

## Description of Additional Supplementary Files

File name: Supplementary Data 1

Description: Species co-abundance network. SparCC was applied to assess the correlation coefficient of microbial co-abundances and Cochran-Q was conducted to assess the heterogeneity of correlation coefficients.

File name: Supplementary Data 2

Description: Species co-occurrence network. Co-occurrence strength was indicated by odds-ratio and Cochran-Q was conducted to assess the heterogeneity of odds-ratios.

File name: Supplementary Data 3

Description: Pathway co-abundance network. SparCC was applied to assess the correlation coefficient of microbial co-abundances and Cochran-Q was conducted to assess the heterogeneity of correlation coefficients.

File name: Supplementary Data 4

Description: Pathway co-occurrence network. Co-occurrence strength was indicated by odds-ratio and Cochran-Q was conducted to assess the heterogeneity of odds-ratios.

File name: Supplementary Data 5

Description: Summary of species co-abundance network. Differential microbial species abundance among cohorts was assessed with ANOVA test with correction for age and sex.

File name: Supplementary Data 6

Description: Summary of pathway co-abundance network. Differential microbial pathway abundance among cohorts was assessed with ANOVA test with correction for age and sex.

File name: Supplementary Data 7

Description: Replication of IBD species co-abundance. SparCC was applied to assess the correlation coefficient of microbial co-abundances and Cochran-Q was conducted to assess the heterogeneity of correlation coefficients.

File name: Supplementary Data 8

Description: Replication of IBD pathway co-abundance. SparCC was applied to assess the correlation coefficient of microbial co-abundances and Cochran-Q was conducted to assess the heterogeneity of correlation coefficients.

File name: Supplementary Data 9

Description: Relevance of phenotypes to IBD species co-abundance. SparCC was applied to assess the correlation coefficient of microbial co-abundances and Cochran-Q was conducted to assess the heterogeneity of correlation coefficients.

File name: Supplementary Data 10

Description: Relevance of phenotypes to IBD pathway co-abundance. SparCC was applied to assess the correlation coefficient of microbial co-abundances and Cochran-Q was conducted to assess the heterogeneity of correlation coefficients.

File name: Supplementary Data 11

Description: Pathway contributed by dominant species in each cohort.

File name: Supplementary Data 12

Description: Correlation between species and pathway abundance. Spearman correlation was applied to assess correlation between microbial species and pathway abundance with adjustment of age and sex.

File name: Supplementary Data 13

Description: Replication and relevance of phenotypes to 300OB species co-abundance. SparCC was applied to assess the correlation coefficient of microbial co-abundances and Cochran-Q was conducted to assess the heterogeneity of correlation coefficients.

File name: Supplementary Data 14

Description: Replication and relevance of phenotypes to 300OB pathway co-abundance. SparCC was applied to assess the correlation coefficient of microbial co-abundances and Cochran-Q was conducted to assess the heterogeneity of correlation coefficients.

File name: Supplementary Data 15

Description: Summary of species co-occurrence network.

File name: Supplementary Data 16

Description: Summary of pathway co-occurrence network.