerism                                                                  |          |  |                 |        |              |       |                      |        |              |       |            |       |              |   |            |       |              |   |            |        |              |       |            |       |              |       |            |       |              |       |            |       |              |       |
| Full donor                                                                 |          |  | 1.000           |        |              |       | 1.000                |        |              |       | 1.000      |       |              |   | 1.000      |       |              |   | 1.000      |        |              |       | 1.000      |       |              | 1.000 |            |       |              | 1.000 |            |       |              |       |
| Mixed                                                                      |          |  | 0.857           | 0.452  |              |       | 0.992                | 0.976  |              |       | 0.794      | 0.451 |              |   | 0.881      | 0.772 |              |   | 0.602      | 0.073  |              |       | 0.519      | 0.391 |              |       | 0.590      | 0.053 |              |       | 0.588      | 0.046 |              |       |
| Full recipient                                                             |          |  | 0.869           | 0.529  |              |       | 0.870                | 0.592  |              |       | 1.319      | 0.348 |              |   | 0.651      | 0.407 |              |   | 0.826      | 0.500  |              |       | 1.958      | 0.286 |              |       | 1.007      | 0.979 |              |       | 0.958      | 0.867 |              |       |
| Time from 1st Tx to 2nd Tx (<Median vs ≥Median)                            |          |  | 1.102           | 0.559  |              |       | 1.602                | 0.019  |              |       | 0.870      | 0.557 |              |   | 1.599      | 0.240 |              |   | 0.881      | 0.574  |              |       | 1.142      | 0.799 |              |       | 1.163      | 0.476 |              |       | 1.117      | 0.595 |              |       |
| DSA prior to 2nd Tx (Neg. vs Pos.)                                         |          |  | 0.667           | 0.166  |              |       | 0.632                | 0.200  |              |       | 0.630      | 0.334 |              |   | 0.680      | 0.610 |              |   | 1.031      | 0.946  |              |       | 0.752      | 0.723 |              |       | 0.903      | 0.796 |              |       | 0.941      | 0.877 |              |       |
| Disease Status prior to 2nd Tx (Relapse vs CR)                             |          |  | 0.968           | 0.924  |              |       | 1.409                | 0.399  |              |       | 0.545      | 0.315 |              |   | 0.037      | 0.272 |              |   | 1.208      | 0.721  |              |       | 1.269      | 0.822 |              |       | 1.212      | 0.685 |              |       | 1.183      | 0.722 |              |       |
| Change donor (No vs Yes)                                                   |          |  | 1.993           | <0.001 |              |       | 1.988                | 0.004  | 1.793        | 0.043 | 1.116      | 0.677 |              |   | 0.687      | 0.358 |              |   | 2.119      | <0.001 |              |       | 0.919      | 0.886 |              |       | 1.808      | 0.006 | 1.684        | 0.030 | 1.808      | 0.003 | 1.709        | 0.040 |
| 2nd Donor Age (<Median vs ≥Median)                                         |          |  | 0.923           | 0.650  |              |       | 0.994                | 0.976  |              |       | 1.107      | 0.686 |              |   | 0.708      | 0.400 |              |   | 1.045      | 0.854  |              |       | 1.397      | 0.548 |              |       | 1.042      | 0.854 |              |       | 1.120      | 0.611 |              |       |
| 2nd Donor Gender (Male vs Female)                                          |          |  | 0.787           | 0.158  |              |       | 0.831                | 0.361  |              |       | 0.981      | 0.937 |              |   | 1.110      | 0.787 |              |   | 0.601      | 0.024  | 0.575        | 0.047 | 1.828      | 0.301 |              |       | 0.666      | 0.053 |              |       | 0.699      | 0.085 |              |       |
| 2nd Donor Type                                                             |          |  |                 |        |              |       |                      |        |              |       |            |       |              |   |            |       |              |   |            |        |              |       |            |       |              |       |            |       |              |       |            |       |              |       |
| MRD                                                                        |          |  | 1.000           |        |              |       | 1.000                |        |              |       | 1.000      |       |              |   | 1.000      |       |              |   | 1.000      |        |              |       | 1.000      |       |              | 1.000 |            |       |              | 1.000 |            |       |              |       |
| URD                                                                        |          |  | 1.009           | 0.987  |              |       | 0.906                | 0.982  |              |       | 1.340      | 0.836 |              |   | 1.001      | 0.979 |              |   | 0.884      | 0.887  |              |       | 1.001      | 0.991 |              |       | 0.784      | 0.772 |              |       | 0.776      | 0.762 |              |       |
| CB                                                                         |          |  | 1.992           | 0.185  |              |       | 2.545                | 0.123  |              |       | 3.675      | 0.245 |              |   | 1.287      | 0.801 |              |   | 1.363      | 0.632  |              |       | 1.003      | 0.986 |              |       | 1.181      | 0.784 |              |       | 1.154      | 0.814 |              |       |
| Haplo                                                                      |          |  | 1.133           | 0.749  |              |       | 1.543                | 0.305  |              |       | 4.934      | 0.113 |              |   | 0.812      | 0.778 |              |   | 1.085      | 0.874  |              |       | 1.116      | 0.916 |              |       | 1.046      | 0.923 |              |       | 1.097      | 0.842 |              |       |
| ABO of 2nd Tx (Matched/Minor mismatched vs Major/Bidirectional mismatched) |          |  | 0.687           | 0.263  |              |       | 0.322                | 0.174  |              |       | 0.952      | 0.913 |              |   | 1.012      | 0.974 |              |   | 0.539      | 0.342  |              |       | 0.883      | 0.824 |              |       | 0.613      | 0.481 |              |       | 0.922      | 0.498 |              |       |
| Conditioning Regimen of 2nd Tx (FC vs Other)                               |          |  | 0.802           | 0.210  |              |       | 0.918                | 0.679  |              |       | 0.850      | 0.515 |              |   | 0.723      | 0.410 |              |   | 0.922      | 0.731  |              |       | 0.923      | 0.885 |              |       | 0.554      | 0.711 |              |       | 0.885      | 0.578 |              |       |
| Graft Source of 2nd Tx                                                     |          |  |                 |        |              |       |                      |        |              |       |            |       |              |   |            |       |              |   |            |        |              |       |            |       |              |       |            |       |              |       |            |       |              |       |
| PB+BM                                                                      |          |  | 1.000           |        | 1.000        |       | 1.000                |        |              |       | 1.000      |       |              |   | 1.000      |       |              |   | 1.000      |        |              |       | 1.000      |       |              | 1.000 |            |       |              | 1.000 |            |       |              |       |
| PB                                                                         |          |  | 2.198           | <0.001 | 1.661        | 0.019 | 1.381                | 0.123  |              |       | 0.754      | 0.259 |              |   | 1.502      | 0.314 |              |   | 1.651      | 0.034  |              |       | 1.052      | 0.924 |              |       | 1.428      | 0.103 |              |       | 1.540      | 0.046 |              |       |
| CB                                                                         |          |  | 2.695           | 0.005  | 2.387        | 0.030 | 2.174                | 0.096  |              |       | 0.885      | 0.796 |              |   | 1.889      | 0.402 |              |   | 1.816      | 0.151  |              |       | 1.112      | 0.986 |              |       | 1.518      | 0.307 |              |       | 1.478      | 0.340 |              |       |
| Infused MNCs (<Median vs ≥Median)                                          |          |  | 1.687           | 0.002  |              |       | 2.204                | <0.001 |              |       | 1.048      | 0.847 |              |   | 1.480      | 0.343 |              |   | 1.908      | 0.006  |              |       | 1.845      | 0.752 |              |       | 1.767      | 0.009 |              |       | 1.724      | 0.012 |              |       |
| Infused CD34 cells (<Median vs ≥Median)                                    |          |  | 1.426           | 0.047  |              |       | 1.738                | 0.009  |              |       | 0.715      | 0.198 |              |   | 1.671      | 0.210 |              |   | 1.522      | 0.099  |              |       | 2.358      | 0.156 |              |       | 1.603      | 0.048 |              |       | 1.637      | 0.036 |              |       |
| GVHD Prophylaxis for 2nd Tx (Other vs Intensified)                         |          |  | 1.829           | 0.002  |              |       | 2.045                | 0.004  |              |       | 1.202      | 0.489 |              |   | 1.788      | 0.284 |              |   | 2.020      | 0.002  |              |       | 1.119      | 0.848 |              |       | 1.845      | 0.005 |              |       | 1.908      | 0.003 |              |       |

Supplementary Table 6. Univariate and multivariate analysis for 2nd transplant outcomes in patients with hematological malignancies.

Abbreviations: GF, graft failure; MRD, matched related donor; URD, unrelated donor; CB, cord blood; Haplo, haploidentical transplantation; Tx, transplantation; DSA, Donor specific antibody; CR, complete remission; FC, fludarabine/cyclophosphamide; BM, bone marrow; PB, peripheral blood; MNCs, mononucleated cells; GVHD, graft versus host disease.

| Variables                                                                  | Outcomes |  | ANC Engraftment |        |              |       | Platelet Engraftment |        |              |       | aGVHD      |       |              |   | cGVHD      |       |              |        | TRM        |   |              |        | OS         |   |              |   |
|----------------------------------------------------------------------------|----------|--|-----------------|--------|--------------|-------|----------------------|--------|--------------|-------|------------|-------|--------------|---|------------|-------|--------------|--------|------------|---|--------------|--------|------------|---|--------------|---|
|                                                                            |          |  | Univariate      |        | Multivariate |       | Univariate           |        | Multivariate |       | Univariate |       | Multivariate |   | Univariate |       | Multivariate |        | Univariate |   | Multivariate |        | Univariate |   | Multivariate |   |
|                                                                            |          |  | HR              | P      | HR           | P     | HR                   | P      | HR           | P     | 1.468      | P     | HR           | P | HR         | P     | HR           | P      | HR         | P | HR           | P      | HR         | P | HR           | P |
| Recipient Gender (Male vs Female)                                          |          |  | 1.169           | 0.330  |              |       | 0.921                | 0.667  |              |       | 1.113      | 0.685 |              |   | 2.023      | 0.129 | 1.468        | 0.079  |            |   | 1.332        | 0.165  |            |   |              |   |
| Recipient Age (<Median vs ≥Median)                                         |          |  | 0.764           | 0.096  |              |       | 0.669                | 0.037  |              |       | 0.882      | 0.634 |              |   | 1.903      | 0.146 | 0.636        | 0.038  |            |   | 0.634        | 0.028  |            |   |              |   |
| Disease (AA vs Other)                                                      |          |  | 0.827           | 0.273  |              |       | 0.613                | 0.014  |              |       | 1.043      | 0.882 |              |   | 2.240      | 0.117 | 0.584        | 0.035  |            |   | 0.504        | 0.007  | 0.390      |   | 0.035        |   |
| 1st Donor Type                                                             |          |  |                 |        |              |       |                      |        |              |       |            |       |              |   |            |       |              |        |            |   |              |        |            |   |              |   |
| MRD                                                                        |          |  | 1.000           |        |              |       | 1.000                |        |              |       | 1.000      |       |              |   | 1.000      |       |              |        |            |   | 1.000        |        |            |   |              |   |
| URD                                                                        |          |  | 0.705           | 0.563  |              |       | 0.123                | 0.051  |              |       | 2.487      | 0.415 |              |   | 5.228      | 0.935 | 0.699        | 0.639  |            |   | 0.873        | 0.852  |            |   |              |   |
| CB                                                                         |          |  | 1.186           | 0.828  |              |       | 0.175                | 0.085  |              |       | 1.502      | 0.692 |              |   | 5.949      | 0.934 | 0.750        | 0.634  |            |   | 0.862        | 0.805  |            |   |              |   |
| Haplo                                                                      |          |  | 1.592           | 0.366  |              |       | 0.255                | 0.177  |              |       | 2.416      | 0.385 |              |   | 1.382      | 0.928 | 1.097        | 0.876  |            |   | 1.210        | 0.748  |            |   |              |   |
| Chimerism                                                                  |          |  |                 |        |              |       |                      |        |              |       |            |       |              |   |            |       |              |        |            |   |              |        |            |   |              |   |
| Full donor                                                                 |          |  | 1.000           |        |              |       | 1.000                |        |              |       | 1.000      |       |              |   | 1.000      |       |              |        |            |   | 1.000        |        |            |   |              |   |
| Mixed                                                                      |          |  | 0.786           | 0.286  |              |       | 0.729                | 0.268  |              |       | 0.826      | 0.598 |              |   | 1.109      | 0.972 | 0.595        | 0.055  |            |   | 0.585        | 0.043  |            |   |              |   |
| Full recipient                                                             |          |  | 0.759           | 0.216  |              |       | 0.510                | 0.014  |              |       | 1.062      | 0.859 |              |   | 0.411      | 0.160 | 0.472        | 0.007  |            |   | 0.559        | 0.026  |            |   |              |   |
| Time from 1st Tx to 2nd Tx (<Median vs ≥Median)                            |          |  | 0.822           | 0.222  |              |       | 1.161                | 0.435  |              |       | 1.306      | 0.314 |              |   | 2.116      | 0.106 | 0.834        | 0.399  |            |   | 0.827        | 0.354  |            |   |              |   |
| DSA prior to 2nd Tx (Neg. vs Pos.)                                         |          |  | 0.590           | 0.101  |              |       | 0.466                | 0.055  |              |       | 0.614      | 0.700 |              |   | 1.524      | 0.581 | 0.605        | 0.232  |            |   | 0.527        | 0.088  |            |   |              |   |
| Disease Status prior to 2nd Tx (Relapse vs CR)                             |          |  | 0.857           | 0.830  |              |       | 0.459                | 0.440  |              |       | 0.047      | 0.502 |              |   | 0.049      | 0.808 | 0.357        | 0.084  |            |   | 0.392        | 0.115  |            |   |              |   |
| Change donor (No vs Yes)                                                   |          |  | 2.050           | <0.001 |              |       | 3.100                | <0.001 | 2.216        | 0.026 | 0.860      | 0.616 |              |   | 0.629      | 0.366 | 2.494        | <0.001 |            |   | 2.309        | <0.001 | 1.745      |   | 0.025        |   |
| 2nd Donor Age (<Median vs ≥Median)                                         |          |  | 0.813           | 0.236  |              |       | 0.804                | 0.303  |              |       | 1.095      | 0.745 |              |   | 1.354      | 0.533 | 0.722        | 0.166  |            |   | 0.737        | 0.173  |            |   |              |   |
| 2nd Donor Gender (Male vs Female)                                          |          |  | 0.733           | 0.063  |              |       | 0.936                | 0.735  |              |       | 0.803      | 0.428 |              |   | 0.777      | 0.586 | 0.741        | 0.166  |            |   | 0.840        | 0.401  |            |   |              |   |
| 2nd Donor Type                                                             |          |  |                 |        |              |       |                      |        |              |       |            |       |              |   |            |       |              |        |            |   |              |        |            |   |              |   |
| MRD                                                                        |          |  | 1.000           |        | 1.000        |       | 1.000                |        |              |       | 1.000      |       |              |   | 1.000      |       |              |        |            |   | 1.000        |        |            |   |              |   |
| URD                                                                        |          |  | 1.637           | 0.379  | 2.660        | 0.133 | 0.792                | 0.711  |              |       | 6.791      | 0.098 |              |   | 2.273      | 0.940 | 1.093        | 0.907  |            |   | 1.089        | 0.910  |            |   |              |   |
| CB                                                                         |          |  | 3.257           | 0.008  | 3.367        | 0.024 | 2.145                | 0.153  |              |       | 3.693      | 0.233 |              |   | 2.652      | 0.939 | 1.296        | 0.672  |            |   | 1.313        | 0.657  |            |   |              |   |
| Haplo                                                                      |          |  | 1.524           | 0.223  | 2.062        | 0.098 | 1.076                | 0.851  |              |       | 4.322      | 0.147 |              |   | 2.435      | 0.939 | 1.259        | 0.654  |            |   | 1.425        | 0.489  |            |   |              |   |
| ABO of 2nd Tx (Matched/Minor mismatched vs Major/Bidirectional mismatched) |          |  | 0.713           | 0.220  |              |       | 0.412                | 0.273  |              |       | 0.545      | 0.614 |              |   | 0.926      | 0.618 | 0.417        | 0.321  |            |   | 0.564        | 0.419  |            |   |              |   |
| Conditioning Regimen of 2nd Tx (FC vs Other)                               |          |  | 0.878           | 0.448  |              |       | 0.879                | 0.523  |              |       | 1.139      | 0.650 |              |   | 0.521      | 0.145 | 0.924        | 0.732  |            |   | 0.929        | 0.734  |            |   |              |   |
| Graft Source of 2nd Tx                                                     |          |  |                 |        |              |       |                      |        |              |       |            |       |              |   |            |       |              |        |            |   |              |        |            |   |              |   |
| PB+BM                                                                      |          |  | 1.000           |        |              |       | 1.000                |        |              |       | 1.000      |       |              |   | 1.000      |       |              |        |            |   | 1.000        |        |            |   |              |   |
| PB                                                                         |          |  | 2.320           | <0.001 |              |       | 2.119                | <0.001 |              |       | 1.255      | 0.450 |              |   | 1.336      | 0.558 | 2.067        | 0.001  |            |   | 1.801        | 0.007  |            |   |              |   |
| CB                                                                         |          |  | 3.155           | <0.001 |              |       | 2.793                | 0.010  |              |       | 1.242      | 0.649 |              |   | 1.274      | 0.751 | 1.554        | 0.233  |            |   | 1.315        | 0.452  |            |   |              |   |
| Infused MNCs (<Median vs ≥Median)                                          |          |  | 2.194           | <0.001 |              |       | 0.380                | <0.001 | 1.740        | 0.033 | 0.992      | 0.977 |              |   | 1.305      | 0.554 | 2.028        | 0.002  |            |   | 1.866        | 0.004  |            |   |              |   |
| Infused CD34 cells (<Median vs ≥Median)                                    |          |  | 1.564           | 0.010  |              |       | 1.794                | 0.004  |              |       | 1.188      | 0.528 |              |   | 1.782      | 0.212 | 1.783        | 0.018  |            |   | 2.016        | 0.003  |            |   |              |   |
| GVHD Prophylaxis for 2nd Tx (Other vs Intensified)                         |          |  | 2.249           | <0.001 |              |       | 3.211                | <0.001 |              |       | 1.007      | 0.979 |              |   | 2.304      | 0.262 | 2.160        | <0.001 |            |   | 1.696        | 0.002  |            |   |              |   |

Supplementary Table 7. Univariate and multivariate analysis for 2nd transplant outcomes in patients with primary GF.

Abbreviations: AA, aplastic anemia; GF, graft failure; MRD, matched related donor; URD, unrelated donor; CB, cord blood; Haplo, haploidentical transplantation; Tx, transplantation; DSA, Donor specific antibody; CR, complete remission; FC, fludarabine/cyclophosphamide; BM, bone marrow; PB, peripheral blood; MNCs, mononucleated cells; GVHD, graft versus host disease.

| Variables                                                    | ANC Engraftment |       | Platelet   |       | aGVHD      |       | cGVHD      |       | TRM        |       | OS         |       |
|--------------------------------------------------------------|-----------------|-------|------------|-------|------------|-------|------------|-------|------------|-------|------------|-------|
|                                                              | Univariate      |       | Univariate |       | Univariate |       | Univariate |       | Univariate |       | Univariate |       |
|                                                              | HR              | P     | HR         | P     | HR         | P     | HR         | P     | HR         | P     | HR         | P     |
| Recipient Gender (Male vs Female)                            | 3.208           | 0.260 | 1.639      | 0.629 | 0.937      | 0.951 | 2.400      | 0.627 | 3.788      | 0.098 | 3.401      | 0.123 |
| Recipient Age (<Median vs ≥Median)                           | 0.702           | 0.425 | 0.770      | 0.630 | 0.564      | 0.377 | 1.699      | 0.572 | 0.352      | 0.145 | 0.308      | 0.092 |
| Time from 1st Tx to 2nd Tx (<Median vs ≥Median)              | 1.201           | 0.677 | 1.157      | 0.785 | 1.118      | 0.861 | 2.114      | 0.414 | 0.620      | 0.477 | 0.524      | 0.318 |
| DSA prior to 2nd Tx (Neg. vs Pos.)                           | 0.811           | 0.644 | 0.629      | 0.393 | 0.585      | 0.407 | 0.622      | 0.604 | 0.817      | 0.764 | 0.694      | 0.572 |
| Change donor (No vs Yes)                                     | 1.028           | 1.961 | 1.790      | 0.446 | 2.810      | 0.329 | 0.142      | 0.053 | 1.408      | 0.671 | 1.241      | 0.786 |
| 2nd Donor Age (<Median vs ≥Median)                           | 0.634           | 0.346 | 0.673      | 0.466 | 0.655      | 0.555 | 0.363      | 0.270 | 1.124      | 0.880 | 1.513      | 0.561 |
| 2nd Donor Gender (Male vs Female)                            | 1.901           | 0.182 | 2.743      | 0.062 | 1.366      | 0.629 | 0.220      | 0.179 | 1.241      | 0.761 | 1.441      | 0.598 |
| Conditioning Regimen of 2nd Tx (FC vs Other)                 | 0.687           | 0.425 | 0.631      | 0.438 | 0.835      | 0.794 | 0.536      | 0.580 | 0.354      | 0.125 | 0.446      | 0.205 |
| Graft Source of 2nd Tx (BM+PB vs Other)                      | 0.467           | 0.063 | 0.244      | 0.031 | 0.764      | 0.678 | 9.610      | 0.079 | 0.157      | 0.024 | 0.247      | 0.048 |
| Infused MNCs (<Median vs ≥Median)                            | 1.180           | 0.720 | 3.115      | 0.044 | 0.762      | 0.674 | 1.433      | 0.697 | 1.880      | 0.373 | 2.183      | 0.258 |
| Infused CD34 cells (<Median vs ≥Median)                      | 1.070           | 0.877 | 0.686      | 0.802 | 0.611      | 0.446 | 2.308      | 0.367 | 1.916      | 0.359 | 2.222      | 0.248 |
| GVHD Prophylaxis for 2nd Tx (Non-intensified vs Intensified) | 3.667           | 0.043 | 0.148      | 3.627 | 2.778      | 0.333 | 2.371      | 0.709 | 5.848      | 0.015 | 4.566      | 0.027 |

**Supplementary Table 8. Univariate analysis for 2nd transplant outcomes in primary GF patients with positive DSA (group A).**

Abbreviations: Tx, transplantation; DSA, Donor specific antibody; FC, fludarabine/cyclophosphamide; BM, bone marrow; PB, peripheral blood; MNCs, mononucleated cells; GVHD, graft versus host disease.

| Variables                                                                  | Outcomes        |              |                      |              |            |              |            |              |            |              |            |              |            |              |            |              |            |              |            |              |            |              |            |              |
|----------------------------------------------------------------------------|-----------------|--------------|----------------------|--------------|------------|--------------|------------|--------------|------------|--------------|------------|--------------|------------|--------------|------------|--------------|------------|--------------|------------|--------------|------------|--------------|------------|--------------|
|                                                                            | ANC Engraftment |              | Platelet Engraftment |              | aGVHD      |              | cGVHD      |              | TRM        |              | OS         |              |            |              |            |              |            |              |            |              |            |              |            |              |
|                                                                            | Univariate      | Multivariate | Univariate           | Multivariate | Univariate | Multivariate | Univariate | Multivariate | Univariate | Multivariate | Univariate | Multivariate | Univariate | Multivariate | Univariate | Multivariate | Univariate | Multivariate | Univariate | Multivariate | Univariate | Multivariate | Univariate | Multivariate |
|                                                                            | HR              | P            | HR                   | P            | HR         | P            | HR         | P            | HR         | P            | HR         | P            | HR         | P            | HR         | P            | HR         | P            | HR         | P            | HR         | P            | HR         | P            |
| Recipient Gender (Male vs Female)                                          | 0.913           | 0.669        |                      |              | 0.769      | 0.284        |            |              | 0.905      | 0.755        |            |              | 1.004      | 0.994        |            |              | 1.175      | 0.599        |            |              | 0.954      | 0.868        |            |              |
| Recipient Age (<Median vs ≥Median)                                         | 0.773           | 0.228        |                      |              | 0.581      | 0.026        |            |              | 0.630      | 0.152        |            |              | 0.837      | 0.776        |            |              | 0.470      | 0.016        |            |              | 0.452      | 0.007        |            |              |
| Disease (AA vs Other)                                                      | 0.761           | 0.215        |                      |              | 0.526      | 0.009        |            |              | 1.073      | 0.831        |            |              | 1.399      | 0.594        |            |              | 0.522      | 0.062        |            |              | 0.430      | 0.014        | 0.179      | 0.007        |
| 1st Donor Type (CB vs Other)                                               | 0.718           | 0.119        |                      |              | 0.687      | 0.121        |            |              | 1.368      | 0.327        |            |              | 0.734      | 0.625        |            |              | 0.801      | 0.465        |            |              | 0.831      | 0.515        |            |              |
| Chimerism (Mixed vs Full recipient)                                        | 1.188           | 0.414        |                      |              | 1.602      | 0.055        |            |              | 1.554      | 0.178        |            |              | 0.278      | 0.058        |            |              | 1.439      | 0.230        |            |              | 1.200      | 0.517        |            |              |
| Time from 1st Tx to 2nd Tx (<Median vs ≥Median)                            | 0.794           | 0.277        |                      |              | 0.746      | 0.225        |            |              | 0.789      | 0.454        |            |              | 2.431      | 0.190        |            |              | 0.917      | 0.773        |            |              | 0.792      | 0.418        |            |              |
| DSA prior to 2nd Tx (Neg. vs Pos.)                                         | 0.707           | 0.633        |                      |              | 0.289      | 0.220        |            |              | 0.045      | 0.437        |            |              | 0.047      | 0.809        |            |              | 0.366      | 0.180        |            |              | 0.260      | 0.032        |            |              |
| Change donor (No vs Yes)                                                   | 2.211           | 0.003        | 2.683                | 0.002        | 2.662      | 0.004        | 2.387      | 0.033        | 0.849      | 0.653        |            |              | 0.709      | 0.611        |            |              | 1.953      | 0.033        |            |              | 1.767      | 0.047        |            |              |
| 2nd Donor Age (<Median vs ≥Median)                                         | 0.730           | 0.180        |                      |              | 0.928      | 0.782        |            |              | 1.602      | 0.164        |            |              | 1.587      | 0.546        |            |              | 0.538      | 0.065        |            |              | 0.631      | 0.133        |            |              |
| 2nd Donor Gender (Male vs Female)                                          | 0.746           | 0.181        |                      |              | 0.800      | 0.371        |            |              | 0.968      | 0.920        |            |              | 0.879      | 0.838        |            |              | 0.670      | 0.185        |            |              | 0.841      | 0.545        |            |              |
| 2nd Donor Type                                                             |                 |              |                      |              |            |              |            |              |            |              |            |              |            |              |            |              |            |              |            |              |            |              |            |              |
| MRD                                                                        | 1.000           |              |                      |              | 1.000      |              |            |              | 1.000      |              |            |              | 1.000      |              |            |              | 1.000      |              |            |              | 1.000      |              |            |              |
| URD                                                                        | 3.623           | 0.044        | 4.065                | 0.006        | 0.665      | 0.58         |            |              | 6.594      | 0.934        |            |              |            |              |            |              | 1.484      | 0.693        |            |              | 1.466      | 0.702        |            |              |
| CB                                                                         | 6.289           | 0.001        | 8.696                | 0.001        | 1.543      | 0.493        |            |              | 5.428      | 0.935        |            |              | 8.970      | 0.952        |            |              | 1.763      | 0.513        |            |              | 1.811      | 0.493        |            |              |
| Haplo                                                                      | 2.849           | 0.011        | 3.663                | 0.008        | 0.833      | 0.695        |            |              | 7.192      | 0.934        |            |              | 3.070      | 0.956        |            |              | 1.614      | 0.510        |            |              | 1.888      | 0.380        |            |              |
| ABO of 2nd Tx (Matched/Minor mismatched vs Major/Bidirectional mismatched) | 0.898           | 0.557        |                      |              | 0.516      | 0.287        |            |              | 0.887      | 0.223        |            |              | 1.245      | 0.625        |            |              | 1.342      | 0.692        |            |              | 1.297      | 0.521        |            |              |
| Conditioning Regimen of 2nd Tx (FC vs Other)                               | 1.231           | 0.368        |                      |              | 1.240      | 0.419        |            |              | 2.070      | 0.069        |            |              | 1.836      | 0.442        |            |              | 1.739      | 0.072        |            |              | 1.534      | 0.141        |            |              |
| Graft Source of 2nd Tx                                                     |                 |              |                      |              |            |              |            |              |            |              |            |              |            |              |            |              |            |              |            |              |            |              |            |              |
| PB+BM                                                                      | 1.000           |              |                      |              | 1.000      |              |            |              | 1.000      |              |            |              | 1.000      |              |            |              | 1.000      |              |            |              | 1.000      |              |            |              |
| PB                                                                         | 2.165           | 0.002        |                      |              | 1.595      | 0.089        |            |              | 0.685      | 0.308        |            |              | 1.169      | 0.825        |            |              | 1.278      | 0.453        |            |              | 1.147      | 0.658        |            |              |
| CB                                                                         | 3.165           | 0.008        |                      |              | 2.169      | 0.102        |            |              | 0.747      | 0.631        |            |              | 3.577      | 0.124        |            |              | 1.231      | 0.700        |            |              | 1.055      | 0.920        |            |              |
| Infused MNCs (<Median vs ≥Median)                                          | 2.327           | <0.001       | 1.998                | 0.011        | 2.419      | <0.001       | 1.817      | 0.048        | 0.818      | 0.538        |            |              | 0.966      | 0.954        |            |              | 2.392      | 0.006        |            |              | 1.862      | 0.032        |            |              |
| Infused CD34 cells (<Median vs ≥Median)                                    | 1.528           | 0.057        |                      |              | 1.720      | 0.034        |            |              | 0.969      | 0.923        |            |              | 1.657      | 0.421        |            |              | 1.572      | 0.153        |            |              | 1.815      | 0.047        |            |              |
| GVHD Prophylaxis for 2nd Tx (Non-intensified vs Intensified)               | 1.524           | 0.166        |                      |              | 1.384      | 0.327        |            |              | 1.133      | 0.778        |            |              | 0.939      | 0.936        |            |              | 0.943      | 0.889        |            |              | 0.803      | 0.591        |            |              |

Supplementary Table 9. Univariate and multivariate analysis for 2nd transplant outcomes in primary GF patients with negative DSA and full recipient or mixed chimerism (group B).

Abbreviations: AA, aplastic anemia; GF, graft failure; MRD, matched related donor; URD, unrelated donor; CB, cord blood; Haplo, haploidentical transplantation; Tx, transplantation; DSA, Donor specific antibody; CR, complete remission; FC, fludarabine/cyclophosphamide; BM, bone marrow; PB, peripheral blood; MNCs, mononucleated cells; GVHD, graft versus host disease.

| Variables \ Outcomes                                                       | ANC Engraftment |       |              |   | Platelet Engraftment |       |              |   | aGVHD      |       |              |   | cGVHD      |       |              |   | TRM        |       |              |   | OS         |       |              |   |
|----------------------------------------------------------------------------|-----------------|-------|--------------|---|----------------------|-------|--------------|---|------------|-------|--------------|---|------------|-------|--------------|---|------------|-------|--------------|---|------------|-------|--------------|---|
|                                                                            | Univariate      |       | Multivariate |   | Univariate           |       | Multivariate |   | Univariate |       | Multivariate |   | Univariate |       | Multivariate |   | Univariate |       | Multivariate |   | Univariate |       | Multivariate |   |
|                                                                            | HR              | P     | HR           | P | HR                   | P     | HR           | P | HR         | P     | HR           | P | HR         | P     | HR           | P | HR         | P     | HR           | P | HR         | P     | HR           | P |
| Recipient Gender (Male vs Female)                                          | 2.151           | 0.048 |              |   | 1.948                | 0.187 |              |   | 0.812      | 0.648 |              |   | 5.747      | 0.325 |              |   | 2.208      | 0.073 |              |   | 2.299      | 0.058 |              |   |
| Recipient Age (<Median vs ≥Median)                                         | 1.190           | 0.650 |              |   | 0.780                | 0.621 |              |   | 1.761      | 0.210 |              |   | 6.449      | 0.112 |              |   | 0.637      | 0.246 |              |   | 0.670      | 0.293 |              |   |
| Disease (AA vs Other)                                                      | 1.064           | 0.893 |              |   | 0.613                | 0.365 |              |   | 0.753      | 0.562 |              |   | 3.495      | 0.447 |              |   | 0.795      | 0.622 |              |   | 0.761      | 0.554 |              |   |
| 1st Donor Type (CB vs Other)                                               | 1.305           | 0.349 |              |   | 0.961                | 0.906 |              |   | 0.875      | 0.710 |              |   | 5.826      | 0.300 |              |   | 1.014      | 0.962 |              |   | 0.957      | 0.887 |              |   |
| Time from 1st Tx to 2nd Tx (<Median vs ≥Median)                            | 0.855           | 0.680 |              |   | 0.646                | 0.408 |              |   | 0.809      | 0.639 |              |   | 4.847      | 0.173 |              |   | 0.510      | 0.088 |              |   | 0.469      | 0.052 |              |   |
| Change donor (No vs Yes)                                                   | 2.125           | 0.067 |              |   | 5.970                | 0.019 |              |   | 0.558      | 0.207 |              |   | 2.611      | 0.623 |              |   | 3.745      | 0.001 |              |   | 3.534      | 0.002 |              |   |
| 2nd Donor Age (<Median vs ≥Median)                                         | 0.632           | 0.246 |              |   | 0.582                | 0.308 |              |   | 0.838      | 0.709 |              |   | 1.545      | 0.665 |              |   | 0.846      | 0.677 |              |   | 0.788      | 0.546 |              |   |
| 2nd Donor Gender (Male vs Female)                                          | 0.502           | 0.101 |              |   | 0.650                | 0.426 |              |   | 0.589      | 0.280 |              |   | 1.714      | 0.592 |              |   | 0.792      | 0.553 |              |   | 0.728      | 0.408 |              |   |
| ABO of 2nd Tx (Matched/Minor mismatched vs Major/Bidirectional mismatched) | 0.614           | 0.321 |              |   | 0.524                | 0.723 |              |   | 0.504      | 0.741 |              |   | 0.837      | 0.729 |              |   | 1.704      | 0.456 |              |   | 1.433      | 0.579 |              |   |
| Conditioning Regimen of 2nd Tx (FC vs Other)                               | 0.356           | 0.014 |              |   | 0.337                | 0.031 |              |   | 0.817      | 0.666 |              |   | 0.013      | 0.291 |              |   | 0.407      | 0.071 |              |   | 0.489      | 0.122 |              |   |
| Graft Source of 2nd Tx                                                     |                 |       |              |   |                      |       |              |   |            |       |              |   |            |       |              |   |            |       |              |   |            |       |              |   |
| PB+BM                                                                      | 1.000           |       |              |   | 1.000                |       |              |   | 1.000      |       |              |   | 1.000      |       |              |   | 1.000      |       |              |   | 1.000      |       |              |   |
| PB                                                                         | 2.358           | 0.037 |              |   | 4.444                | 0.022 |              |   | 2.035      | 0.135 |              |   | 0.026      | 0.571 |              |   | 3.411      | 0.004 |              |   | 3.166      | 0.005 |              |   |
| CB                                                                         | 2.342           | 0.260 |              |   | 2.899                | 0.307 |              |   | 0.786      | 0.819 |              |   | 0.027      | 0.566 |              |   | 0.723      | 0.758 |              |   | 0.599      | 0.626 |              |   |
| Infused MNCs (<Median vs ≥Median)                                          | 2.047           | 0.077 |              |   | 4.474                | 0.007 |              |   | 1.344      | 0.513 |              |   | 2.748      | 0.383 |              |   | 1.859      | 0.143 |              |   | 1.953      | 0.111 |              |   |
| Infused CD34 cells (<Median vs ≥Median)                                    | 2.395           | 0.048 |              |   | 3.775                | 0.017 |              |   | 1.126      | 0.820 |              |   | 2.067      | 0.532 |              |   | 1.626      | 0.330 |              |   | 1.718      | 0.269 |              |   |
| GVHD Prophylaxis for 2nd Tx (Non-intensified vs Intensified)               | 3.428           | 0.003 |              |   | 9.100                | 0.004 |              |   | 1.185      | 0.712 |              |   | 3.831      | 0.413 |              |   | 3.413      | 0.003 |              |   | 3.058      | 0.005 |              |   |

**Supplementary Table 10. Univariate and multivariate analysis for 2nd transplant outcomes in primary GF patients with negative DSA and full donor chimerism (group C).**

Abbreviations: AA, aplastic anemia; GF, graft failure; MRD, matched related donor; URD, unrelated donor; CB, cord blood; Haplo, haploidentical transplantation; Tx, transplantation; DSA, Donor specific antibody; CR, complete remission; FC, fludarabine/cyclophosphamide; BM, bone marrow; PB, peripheral blood; MNCs, mononucleated cells; GVHD, graft versus host disease.

| Variables                                                                  | Outcomes |  | ANC Engraftment |       |              |   | Platelet Engraftment |        |              |       | aGVHD      |       |              |   | cGVHD      |       |              |       | TRM        |       |              |   | OS         |       |              |   |
|----------------------------------------------------------------------------|----------|--|-----------------|-------|--------------|---|----------------------|--------|--------------|-------|------------|-------|--------------|---|------------|-------|--------------|-------|------------|-------|--------------|---|------------|-------|--------------|---|
|                                                                            |          |  | Univariate      |       | Multivariate |   | Univariate           |        | Multivariate |       | Univariate |       | Multivariate |   | Univariate |       | Multivariate |       | Univariate |       | Multivariate |   | Univariate |       | Multivariate |   |
|                                                                            |          |  | HR              | P     | HR           | P | HR                   | P      | HR           | P     | HR         | P     | HR           | P | HR         | P     | HR           | P     | HR         | P     | HR           | P | HR         | P     | HR           | P |
| Recipient Gender (Male vs Female)                                          |          |  | 0.831           | 0.482 |              |   | 0.976                | 0.934  |              |       | 0.624      | 0.311 |              |   | 0.497      | 0.279 |              |       | 0.761      | 0.519 |              |   | 0.923      | 0.843 |              |   |
| Recipient Age (<Median vs ≥Median)                                         |          |  | 0.691           | 0.129 |              |   | 0.599                | 0.058  | 0.388        | 0.007 | 0.794      | 0.557 |              |   | 3.994      | 0.018 | 3.470        | 0.037 | 0.614      | 0.242 |              |   | 0.685      | 0.332 |              |   |
| Disease (AA vs Other)                                                      |          |  | 0.900           | 0.674 |              |   | 1.706                | 0.786  |              |       | 1.689      | 0.236 |              |   | 3.118      | 0.084 |              |       | 0.901      | 0.805 |              |   | 0.716      | 0.416 |              |   |
| 1st Donor Type                                                             |          |  |                 |       |              |   |                      |        |              |       |            |       |              |   |            |       |              |       |            |       |              |   |            |       |              |   |
| MRD                                                                        |          |  | 1.000           |       |              |   | 1.000                |        | 1.000        |       | 1.000      |       |              |   | 1.000      |       |              |       | 1.000      |       |              |   | 1.000      |       |              |   |
| URD                                                                        |          |  | 1.684           | 0.278 |              |   | 4.167                | 0.006  | 6.289        | 0.007 | 2.954      | 0.126 |              |   | 1.020      | 0.995 |              |       | 4.125      | 0.036 |              |   | 3.676      | 0.042 |              |   |
| CB                                                                         |          |  | 0.999           | 0.999 |              |   | 0.866                | 0.847  | 1.580        | 0.569 | 1.020      | 0.980 |              |   | 1.558      | 0.683 |              |       | 2.397      | 0.435 |              |   | 1.930      | 0.549 |              |   |
| Haplo                                                                      |          |  | 1.642           | 0.085 |              |   | 3.003                | <0.001 | 2.623        | 0.023 | 2.312      | 0.130 |              |   | 0.765      | 0.635 |              |       | 1.964      | 0.237 |              |   | 1.886      | 0.219 |              |   |
| Chimerism                                                                  |          |  |                 |       |              |   |                      |        |              |       |            |       |              |   |            |       |              |       |            |       |              |   |            |       |              |   |
| Full donor                                                                 |          |  | 1.000           |       |              |   | 1.000                |        |              |       | 1.000      |       |              |   | 1.000      |       |              |       | 1.000      |       |              |   | 1.000      |       |              |   |
| Mixed                                                                      |          |  | 1.060           | 0.824 |              |   | 1.004                | 0.989  |              |       | 0.811      | 0.624 |              |   | 0.727      | 0.591 |              |       | 0.835      | 0.695 |              |   | 0.819      | 0.649 |              |   |
| Full recipient                                                             |          |  | 0.664           | 0.256 |              |   | 0.695                | 0.342  |              |       | 1.029      | 0.960 |              |   | 1.205      | 0.789 |              |       | 1.143      | 0.821 |              |   | 1.243      | 0.687 |              |   |
| Time from 1st Tx to 2nd Tx (<Median vs ≥Median)                            |          |  | 0.909           | 0.693 |              |   | 1.265                | 0.379  |              |       | 0.674      | 0.329 |              |   | 0.581      | 0.309 |              |       | 0.840      | 0.670 |              |   | 0.959      | 0.914 |              |   |
| DSA prior to 2nd Tx (Neg. vs Pos.)                                         |          |  | 0.642           | 0.320 |              |   | 0.775                | 0.633  |              |       | 0.749      | 0.701 |              |   | 0.038      | 0.433 |              |       | 2.058      | 0.490 |              |   | 2.058      | 0.490 |              |   |
| Disease Status prior to 2nd Tx (Relapse vs CR)                             |          |  | 0.918           | 0.832 |              |   | 1.245                | 0.635  |              |       | 1.791      | 0.410 |              |   | 0.031      | 0.275 |              |       | 1.996      | 0.519 |              |   | 1.122      | 0.884 |              |   |
| Change donor (No vs Yes)                                                   |          |  | 1.246           | 0.385 |              |   | 1.361                | 0.274  |              |       | 2.038      | 0.126 |              |   | 0.718      | 0.525 |              |       | 1.527      | 0.303 |              |   | 1.364      | 0.426 |              |   |
| 2nd Donor Age (<Median vs ≥Median)                                         |          |  | 0.756           | 0.263 |              |   | 0.631                | 0.495  |              |       | 1.937      | 0.117 |              |   | 1.213      | 0.712 |              |       | 0.722      | 0.453 |              |   | 0.565      | 0.171 |              |   |
| 2nd Donor Gender (Male vs Female)                                          |          |  | 1.275           | 0.323 |              |   | 0.797                | 0.406  |              |       | 1.320      | 0.489 |              |   | 1.871      | 0.236 |              |       | 0.735      | 0.467 |              |   | 0.605      | 0.214 |              |   |
| 2nd Donor Type                                                             |          |  |                 |       |              |   |                      |        |              |       |            |       |              |   |            |       |              |       |            |       |              |   |            |       |              |   |
| MRD                                                                        |          |  | 1.000           |       |              |   | 1.000                |        |              |       | 1.000      |       |              |   | 1.000      |       |              |       | 1.000      |       |              |   | 1.000      |       |              |   |
| URD                                                                        |          |  | 0.838           | 0.701 |              |   | 1.387                | 0.481  |              |       | 6.170      | 0.929 |              |   | 0.656      | 0.718 |              |       | 1.067      | 0.944 |              |   | 0.857      | 0.860 |              |   |
| CB                                                                         |          |  | 2.732           | 0.201 |              |   | 12.65                | 0.156  |              |       | 1.063      | 0.926 |              |   | 0.000      | 0.990 |              |       | 3.017      | 0.345 |              |   | 2.655      | 0.389 |              |   |
| Haplo                                                                      |          |  | 1.458           | 0.289 |              |   | 2.660                | 0.008  |              |       | 8.505      | 0.927 |              |   | 1.109      | 0.876 |              |       | 1.495      | 0.525 |              |   | 1.304      | 0.633 |              |   |
| ABO of 2nd Tx (Matched/Minor mismatched vs Major/Bidirectional mismatched) |          |  | 0.753           | 0.214 |              |   | 0.325                | 0.186  |              |       | 0.634      | 0.589 |              |   | 1.023      | 0.541 |              |       | 0.475      | 0.315 |              |   | 0.606      | 0.427 |              |   |
| Conditioning Regimen of 2nd Tx (FC vs Other)                               |          |  | 0.641           | 0.143 |              |   | 1.328                | 0.400  |              |       | 0.578      | 0.216 |              |   | 1.556      | 0.565 |              |       | 1.404      | 0.477 |              |   | 1.595      | 0.296 |              |   |
| Graft Source of 2nd Tx                                                     |          |  |                 |       |              |   |                      |        |              |       |            |       |              |   |            |       |              |       |            |       |              |   |            |       |              |   |
| PB+BM                                                                      |          |  | 1.000           |       |              |   | 1.000                |        |              |       | 1.000      |       |              |   | 1.000      |       |              |       | 1.000      |       |              |   | 1.000      |       |              |   |
| PB                                                                         |          |  | 1.145           | 0.582 |              |   | 0.847                | 0.541  |              |       | 0.545      | 0.130 |              |   | 1.582      | 0.404 |              |       | 0.698      | 0.390 |              |   | 0.744      | 0.451 |              |   |
| CB                                                                         |          |  | 2.203           | 0.283 |              |   | 2.632                | 0.345  |              |       | 1.122      | 0.912 |              |   | 0.000      | 0.990 |              |       | 1.822      | 0.567 |              |   | 1.880      | 0.546 |              |   |
| Infused MNCs (<Median vs ≥Median)                                          |          |  | 0.769           | 0.275 |              |   | 1.020                | 0.783  |              |       | 1.652      | 0.219 |              |   | 1.150      | 0.795 |              |       | 0.838      | 0.666 |              |   | 0.788      | 0.538 |              |   |
| Infused CD34 cells (<Median vs ≥Median)                                    |          |  | 1.153           | 0.584 |              |   | 2.098                | 0.012  |              |       | 0.616      | 0.375 |              |   | 1.584      | 0.449 |              |       | 0.878      | 0.778 |              |   | 1.015      | 0.973 |              |   |
| GVHD Prophylaxis for 2nd Tx (Other vs Intensified)                         |          |  | 0.930           | 0.793 |              |   | 1.208                | 0.691  |              |       | 1.133      | 0.095 |              |   | 0.944      | 0.930 |              |       | 1.637      | 0.278 |              |   | 1.938      | 0.110 |              |   |

Supplementary Table 11. Univariate and multivariate analysis for 2nd transplant outcomes in patients with secondary GF.

Abbreviations: AA, aplastic anemia; GF, graft failure; MRD, matched related donor; URD, unrelated donor; CB, cord blood; Haplo, haploidentical transplantation; Tx, transplantation; DSA, Donor specific antibody; CR, complete remission; FC, fludarabine/cyclophosphamide; BM, bone marrow; PB, peripheral blood; MNCs, mononucleated cells; GVHD, graft versus host disease.

| Variables                                                                  | Outcomes |  |  |  | ANC Engraftment |       |              |       | Platelet Engraftment |       |              |       | aGVHD      |       |              |   | cGVHD      |        |              |       | TRM        |       |              |   | OS         |       |              |       |
|----------------------------------------------------------------------------|----------|--|--|--|-----------------|-------|--------------|-------|----------------------|-------|--------------|-------|------------|-------|--------------|---|------------|--------|--------------|-------|------------|-------|--------------|---|------------|-------|--------------|-------|
|                                                                            |          |  |  |  | Univariate      |       | Multivariate |       | Univariate           |       | Multivariate |       | Univariate |       | Multivariate |   | Univariate |        | Multivariate |       | Univariate |       | Multivariate |   | Univariate |       | Multivariate |       |
|                                                                            |          |  |  |  | HR              | P     | HR           | P     | HR                   | P     | HR           | P     | HR         | P     | HR           | P | HR         | P      | HR           | P     | HR         | P     | HR           | P | HR         | P     | HR           | P     |
| Recipient Gender (Male vs Female)                                          |          |  |  |  | 0.838           | 0.479 |              |       | 0.626                | 0.093 |              |       | 0.754      | 0.429 |              |   | 1.345      | 0.676  |              |       | 1.460      | 0.339 |              |   | 1.099      | 0.783 |              |       |
| Recipient Age (<Median vs ≥Median)                                         |          |  |  |  | 0.555           | 0.021 |              |       | 0.488                | 0.009 |              |       | 0.799      | 0.521 |              |   | 6.560      | 0.022  |              |       | 0.359      | 0.012 |              |   | 0.375      | 0.006 |              |       |
| Disease (AA vs Other)                                                      |          |  |  |  | 0.702           | 0.172 |              |       | 0.471                | 0.009 |              |       | 1.958      | 0.099 |              |   | 3.249      | 0.151  |              |       | 0.248      | 0.010 |              |   | 0.175      | 0.001 | 0.122        | 0.049 |
| 1st Donor Type                                                             |          |  |  |  |                 |       |              |       |                      |       |              |       |            |       |              |   |            |        |              |       |            |       |              |   |            |       |              |       |
| MRD                                                                        |          |  |  |  | 1.000           |       |              |       | 1.000                |       |              |       | 1.000      |       |              |   | 1.000      |        |              |       | 1.000      |       |              |   | 1.000      |       |              |       |
| URD                                                                        |          |  |  |  | 0.870           | 0.850 |              |       | 0.349                | 0.232 |              |       | 1.172      | 0.889 |              |   | 0.183      | 0.246  |              |       | 0.000      | 0.976 |              |   | 0.238      | 0.242 |              |       |
| CB                                                                         |          |  |  |  | 1.218           | 0.745 |              |       | 0.840                | 0.812 |              |       | 7.499      | 0.894 |              |   | 0.030      | 0.042  |              |       | 2.066      | 0.346 |              |   | 0.607      | 0.509 |              |       |
| Haplo                                                                      |          |  |  |  | 2.387           | 0.158 |              |       | 1.238                | 0.774 |              |       | 1.089      | 0.890 |              |   | 0.347      | 0.355  |              |       | 1.160      | 0.844 |              |   | 1.015      | 0.994 |              |       |
| GF Type (Primary vs Secondary)                                             |          |  |  |  | 1.250           | 0.503 |              |       | 1.702                | 0.129 |              |       | 0.747      | 0.585 |              |   | 3.507      | 0.086  |              |       | 1.052      | 0.926 |              |   | 1.092      | 0.855 |              |       |
| Time from 1st Tx to 2nd Tx (<Median vs ≥Median)                            |          |  |  |  | 0.907           | 0.694 |              |       | 0.919                | 0.754 |              |       | 0.953      | 0.889 |              |   | 2.517      | 0.258  |              |       | 1.280      | 0.515 |              |   | 1.074      | 0.834 |              |       |
| DSA prior to 2nd Tx (Neg. vs Pos.)                                         |          |  |  |  | 0.587           | 0.263 |              |       | 0.708                | 0.512 |              |       | 0.660      | 0.574 |              |   | 3.755      | 0.255  |              |       | 0.855      | 0.836 |              |   | 0.552      | 0.282 |              |       |
| Disease Status prior to 2nd Tx (Relapse vs CR)                             |          |  |  |  | 0.045           | 0.356 |              |       | 0.047                | 0.566 |              |       | 0.048      | 0.729 |              |   |            |        |              |       | 0.087      | 0.029 |              |   | 0.087      | 0.029 |              |       |
| Change donor (No vs Yes)                                                   |          |  |  |  | 2.390           | 0.018 |              |       | 2.937                | 0.022 | 3.045        | 0.049 | 2.107      | 0.219 |              |   | 0.086      | <0.001 | 0.058        | 0.033 | 2.865      | 0.010 |              |   | 2.101      | 0.056 |              |       |
| 2nd Donor Age (<Median vs ≥Median)                                         |          |  |  |  | 0.937           | 0.808 |              |       | 1.152                | 0.626 |              |       | 1.862      | 0.102 |              |   | 1.918      | 0.397  |              |       | 0.460      | 0.074 |              |   | 0.468      | 0.044 |              |       |
| 2nd Donor Gender (Male vs Female)                                          |          |  |  |  | 0.830           | 0.486 |              |       | 0.943                | 0.839 |              |       | 0.960      | 0.913 |              |   | 0.261      | 0.209  |              |       | 0.716      | 0.388 |              |   | 0.880      | 0.718 |              |       |
| 2nd Donor Type                                                             |          |  |  |  |                 |       |              |       |                      |       |              |       |            |       |              |   |            |        |              |       |            |       |              |   |            |       |              |       |
| MRD                                                                        |          |  |  |  | 1.000           |       |              |       | 1.000                |       |              |       | 1.000      |       |              |   | 1.000      |        |              |       | 1.000      |       |              |   | 1.000      |       |              |       |
| URD                                                                        |          |  |  |  | 2.141           | 0.322 |              |       | 0.678                | 0.673 |              |       | 3.406      | 0.913 |              |   | 0.000      | 0.991  |              |       | 0.637      | 0.713 |              |   | 0.639      | 0.715 |              |       |
| CB                                                                         |          |  |  |  | 5.344           | 0.020 |              |       | 5.405                | 0.065 |              |       | 2.294      | 0.917 |              |   | 1.428      | 0.802  |              |       | 1.555      | 0.611 |              |   | 1.696      | 0.543 |              |       |
| Haplo                                                                      |          |  |  |  | 1.715           | 0.302 |              |       | 1.026                | 0.966 |              |       | 2.522      | 0.916 |              |   | 0.344      | 0.327  |              |       | 0.777      | 0.734 |              |   | 1.048      | 0.949 |              |       |
| ABO of 2nd Tx (Matched/Minor mismatched vs Major/Bidirectional mismatched) |          |  |  |  | 0.566           | 0.248 |              |       | 0.458                | 0.213 |              |       | 0.756      | 0.598 |              |   | 0.775      | 0.631  |              |       | 0.689      | 0.347 |              |   | 0.613      | 0.498 |              |       |
| Conditioning Regimen of 2nd Tx (FC vs Other)                               |          |  |  |  | 1.181           | 0.544 |              |       | 1.224                | 0.505 |              |       | 1.433      | 0.376 |              |   | 2.653      | 0.361  |              |       | 1.205      | 0.645 |              |   | 1.364      | 0.384 |              |       |
| Graft Source of 2nd Tx                                                     |          |  |  |  |                 |       |              |       |                      |       |              |       |            |       |              |   |            |        |              |       |            |       |              |   |            |       |              |       |
| PB+BM                                                                      |          |  |  |  | 1.000           |       | 1.000        |       | 1.000                |       | 1.000        |       | 1.000      |       |              |   | 1.000      |        | 1.000        |       | 1.000      |       |              |   | 1.000      |       |              |       |
| PB                                                                         |          |  |  |  | 2.545           | 0.003 | 1.866        | 0.076 | 1.980                | 0.052 | 1.332        | 0.454 | 1.010      | 0.980 |              |   | 4.354      | 0.055  | 1.795        | 0.043 | 3.057      | 0.007 |              |   | 2.060      | 0.055 |              |       |
| CB                                                                         |          |  |  |  | 4.348           | 0.006 | 3.846        | 0.034 | 6.329                | 0.011 | 5.917        | 0.015 | 0.979      | 0.973 |              |   | 6.025      | 0.112  | 2.552        | 0.943 | 2.879      | 0.066 |              |   | 2.035      | 0.198 |              |       |
| Infused MNCs (<Median vs ≥Median)                                          |          |  |  |  | 2.020           | 0.008 |              |       | 2.047                | 0.013 |              |       | 0.842      | 0.634 |              |   | 0.497      | 0.339  |              |       | 1.736      | 0.155 |              |   | 1.330      | 0.401 |              |       |
| Infused CD34 cells (<Median vs ≥Median)                                    |          |  |  |  | 1.562           | 0.090 |              |       | 1.353                | 0.278 |              |       | 1.370      | 0.383 |              |   | 1.655      | 0.491  |              |       | 1.416      | 0.381 |              |   | 1.873      | 0.083 |              |       |
| GVHD Prophylaxis for 2nd Tx (Other vs Intensified)                         |          |  |  |  | 2.202           | 0.039 |              |       | 1.951                | 0.123 |              |       | 2.156      | 0.205 |              |   | 0.312      | 0.155  |              |       | 2.577      | 0.024 |              |   | 1.938      | 0.101 |              |       |

Supplementary Table 12. Univariate and multivariate analysis for 2nd transplant outcomes in patients with full recipient chimerisms.

Abbreviations: AA, aplastic anemia; GF, graft failure; MRD, matched related donor; URD, unrelated donor; CB, cord blood; Haplo, haploidentical transplantation; Tx, transplantation; DSA, Donor specific antibody; CR, complete remission; FC, fludarabine/cyclophosphamide; BM, bone marrow; PB, peripheral blood; MNCs, mononucleated cells; GVHD, graft versus host disease.

| Variables                                                                  | Outcomes   |       |              |       | ANC Engraftment |        |              |       | Platelet Engraftment |       |              |   | aGVHD      |       |              |       | cGVHD      |        |              |       | TRM        |        |              |       | OS         |   |              |   |
|----------------------------------------------------------------------------|------------|-------|--------------|-------|-----------------|--------|--------------|-------|----------------------|-------|--------------|---|------------|-------|--------------|-------|------------|--------|--------------|-------|------------|--------|--------------|-------|------------|---|--------------|---|
|                                                                            | Univariate |       | Multivariate |       | Univariate      |        | Multivariate |       | Univariate           |       | Multivariate |   | Univariate |       | Multivariate |       | Univariate |        | Multivariate |       | Univariate |        | Multivariate |       | Univariate |   | Multivariate |   |
|                                                                            | HR         | P     | HR           | P     | HR              | P      | HR           | P     | HR                   | P     | HR           | P | HR         | P     | HR           | P     | HR         | P      | HR           | P     | HR         | P      | HR           | P     | HR         | P | HR           | P |
| Recipient Gender (Male vs Female)                                          | 1.802      | 0.025 |              |       | 1.567           | 0.152  |              |       | 0.688                | 0.299 |              |   | 1.769      | 0.363 |              |       | 1.534      | 0.205  |              |       | 1.626      | 0.144  |              |       | 1.000      |   | 1.000        |   |
| Recipient Age (<Median vs ≥Median)                                         | 1.213      | 0.462 |              |       | 0.869           | 0.653  |              |       | 1.071                | 0.847 |              |   | 4.939      | 0.020 | 4.581        | 0.039 | 0.729      | 0.334  |              |       | 0.722      | 0.307  |              |       |            |   |              |   |
| Disease (AA vs Other)                                                      | 0.814      | 0.474 |              |       | 0.989           | 0.974  |              |       | 0.849                | 0.669 |              |   | 6.218      | 0.084 |              |       | 0.735      | 0.422  |              |       | 0.670      | 0.292  |              |       |            |   |              |   |
| 1st Donor Type                                                             |            |       |              |       |                 |        |              |       |                      |       |              |   |            |       |              |       |            |        |              |       |            |        |              |       |            |   |              |   |
| MRD                                                                        | 1.000      |       |              |       | 1.000           |        |              |       | 1.000                |       |              |   | 1.000      |       |              |       | 1.000      |        | 1.000        |       | 1.000      |        |              |       | 1.000      |   | 1.000        |   |
| URD                                                                        | 3.448      | 0.248 |              |       | 4.049           | 0.193  |              |       | 1.805                | 0.630 |              |   |            |       |              |       | 10.29      | 0.007  | 14.38        | 0.012 | 7.534      | 0.009  | 1.180        | 0.831 |            |   |              |   |
| CB                                                                         | 1.178      | 0.746 |              |       | 2.959           | 0.056  |              |       | 2.244                | 0.334 |              |   |            |       |              |       | 2.192      | 0.337  | 1.020        | 0.985 | 1.471      | 0.585  | 13.19        | 0.001 |            |   |              |   |
| Haplo                                                                      | 0.965      | 0.931 |              |       | 2.591           | 0.027  |              |       | 2.588                | 0.197 |              |   | 1.050      | 0.589 |              |       | 2.153      | 0.210  | 0.801        | 0.775 | 1.823      | 0.325  | 0.938        | 0.927 |            |   |              |   |
| GF Type (Primary vs Secondary)                                             | 1.250      | 0.400 |              |       | 2.285           | 0.009  |              |       | 0.623                | 0.204 |              |   | 0.849      | 0.788 |              |       | 2.545      | 0.012  |              |       | 2.500      | 0.010  |              |       |            |   |              |   |
| Time from 1st Tx to 2nd Tx (<Median vs ≥Median)                            | 0.955      | 0.86  |              |       | 1.348           | 0.342  |              |       | 0.503                | 0.060 |              |   | 0.967      | 0.958 |              |       | 1.041      | 0.902  |              |       | 1.073      | 0.825  |              |       |            |   |              |   |
| DSA prior to 2nd Tx (Neg. vs Pos.)                                         | 0.908      | 0.846 |              |       | 1.053           | 0.933  |              |       | 1.684                | 0.194 |              |   | 0.742      | 0.782 |              |       | 1.792      | 0.58   |              |       | 1.792      | 0.580  |              |       |            |   |              |   |
| Disease Status prior to 2nd Tx (Relapse vs CR)                             | 1.187      | 0.817 |              |       | 2.277           | 0.431  |              |       | 0.044                | 0.532 |              |   | 0.042      | 0.653 |              |       | 1.094      | 0.931  |              |       | 1.094      | 0.931  |              |       |            |   |              |   |
| Change donor (No vs Yes)                                                   | 1.591      | 0.079 |              |       | 2.032           | 0.032  | 2.317        | 0.032 | 0.927                | 0.831 |              |   | 0.724      | 0.597 |              |       | 2.146      | 0.022  |              |       | 2.058      | 0.026  | 3.125        | 0.036 |            |   |              |   |
| 2nd Donor Age (<Median vs ≥Median)                                         | 0.758      | 0.307 |              |       | 0.817           | 0.535  |              |       | 1.258                | 0.543 |              |   | 0.720      | 0.589 |              |       | 1.002      | 0.995  |              |       | 0.917      | 0.796  |              |       |            |   |              |   |
| 2nd Donor Gender (Male vs Female)                                          | 0.571      | 0.054 |              |       | 0.501           | 0.053  |              |       | 1.188                | 0.640 |              |   | 3.698      | 0.037 |              |       | 0.673      | 0.231  |              |       | 0.608      | 0.120  |              |       |            |   |              |   |
| 2nd Donor Type                                                             |            |       |              |       |                 |        |              |       |                      |       |              |   |            |       |              |       |            |        |              |       |            |        |              |       |            |   |              |   |
| MRD                                                                        | 1.000      |       |              |       | 1.000           |        |              |       | 1.000                |       |              |   | 1.000      |       |              |       | 1.000      |        |              |       | 1.000      |        |              |       |            |   |              |   |
| URD                                                                        | 0.437      | 0.205 |              |       | 0.492           | 0.28   |              |       | 1.894                | 0.602 |              |   |            |       |              |       |            |        |              |       |            |        |              |       |            |   |              |   |
| CB                                                                         | 1.377      | 0.676 |              |       | 2.941           | 0.215  |              |       | 3.548                | 0.303 |              |   |            |       |              |       | 1.259      | 0.818  |              |       | 0.849      | 0.858  |              |       |            |   |              |   |
| Haplo                                                                      | 0.824      | 0.712 |              |       | 2.075           | 0.176  |              |       | 3.107                | 0.266 |              |   | 1.243      | 0.836 |              |       | 1.651      | 0.491  |              |       | 1.201      | 0.761  |              |       |            |   |              |   |
| ABO of 2nd Tx (Matched/Minor mismatched vs Major/Bidirectional mismatched) | 0.724      | 0.452 |              |       | 0.889           | 0.515  |              |       | 0.855                | 0.679 |              |   | 1.012      | 0.623 |              |       | 0.895      | 0.442  |              |       | 0.750      | 0.323  |              |       |            |   |              |   |
| Conditioning Regimen of 2nd Tx (FC vs Other)                               | 0.401      | 0.002 | 0.393        | 0.049 | 0.661           | 0.203  |              |       | 0.579                | 0.136 |              |   | 0.272      | 0.043 |              |       | 0.649      | 0.258  |              |       | 0.717      | 0.365  |              |       |            |   |              |   |
| Graft Source of 2nd Tx                                                     |            |       |              |       |                 |        |              |       |                      |       |              |   |            |       |              |       |            |        |              |       |            |        |              |       |            |   |              |   |
| PB+BM                                                                      | 1.000      |       |              |       | 1.000           |        |              |       | 1.000                |       |              |   | 1.000      |       |              |       | 1.000      |        |              |       | 1.000      |        |              |       |            |   |              |   |
| PB                                                                         | 1.639      | 0.066 |              |       | 1.667           | 0.113  |              |       | 0.958                | 0.907 |              |   | 0.841      | 0.779 |              |       | 1.666      | 0.144  |              |       | 1.567      | 0.186  |              |       |            |   |              |   |
| CB                                                                         | 2.299      | 0.173 |              |       | 2.188           | 0.291  |              |       | 1.237                | 0.780 |              |   |            |       |              |       | 1.178      | 0.829  |              |       | 1.044      | 0.955  |              |       |            |   |              |   |
| Infused MNCs (<Median vs ≥Median)                                          | 1.686      | 0.051 |              |       | 1.999           | 0.03   |              |       | 1.003                | 0.994 |              |   | 2.270      | 0.252 |              |       | 1.351      | 0.359  |              |       | 1.164      | 0.634  |              |       |            |   |              |   |
| Infused CD34 cells (<Median vs ≥Median)                                    | 2.292      | 0.007 |              |       | 4.180           | <0.001 | 3.265        | 0.018 | 0.692                | 0.381 |              |   | 2.175      | 0.344 |              |       | 2.475      | 0.035  |              |       | 2.611      | 0.025  |              |       |            |   |              |   |
| GVHD Prophylaxis for 2nd Tx (Other vs Intensified)                         | 2.150      | 0.006 |              |       | 3.778           | <0.001 | 4.262        | 0.027 | 1.426                | 0.341 |              |   | 1.555      | 0.574 |              |       | 3.021      | <0.001 | 4.717        | 0.008 | 2.959      | <0.001 | 4.184        | 0.014 |            |   |              |   |

Supplementary Table 13. Univariate and multivariate analysis for 2nd transplant outcomes in patients with full donor chimerisms.

Abbreviations: AA, aplastic anemia; GF, graft failure; MRD, matched related donor; URD, unrelated donor; CB, cord blood; Haplo, haploidentical transplantation; Tx, transplantation; DSA, Donor specific antibody; CR, complete remission; FC, fludarabine/cyclophosphamide; BM, bone marrow; PB, peripheral blood; MNCs, mononucleated cells; GVHD, graft versus host disease.

| Variables                                                                  | Outcomes |  | ANC Engraftment |       |              |       | Platelet Engraftment |       |              |   | aGVHD      |       |              |   | cGVHD      |       |              |   | TRM        |       |              |   | OS         |       |              |   |
|----------------------------------------------------------------------------|----------|--|-----------------|-------|--------------|-------|----------------------|-------|--------------|---|------------|-------|--------------|---|------------|-------|--------------|---|------------|-------|--------------|---|------------|-------|--------------|---|
|                                                                            |          |  | Univariate      |       | Multivariate |       | Univariate           |       | Multivariate |   | Univariate |       | Multivariate |   | Univariate |       | Multivariate |   | Univariate |       | Multivariate |   | Univariate |       | Multivariate |   |
|                                                                            |          |  | HR              | P     | HR           | P     | HR                   | P     | HR           | P | HR         | P     | HR           | P | HR         | P     | HR           | P | HR         | P     | HR           | P | HR         | P     | HR           | P |
| Recipient Gender (Male vs Female)                                          |          |  | 0.837           | 0.428 |              | 0.794 | 0.378                |       |              |   | 1.176      | 0.661 |              |   | 0.900      | 0.841 |              |   | 0.926      | 0.817 |              |   | 0.917      | 0.787 |              |   |
| Recipient Age (<Median vs ≥Median)                                         |          |  | 0.813           | 0.348 |              |       | 0.697                | 0.160 |              |   | 0.958      | 0.906 |              |   | 0.905      | 0.848 |              |   | 0.768      | 0.427 |              |   | 0.784      | 0.451 |              |   |
| Disease (AA vs Other)                                                      |          |  | 0.930           | 0.757 |              |       | 0.644                | 0.096 |              |   | 1.183      | 0.673 |              |   | 1.453      | 0.523 |              |   | 1.182      | 0.624 |              |   | 1.089      | 0.799 |              |   |
| 1st Donor Type                                                             |          |  |                 |       |              |       |                      |       |              |   |            |       |              |   |            |       |              |   |            |       |              |   |            |       |              |   |
| MRD                                                                        |          |  | 1.000           |       |              |       | 1.000                |       |              |   | 1.000      |       |              |   | 1.000      |       |              |   | 1.000      |       |              |   | 1.000      |       |              |   |
| URD                                                                        |          |  | 1.019           | 0.965 |              |       | 1.859                | 0.202 |              |   | 2.605      | 0.191 |              |   | 1.024      | 0.985 |              |   | 3.108      | 0.121 |              |   | 3.174      | 0.115 |              |   |
| CB                                                                         |          |  | 1.524           | 0.271 |              |       | 1.653                | 0.241 |              |   | 0.888      | 0.885 |              |   | 4.724      | 0.058 |              |   | 3.380      | 0.069 |              |   | 3.458      | 0.064 |              |   |
| Haplo                                                                      |          |  | 2.203           | 0.015 |              |       | 1.992                | 0.050 |              |   | 2.005      | 0.263 |              |   | 1.286      | 0.759 |              |   | 2.400      | 0.159 |              |   | 2.695      | 0.109 |              |   |
| GF Type (Primary vs Secondary)                                             |          |  | 0.939           | 0.781 |              |       | 1.737                | 0.036 |              |   | 0.838      | 0.641 |              |   | 0.819      | 0.716 |              |   | 1.689      | 0.159 |              |   | 1.605      | 0.186 |              |   |
| Time from 1st Tx to 2nd Tx (<Median vs ≥Median)                            |          |  | 1.134           | 0.571 |              |       | 1.855                | 0.021 |              |   | 0.511      | 0.075 |              |   | 0.612      | 0.345 |              |   | 1.832      | 0.077 |              |   | 1.815      | 0.073 |              |   |
| DSA prior to 2nd Tx (Neg. vs Pos.)                                         |          |  | 0.482           | 0.077 |              |       | 0.341                | 0.042 |              |   | 0.636      | 0.547 |              |   | 0.039      | 0.405 |              |   | 0.525      | 0.207 |              |   | 0.539      | 0.232 |              |   |
| Disease Status prior to 2nd Tx (Relapse vs CR)                             |          |  | 1.081           | 0.841 |              |       | 1.366                | 0.488 |              |   | 1.050      | 0.940 |              |   | 0.036      | 0.456 |              |   | 1.642      | 0.508 |              |   | 1.232      | 0.741 |              |   |
| Change donor (No vs Yes)                                                   |          |  | 1.583           | 0.073 |              |       | 1.552                | 0.151 |              |   | 1.002      | 0.996 |              |   | 2.657      | 0.198 |              |   | 1.425      | 0.304 |              |   | 1.477      | 0.242 |              |   |
| 2nd Donor Age (<Median vs ≥Median)                                         |          |  | 0.667           | 0.090 |              |       | 0.636                | 0.104 |              |   | 1.194      | 0.645 |              |   | 1.264      | 0.690 |              |   | 0.913      | 0.795 |              |   | 0.930      | 0.831 |              |   |
| 2nd Donor Gender (Male vs Female)                                          |          |  | 1.285           | 0.256 |              |       | 1.285                | 0.330 |              |   | 1.123      | 0.751 |              |   | 0.944      | 0.911 |              |   | 0.949      | 0.874 |              |   | 0.968      | 0.920 |              |   |
| 2nd Donor Type                                                             |          |  |                 |       |              |       |                      |       |              |   |            |       |              |   |            |       |              |   |            |       |              |   |            |       |              |   |
| MRD                                                                        |          |  | 1.000           |       |              |       | 1.000                |       |              |   | 1.000      |       |              |   | 1.000      |       |              |   | 1.000      |       |              |   | 1.000      |       |              |   |
| URD                                                                        |          |  | 1.996           | 0.244 |              |       | 1.458                | 0.532 |              |   | 3.679      | 0.934 |              |   | 1.480      | 0.948 |              |   | 3.087      | 0.171 |              |   | 3.214      | 0.157 |              |   |
| CB                                                                         |          |  | 3.021           | 0.066 |              |       | 2.101                | 0.267 |              |   | 5.03       | 0.932 |              |   | 1.347      | 0.948 |              |   | 1.063      | 0.958 |              |   | 1.096      | 0.937 |              |   |
| Haplo                                                                      |          |  | 2.331           | 0.015 |              |       | 2.004                | 0.058 |              |   | 8.219      | 0.929 |              |   | 0.756      | 0.957 |              |   | 1.595      | 0.443 |              |   | 1.707      | 0.378 |              |   |
| ABO of 2nd Tx (Matched/Minor mismatched vs Major/Bidirectional mismatched) |          |  | 0.823           | 0.379 |              |       | 0.563                | 0.488 |              |   | 0.889      | 0.420 |              |   | 0.753      | 0.369 |              |   | 0.562      | 0.236 |              |   | 0.723      | 0.412 |              |   |
| Conditioning Regimen of 2nd Tx (FC vs Other)                               |          |  | 1.144           | 0.566 |              |       | 1.417                | 0.211 |              |   | 1.099      | 0.817 |              |   | 1.256      | 0.700 |              |   | 1.603      | 0.165 |              |   | 1.490      | 0.232 |              |   |
| Graft Source of 2nd Tx                                                     |          |  |                 |       |              |       |                      |       |              |   |            |       |              |   |            |       |              |   |            |       |              |   |            |       |              |   |
| PB+BM                                                                      |          |  | 1.000           |       |              |       | 1.000                |       |              |   | 1.000      |       |              |   | 1.000      |       |              |   | 1.000      |       |              |   | 1.000      |       |              |   |
| PB                                                                         |          |  | 1.550           | 0.053 |              |       | 0.840                | 0.507 |              |   | 0.434      | 0.033 |              |   | 0.747      | 0.590 |              |   | 0.645      | 0.200 |              |   | 0.746      | 0.373 |              |   |
| CB                                                                         |          |  | 1.761           | 0.282 |              |       | 1.059                | 0.925 |              |   | 0.513      | 0.516 |              |   | 1.742      | 0.602 |              |   | 0.549      | 0.558 |              |   | 0.565      | 0.578 |              |   |
| Infused MNCs (<Median vs ≥Median)                                          |          |  | 1.135           | 0.564 |              |       | 1.288                | 0.325 |              |   | 1.175      | 0.662 |              |   | 2.058      | 0.188 |              |   | 1.616      | 0.152 |              |   | 1.572      | 0.165 |              |   |
| Infused CD34 cells (<Median vs ≥Median)                                    |          |  | 1.100           | 0.674 |              |       | 1.504                | 0.130 |              |   | 0.595      | 0.169 |              |   | 1.256      | 0.660 |              |   | 1.935      | 0.597 |              |   | 1.297      | 0.436 |              |   |
| GVHD Prophylaxis for 2nd Tx (Other vs Intensified)                         |          |  | 1.155           | 0.626 |              |       | 1.048                | 0.898 |              |   | 1.805      | 0.332 |              |   | 3.763      | 0.201 |              |   | 0.579      | 0.303 |              |   | 0.686      | 0.433 |              |   |

Supplementary Table 14. Univariate and multivariate analysis for 2nd transplant outcomes in patients with mixed chimerisms.

Abbreviations: AA, aplastic anemia; GF, graft failure; MRD, matched related donor; URD, unrelated donor; CB, cord blood; Haplo, haploidentical transplantation; Tx, transplantation; DSA, Donor specific antibody; CR, complete remission; FC, fludarabine/cyclophosphamide; BM, bone marrow; PB, peripheral blood; MNCs, mononucleated cells; GVHD, graft versus host disease.

| Variables                                                                  | Outcomes |  | ANC Engraftment |       |              |       | Platelet Engraftment |       |              |       | aGVHD      |       |              |   | cGVHD      |       |              |       | TRM        |       |              |       | OS         |       |              |       |
|----------------------------------------------------------------------------|----------|--|-----------------|-------|--------------|-------|----------------------|-------|--------------|-------|------------|-------|--------------|---|------------|-------|--------------|-------|------------|-------|--------------|-------|------------|-------|--------------|-------|
|                                                                            |          |  | Univariate      |       | Multivariate |       | Univariate           |       | Multivariate |       | Univariate |       | Multivariate |   | Univariate |       | Multivariate |       | Univariate |       | Multivariate |       | Univariate |       | Multivariate |       |
|                                                                            |          |  | HR              | P     | HR           | P     | HR                   | P     | HR           | P     | HR         | P     | HR           | P | HR         | P     | HR           | P     | HR         | P     | HR           | P     | HR         | P     | HR           | P     |
| Recipient Gender (Male vs Female)                                          |          |  | 0.957           | 0.856 |              |       | 1.015                | 0.957 |              |       | 0.680      | 0.306 |              |   | 13.895     | 0.012 | 11.030       | 0.023 | 1.269      | 0.490 |              |       | 1.350      | 0.363 |              |       |
| Recipient Age (<Median vs ≥Median)                                         |          |  | 0.950           | 0.835 |              |       | 0.589                | 0.069 |              |       | 1.228      | 0.584 |              |   | 2.013      | 0.236 |              |       | 0.726      | 0.354 |              |       | 0.710      | 0.296 |              |       |
| Disease (AA vs Other)                                                      |          |  | 0.958           | 0.888 |              |       | 1.057                | 0.877 |              |       | 2.532      | 0.128 |              |   | 3.279      | 0.221 |              |       | 0.851      | 0.721 |              |       | 0.736      | 0.491 |              |       |
| 1st Donor Type                                                             |          |  |                 |       |              |       |                      |       |              |       |            |       |              |   |            |       |              |       |            |       |              |       |            |       |              |       |
| MRD                                                                        |          |  | 1.000           |       |              |       | 1.000                |       |              |       | 1.000      |       |              |   | 1.000      |       |              |       | 1.000      |       |              |       | 1.000      |       |              |       |
| URD                                                                        |          |  | 0.980           | 0.977 |              |       | 0.846                | 0.827 |              |       | 2.130      | 0.915 |              |   |            |       |              |       | 1.350      | 0.765 |              |       | 2.061      | 0.429 |              |       |
| CB                                                                         |          |  | 1.464           | 0.482 |              |       | 0.464                | 0.249 |              |       | 1.644      | 0.917 |              |   | 3.349      | 0.964 |              |       | 1.349      | 0.721 |              |       | 1.341      | 0.726 |              |       |
| Haplo                                                                      |          |  | 2.119           | 0.117 |              |       | 0.938                | 0.916 |              |       | 2.958      | 0.912 |              |   | 1.084      | 0.960 |              |       | 1.545      | 0.555 |              |       | 1.805      | 0.421 |              |       |
| GF Type (Primary vs Secondary)                                             |          |  | 1.300           | 0.393 |              |       | 1.256                | 0.507 |              |       | 1.346      | 0.494 |              |   | 0.635      | 0.559 |              |       | 1.263      | 0.604 |              |       | 1.203      | 0.658 |              |       |
| Chimerism                                                                  |          |  |                 |       |              |       |                      |       |              |       |            |       |              |   |            |       |              |       |            |       |              |       |            |       |              |       |
| Full donor                                                                 |          |  | 1.000           |       |              |       | 1.000                |       |              |       | 1.000      |       |              |   | 1.000      |       |              |       | 1.000      |       |              |       | 1.000      |       |              |       |
| Mixed                                                                      |          |  | 1.770           | 0.060 | 2.865        | 0.015 | 1.381                | 0.350 |              |       | 0.421      | 0.051 |              |   | 0.461      | 0.217 |              |       | 1.272      | 0.565 |              |       | 1.115      | 0.789 |              |       |
| Full recipient                                                             |          |  | 1.692           | 0.109 | 1.934        | 0.170 | 1.066                | 0.861 |              |       | 0.546      | 0.187 |              |   | 0.151      | 0.077 |              |       | 1.034      | 0.943 |              |       | 1.212      | 0.654 |              |       |
| Time from 1st Tx to 2nd Tx (<Median vs ≥Median)                            |          |  | 1.891           | 0.013 |              |       | 1.322                | 0.334 |              |       | 1.141      | 0.725 |              |   | 1.366      | 0.612 |              |       | 1.927      | 0.063 | 0.204        | 0.028 | 1.637      | 0.134 |              |       |
| DSA prior to 2nd Tx (Neg. vs Pos.)                                         |          |  | 0.492           | 0.072 |              |       | 0.595                | 0.244 |              |       | 1.693      | 0.318 |              |   | 0.940      | 0.938 |              |       | 1.789      | 0.445 |              |       | 1.534      | 0.497 |              |       |
| Disease Status prior to 2nd Tx (Relapse vs CR)                             |          |  | 0.048           | 0.907 |              |       | 0.047                | 0.588 |              |       | 0.047      | 0.838 |              |   |            |       |              |       | 0.089      | 0.036 |              |       | 0.808      | 0.036 |              |       |
| Change donor (No vs Yes)                                                   |          |  | 1.692           | 0.065 |              |       | 1.780                | 0.105 |              |       | 1.077      | 0.858 |              |   | 0.949      | 0.938 |              |       | 2.421      | 0.010 | 0.373        | 0.006 | 1.988      | 0.037 | 2.179        | 0.034 |
| 2nd Donor Age (<Median vs ≥Median)                                         |          |  | 0.871           | 0.592 |              |       | 0.719                | 0.275 |              |       | 1.940      | 0.105 |              |   | 0.856      | 0.798 |              |       | 0.807      | 0.552 |              |       | 0.645      | 0.208 |              |       |
| 2nd Donor Gender (Male vs Female)                                          |          |  | 1.014           | 0.954 |              |       | 0.744                | 0.304 |              |       | 0.877      | 0.723 |              |   | 1.154      | 0.807 |              |       | 0.733      | 0.737 |              |       | 0.768      | 0.423 |              |       |
| 2nd Donor Type                                                             |          |  |                 |       |              |       |                      |       |              |       |            |       |              |   |            |       |              |       |            |       |              |       |            |       |              |       |
| MRD                                                                        |          |  | 1.000           |       |              |       | 1.000                |       |              |       | 1.000      |       |              |   | 1.000      |       |              |       | 1.000      |       |              |       | 1.000      |       |              |       |
| URD                                                                        |          |  | 1.812           | 0.418 | 1.282        | 0.073 | 0.773                | 0.755 |              |       | 3.874      | 0.945 |              |   |            |       |              |       | 2.264      | 0.417 |              |       | 2.461      | 0.371 |              |       |
| CB                                                                         |          |  | 3.891           | 0.066 | 4.167        | 0.012 | 1.353                | 0.741 |              |       | 4.058      | 0.945 |              |   | 3.055      | 0.957 |              |       | 2.170      | 0.442 |              |       | 2.414      | 0.382 |              |       |
| Haplo                                                                      |          |  | 1.805           | 0.211 | 1.064        | 0.064 | 0.817                | 0.736 |              |       | 7.662      | 0.942 |              |   | 8.532      | 0.961 |              |       | 1.437      | 0.621 |              |       | 1.684      | 0.475 |              |       |
| ABO of 2nd Tx (Matched/Minor mismatched vs Major/Bidirectional mismatched) |          |  | 0.889           | 0.457 |              |       | 0.647                | 0.236 |              |       | 0.995      | 0.675 |              |   | 1.104      | 0.744 |              |       | 0.614      | 0.522 |              |       | 0.852      | 0.324 |              |       |
| Graft Source of 2nd Tx                                                     |          |  |                 |       |              |       |                      |       |              |       |            |       |              |   |            |       |              |       |            |       |              |       |            |       |              |       |
| PB+BM                                                                      |          |  | 1.000           |       |              |       | 1.000                |       |              |       | 1.000      |       |              |   | 1.000      |       |              |       | 1.000      |       |              |       | 1.000      |       |              |       |
| PB                                                                         |          |  | 1.838           | 0.025 |              |       | 1.894                | 0.046 |              |       | 1.754      | 0.179 |              |   | 0.725      | 0.635 |              |       | 1.484      | 0.267 |              |       | 1.191      | 0.606 |              |       |
| CB                                                                         |          |  | 2.890           | 0.078 |              |       | 2.075                | 0.317 |              |       | 1.992      | 0.502 |              |   | 3.713      | 0.238 |              |       | 1.782      | 0.443 |              |       | 1.556      | 0.554 |              |       |
| Infused MNCs (<Median vs ≥Median)                                          |          |  | 1.462           | 0.124 |              |       | 1.657                | 0.081 | 1.895        | 0.037 | 0.970      | 0.937 |              |   | 1.007      | 0.990 |              |       | 1.385      | 0.347 |              |       | 1.458      | 0.253 |              |       |
| Infused CD34 cells (<Median vs ≥Median)                                    |          |  | 1.234           | 0.403 |              |       | 1.437                | 0.214 |              |       | 0.527      | 0.112 |              |   | 2.722      | 0.139 |              |       | 1.637      | 0.187 |              |       | 1.957      | 0.062 | 2.208        | 0.031 |
| GVHD Prophylaxis for 2nd Tx (Other vs intensified)                         |          |  | 3.788           | 0.025 |              |       | 5.902                | 0.079 |              |       | 2.304      | 0.285 |              |   | 2.141      | 0.642 |              |       | 3.922      | 0.001 |              |       | 3.472      | 0.003 |              |       |

Supplementary Table 15. Univariate and multivariate analysis for 2nd transplant outcomes in patients receving FC-based conditioning regimens.

Abbreviations: AA, aplastic anemia; GF, graft failure; MRD, matched related donor; URD, unrelated donor; CB, cord blood; Haplo, haploidentical transplantation; Tx, transplantation; DSA, Donor specific antibody; CR, complete remission; FC, fludarabine/cyclophosphamide; BM, bone marrow; PB, peripheral blood; MNCs, mononucleated cells; GVHD, graft versus host disease.

| Variables                                                                  | Outcomes |  | ANC Engraftment |        |              |   | Platelet Engraftment |        |              |        | aGVHD      |       |              |   | cGVHD      |       |              |       | TRM        |   |              |       | OS         |   |              |   |
|----------------------------------------------------------------------------|----------|--|-----------------|--------|--------------|---|----------------------|--------|--------------|--------|------------|-------|--------------|---|------------|-------|--------------|-------|------------|---|--------------|-------|------------|---|--------------|---|
|                                                                            |          |  | Univariate      |        | Multivariate |   | Univariate           |        | Multivariate |        | Univariate |       | Multivariate |   | Univariate |       | Multivariate |       | Univariate |   | Multivariate |       | Univariate |   | Multivariate |   |
|                                                                            |          |  | HR              | P      | HR           | P | HR                   | P      | HR           | P      | HR         | P     | HR           | P | HR         | P     | HR           | P     | HR         | P | HR           | P     | HR         | P | HR           | P |
| Recipient Gender (Male vs Female)                                          |          |  | 1.528           | 0.189  |              |   | 0.811                | 0.595  |              |        | 0.832      | 0.718 |              |   | 0.294      | 0.275 | 1.852        | 0.199 |            |   | 1.605        | 0.297 |            |   |              |   |
| Recipient Age (<Median vs ≥Median)                                         |          |  | 0.788           | 0.452  |              |   | 0.438                | 0.034  |              |        | 1.467      | 0.437 |              |   | 2.560      | 0.303 | 0.421        | 0.052 |            |   | 0.470        | 0.079 | 0.757      |   | 0.019        |   |
| Disease (AA vs Other)                                                      |          |  | 0.999           | 0.991  |              |   | 1.026                | 0.799  |              |        | 1.122      | 0.402 |              |   | 0.921      | 0.731 | 1.174        | 0.209 |            |   | 1.189        | 0.169 |            |   |              |   |
| 1st Donor Type                                                             |          |  |                 |        |              |   |                      |        |              |        |            |       |              |   |            |       |              |       |            |   |              |       |            |   |              |   |
| MRD                                                                        |          |  | 1.000           |        |              |   | 1.000                |        |              |        | 1.000      |       |              |   | 1.000      |       |              |       |            |   | 1.000        |       |            |   |              |   |
| URD                                                                        |          |  | 6.579           | 0.051  |              |   | 3.726                | 0.262  |              |        | 7.029      | 0.927 |              |   |            |       | 5.600        | 0.922 |            |   | 5.292        | 0.918 |            |   |              |   |
| CB                                                                         |          |  | 5.882           | 0.027  |              |   | 1.553                | 0.671  |              |        | 7.084      | 0.927 |              |   | 0.290      | 0.314 | 5.782        | 0.922 |            |   | 6.251        | 0.917 |            |   |              |   |
| Haplo                                                                      |          |  | 9.804           | 0.005  |              |   | 1.692                | 0.618  |              |        | 1.167      | 0.923 |              |   | 0.332      | 0.369 | 1.734        | 0.912 |            |   | 1.609        | 0.908 |            |   |              |   |
| GF Type (Primary vs Secondary)                                             |          |  | 0.946           | 0.884  |              |   | 1.171                | 0.731  |              |        | 0.219      | 0.141 |              |   | 5.083      | 0.076 | 1.610        | 0.443 |            |   | 1.712        | 0.386 |            |   |              |   |
| Chimerism                                                                  |          |  |                 |        |              |   |                      |        |              |        |            |       |              |   |            |       |              |       |            |   |              |       |            |   |              |   |
| Full donor                                                                 |          |  | 1.000           |        |              |   | 1.000                |        |              |        | 1.000      |       |              |   | 1.000      |       |              |       |            |   | 1.000        |       |            |   |              |   |
| Mixed                                                                      |          |  | 0.371           | 0.022  |              |   | 0.189                | 0.012  |              |        | 1.001      | 0.999 |              |   | 0.740      | 0.763 | 0.311        | 0.047 |            |   | 0.308        | 0.045 |            |   |              |   |
| Full recipient                                                             |          |  | 0.460           | 0.062  |              |   | 0.181                | 0.008  |              |        | 1.093      | 0.883 |              |   | 0.246      | 0.255 | 0.253        | 0.012 |            |   | 0.302        | 0.019 |            |   |              |   |
| Time from 1st Tx to 2nd Tx (<Median vs ≥Median)                            |          |  | 0.478           | 0.021  |              |   | 0.568                | 0.140  |              |        | 0.590      | 0.285 |              |   | 2.197      | 0.390 | 0.452        | 0.074 |            |   | 0.508        | 0.114 |            |   |              |   |
| DSA prior to 2nd Tx (Neg. vs Pos.)                                         |          |  | 0.993           | 0.994  |              |   | 0.040                | 0.373  |              |        | 0.046      | 0.656 |              |   |            |       | 0.107        | 0.069 |            |   | 0.107        | 0.069 |            |   |              |   |
| Change donor (No vs Yes)                                                   |          |  | 1.810           | 0.075  |              |   | 3.422                | 0.008  | 0.180        | 0.027  | 1.204      | 0.715 |              |   | 0.282      | 0.166 | 2.551        | 0.029 |            |   | 2.315        | 0.045 | 6.358      |   | 0.025        |   |
| 2nd Donor Age (<Median vs ≥Median)                                         |          |  | 0.756           | 0.407  |              |   | 1.102                | 0.808  |              |        | 1.089      | 0.864 |              |   | 0.014      | 0.303 | 1.287        | 0.595 |            |   | 0.861        | 0.745 |            |   |              |   |
| 2nd Donor Gender (Male vs Female)                                          |          |  | 0.699           | 0.279  |              |   | 1.008                | 0.984  |              |        | 1.413      | 0.485 |              |   | 0.401      | 0.417 | 0.898        | 0.808 |            |   | 0.979        | 0.962 |            |   |              |   |
| 2nd Donor Type                                                             |          |  |                 |        |              |   |                      |        |              |        |            |       |              |   |            |       |              |       |            |   |              |       |            |   |              |   |
| MRD                                                                        |          |  | 1.000           |        |              |   | 1.000                |        |              |        | 1.000      |       |              |   | 1.000      |       |              |       |            |   | 1.000        |       |            |   |              |   |
| URD                                                                        |          |  | 4.348           | 0.112  |              |   | 1.922                | 0.468  |              |        |            |       |              |   |            |       | 6.111        | 0.952 |            |   | 6.032        | 0.950 |            |   |              |   |
| CB                                                                         |          |  | 3.125           | <0.001 |              |   | 11.63                | 0.030  |              |        | 3.238      | 0.959 |              |   |            |       |              |       |            |   |              |       |            |   |              |   |
| Haplo                                                                      |          |  | 6.803           | 0.002  |              |   | 3.058                | 0.044  |              |        | 8.952      | 0.955 |              |   | 0.613      | 0.663 | 8.145        | 0.950 |            |   | 8.249        | 0.949 |            |   |              |   |
| ABO of 2nd Tx (Matched/Minor mismatched vs Major/Bidirectional mismatched) |          |  | 0.723           | 0.557  |              |   | 0.679                | 0.231  |              |        | 0.782      | 0.431 |              |   | 1.064      | 0.894 | 0.623        | 0.246 |            |   | 0.741        | 0.356 |            |   |              |   |
| Graft Source of 2nd Tx                                                     |          |  |                 |        |              |   |                      |        |              |        |            |       |              |   |            |       |              |       |            |   |              |       |            |   |              |   |
| PB+BM                                                                      |          |  | 1.000           |        |              |   | 1.000                |        |              |        | 1.000      |       |              |   | 1.000      |       |              |       |            |   | 1.000        |       |            |   |              |   |
| PB                                                                         |          |  | 3.205           | 0.001  |              |   | 2.857                | 0.013  |              |        | 0.596      | 0.318 |              |   | 3.115      | 0.213 | 3.215        | 0.013 |            |   | 2.817        | 0.022 |            |   |              |   |
| CB                                                                         |          |  | 11.23           | 0.002  |              |   | 6.803                | 0.062  |              |        | 0.350      | 0.317 |              |   |            |       | 1.627        | 0.545 |            |   | 1.461        | 0.632 |            |   |              |   |
| Infused MNCs (<Median vs ≥Median)                                          |          |  | 3.012           | 0.002  |              |   | 4.552                | 0.001  | 3.871        | 0.042  | 0.904      | 0.840 |              |   | 1.198      | 0.843 | 2.801        | 0.025 |            |   | 0.405        | 0.039 |            |   |              |   |
| Infused CD34 cells (<Median vs ≥Median)                                    |          |  | 2.973           | 0.006  |              |   | 3.291                | 0.007  |              |        | 1.400      | 0.546 |              |   | 0.810      | 0.833 | 2.532        | 0.094 |            |   | 2.950        | 0.049 | 7.874      |   | 0.048        |   |
| GVHD Prophylaxis for 2nd Tx (Other vs intensified)                         |          |  | 2.370           | 0.009  |              |   | 5.123                | <0.001 | 2.013        | <0.001 | 1.359      | 0.529 |              |   | 1.386      | 0.772 | 2.045        | 0.108 |            |   | 2.183        | 0.075 | 6.098      |   | 0.029        |   |

Supplementary Table 16. Univariate and multivariate analysis for 2nd transplant outcomes in patients receving TBI-based conditioning regimens.

Abbreviations: AA, aplastic anemia; GF, graft failure; MRD, matched related donor; URD, unrelated donor; CB, cord blood; Haplo, haploidentical transplantation; Tx, transplantation; DSA, Donor specific antibody; CR, complete remission; FC, fludarabine/cyclophosphamide; BM, bone marrow; PB, peripheral blood; MNCs, mononucleated cells; GVHD, graft versus host disease.