

SUPPLEMENTARY TABLES & FIGURES

Integrating genetics and transcriptomics to characterize shared mechanisms in digestive diseases and psychiatric disorders

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Supplementary Table 1. SNP based heritability estimated by LDSC

| Phenotype | Heritability(h2) | Heritability SE |
|--|-------------------------|------------------------|
| Irritable bowel syndrome | 0.0249 | 0.0015 |
| Gastroesophageal reflux disease | 0.0676 | 0.0027 |
| Peptic ulcer | 0.0106 | 0.0013 |
| Acute pancreatitis | 0.0034 | 0.0006 |
| Non-alcoholic fatty liver disease | 0.0015 | 0.0006 |
| Appendicitis | 0.0022 | 0.001 |
| Colorectal cancer | 0.1011 | 0.0094 |
| Inflammatory bowel disease | 0.3114 | 0.0306 |
| Crohn's disease | 0.181 | 0.0201 |
| Ulcerative colitis | 0.4442 | 0.051 |
| Stool frequency | 0.0685 | 0.0047 |
| Diverticular disease | 0.0347 | 0.002 |
| Gastritis-duodenitis | 0.0155 | 0.0014 |
| Cholelithiasis and cholecystitis | 0.0182 | 0.002 |
| Anxiety, panic disorder | 0.0065 | 0.001 |
| Neuroticism | 0.0927 | 0.0039 |
| Major depressive disorder | 0.0377 | 0.0015 |
| Schizophrenia | 0.3697 | 0.0129 |
| Attention-deficit hyperactivity disorder | 0.0945 | 0.0045 |
| Autism spectrum disorder | 0.2016 | 0.0151 |
| Bipolar disorder | 0.6376 | 0.0246 |
| Post traumatic stress disorder | 0.063 | 0.0115 |
| Anorexia nervosa | 0.1716 | 0.0112 |
| Depression | 0.0453 | 0.0016 |

Supplementary Table 2. Genetic correlations between psychiatric disorders and digestive diseases.

| Psychiatric conditions | Digestive conditions | rg | SE | Z | P | FDR q-value |
|--|-----------------------------------|----------|--------|---------|----------|-------------|
| Anorexia nervosa | Acute pancreatitis | -0.0892 | 0.0708 | -1.2586 | 0.2082 | 0.26025 |
| | Appendicitis | -0.0243 | 0.1024 | -0.2369 | 0.8127 | 0.855473684 |
| | Cholelithiasis and cholecystitis | -0.0969 | 0.0457 | -2.1184 | 0.0341 | 0.057518072 |
| | Crohn's disease | 0.0902 | 0.0487 | 1.8514 | 0.0641 | 0.096795699 |
| | Diverticular disease | -0.0316 | 0.0357 | -0.8847 | 0.3763 | 0.428308943 |
| | Gastritis and duodenitis | -0.0543 | 0.0685 | 0.9045 | 0.2917 | 0.34904274 |
| | Gastroesophageal reflux disease | -0.0037 | 0.0326 | -0.1136 | 0.9096 | 0.936352941 |
| | Inflammatory bowel disease | 0.0421 | 0.0403 | 1.0455 | 0.2958 | 0.350949153 |
| | Irritable bowel syndrome | 0.1355 | 0.0364 | 3.7251 | 0.0002 | 0.000482759 |
| | Non-alcoholic fatty liver disease | -0.2358 | 0.1238 | -1.9047 | 0.0568 | 0.087384615 |
| | Peptic ulcer | 0.0277 | 0.0522 | 0.5297 | 0.5963 | 0.652203125 |
| | Stool frequency | 0.0532 | 0.0404 | 1.3182 | 0.1874 | 0.238509091 |
| | Ulcerative colitis | 9.00E-04 | 0.0377 | 0.0228 | 0.9818 | 0.988863309 |
| | Colorectal cancer | -0.0418 | 0.0356 | -1.1743 | 0.2403 | 0.290017241 |
| Anxiety, panic disorder | Acute pancreatitis | 0.2403 | 0.1249 | 1.9246 | 0.0543 | 0.086177778 |
| | Appendicitis | -0.0707 | 0.1839 | -0.3842 | 0.7008 | 0.752793893 |
| | Cholelithiasis and cholecystitis | 0.1196 | 0.0761 | 1.571 | 0.1162 | 0.156423077 |
| | Crohn's disease | 0.1907 | 0.0698 | 2.7322 | 0.0063 | 0.011454545 |
| | Diverticular disease | 0.1893 | 0.0638 | 2.9651 | 0.003 | 0.006 |
| | Gastritis and duodenitis | 0.2785 | 0.1036 | 3.7791 | 0.0013 | 0.00284375 |
| | Gastroesophageal reflux disease | 0.2873 | 0.0517 | 5.5561 | 2.76E-08 | 1.04E-07 |
| | Inflammatory bowel disease | 0.1483 | 0.0575 | 2.5783 | 0.0099 | 0.017544304 |
| | Irritable bowel syndrome | 0.5437 | 0.0672 | 8.0916 | 5.89E-16 | 3.59E-15 |
| | Non-alcoholic fatty liver disease | -0.002 | 0.1741 | -0.0117 | 0.9907 | 0.9907 |
| | Peptic ulcer | 0.2769 | 0.0983 | 2.8168 | 0.0049 | 0.009146667 |
| | Stool frequency | 0.0378 | 0.0676 | 0.5598 | 0.5756 | 0.639555556 |
| | Ulcerative colitis | 0.0744 | 0.0568 | 1.3101 | 0.1902 | 0.239891892 |
| | Colorectal cancer | -0.0034 | 0.0603 | -0.0568 | 0.9547 | 0.975605839 |
| Attention-deficit hyperactivity disorder | Acute pancreatitis | 0.5238 | 0.0635 | 8.2469 | 1.63E-16 | 1.14E-15 |
| | Appendicitis | 0.0394 | 0.0897 | 0.4395 | 0.6603 | 0.716604651 |
| | Cholelithiasis and cholecystitis | 0.2828 | 0.0455 | 6.2201 | 4.97E-10 | 2.40E-09 |
| | Crohn's disease | -0.0246 | 0.0365 | -0.6731 | 0.5009 | 0.561008 |
| | Diverticular disease | 0.2482 | 0.0271 | 9.1633 | 5.03E-20 | 4.14E-19 |
| | Gastritis and duodenitis | 0.6112 | 0.0529 | 10.4382 | 3.54E-45 | 5.51E-44 |
| | Gastroesophageal reflux disease | 0.5348 | 0.0258 | 20.72 | 2.29E-95 | 5.34E-94 |
| | Inflammatory bowel disease | 0.0284 | 0.0306 | 0.9303 | 0.3522 | 0.404163934 |
| | Irritable bowel syndrome | 0.2627 | 0.0369 | 7.1106 | 1.16E-12 | 6.25E-12 |
| | Non-alcoholic fatty liver disease | 0.5654 | 0.1135 | 4.9805 | 6.34E-07 | 2.06E-06 |
| | Peptic ulcer | 0.516 | 0.0529 | 9.7457 | 1.92E-22 | 1.68E-21 |
| | Stool frequency | 0.1234 | 0.0334 | 3.6914 | 0.0002 | 0.000482759 |
| | Ulcerative colitis | 0.0525 | 0.03 | 1.7513 | 0.0799 | 0.116520833 |
| | Colorectal cancer | 0.1322 | 0.0297 | 4.4557 | 8.36E-06 | 2.29E-05 |
| Autism spectrum disorder | Acute pancreatitis | 0.2269 | 0.0723 | 3.1398 | 0.0017 | 0.003661538 |
| | Appendicitis | 0.2096 | 0.1268 | 1.6526 | 0.0984 | 0.13776 |
| | Cholelithiasis and cholecystitis | 0.0866 | 0.0636 | 1.3626 | 0.173 | 0.222201835 |
| | Crohn's disease | -0.0711 | 0.047 | -1.5123 | 0.1305 | 0.170747664 |
| | Diverticular disease | 0.0625 | 0.0345 | 1.8152 | 0.0695 | 0.103510638 |
| | Gastritis and duodenitis | 0.0973 | 0.0603 | 1.7263 | 0.0643 | 0.096795699 |
| | Gastroesophageal reflux disease | 0.0821 | 0.0367 | 2.2362 | 0.0253 | 0.043728395 |
| | Inflammatory bowel disease | -0.0619 | 0.0386 | -1.6051 | 0.1085 | 0.147475728 |
| | Irritable bowel syndrome | 0.2475 | 0.0481 | 5.14 | 2.75E-07 | 9.63E-07 |
| | Non-alcoholic fatty liver disease | 0.1336 | 0.1125 | 1.1876 | 0.235 | 0.286086957 |
| | Peptic ulcer | 0.0026 | 0.066 | 0.0394 | 0.9686 | 0.982637681 |
| | Stool frequency | 0.0745 | 0.0461 | 1.6165 | 0.106 | 0.145490196 |
| | Ulcerative colitis | -0.0394 | 0.0416 | -0.946 | 0.3441 | 0.40145 |
| | Colorectal cancer | -0.0091 | 0.0352 | -0.2576 | 0.7967 | 0.844984848 |
| Bipolar disorder | Acute pancreatitis | 0.0519 | 0.0554 | 0.9374 | 0.3486 | 0.403338843 |
| | Appendicitis | 0.1785 | 0.0861 | 2.0732 | 0.0381 | 0.0635 |
| | Cholelithiasis and cholecystitis | -0.0087 | 0.0398 | -0.2192 | 0.8265 | 0.863507463 |
| | Crohn's disease | 0.0917 | 0.0302 | 3.0378 | 0.0024 | 0.004941176 |
| | Diverticular disease | 0.0863 | 0.0255 | 3.3857 | 0.0007 | 0.001555556 |
| | Gastritis and duodenitis | 0.0701 | 0.0511 | 1.3401 | 0.0853 | 0.121857143 |
| | Gastroesophageal reflux disease | 0.0707 | 0.0245 | 2.8838 | 0.0039 | 0.007479452 |
| | Inflammatory bowel disease | 0.0968 | 0.0279 | 3.4717 | 0.0005 | 0.001147541 |
| | Irritable bowel syndrome | 0.1236 | 0.0305 | 4.0542 | 5.03E-05 | 0.000135423 |

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|--------------------------------|-----------------------------------|---------|--------|---------|-----------|-------------|
| | Non-alcoholic fatty liver disease | 0.1011 | 0.085 | 1.1888 | 0.2345 | 0.286086957 |
| | Peptic ulcer | 0.0709 | 0.0432 | 1.6428 | 0.1004 | 0.139168317 |
| | Stool frequency | 0.1811 | 0.0291 | 6.2317 | 4.61E-10 | 2.31E-09 |
| | Ulcerative colitis | 0.0822 | 0.029 | 2.8323 | 0.0046 | 0.008702703 |
| | Colorectal cancer | 0.004 | 0.0262 | 0.1529 | 0.8785 | 0.911037037 |
| Major depressive disorder | Acute pancreatitis | 0.3991 | 0.0558 | 7.1498 | 8.69E-13 | 4.87E-12 |
| | Appendicitis | 0.2331 | 0.0808 | 2.886 | 0.0039 | 0.007479452 |
| | Cholelithiasis and cholecystitis | 0.2503 | 0.0317 | 7.8822 | 3.22E-15 | 1.88E-14 |
| | Crohn's disease | 0.0941 | 0.0311 | 3.0255 | 0.0025 | 0.005072464 |
| | Diverticular disease | 0.3026 | 0.0253 | 11.9509 | 6.43E-33 | 6.92E-32 |
| | Gastritis and duodenitis | 0.4557 | 0.0487 | 10.1268 | 2.25E-35 | 2.86E-34 |
| | Gastroesophageal reflux disease | 0.521 | 0.0203 | 25.68 | 1.96E-145 | 1.37E-143 |
| | Inflammatory bowel disease | 0.1208 | 0.0246 | 4.9123 | 9.00E-07 | 2.80E-06 |
| | Irritable bowel syndrome | 0.5736 | 0.0252 | 22.7698 | 9.14E-115 | 3.20E-113 |
| | Non-alcoholic fatty liver disease | 0.4585 | 0.1016 | 4.5112 | 6.45E-06 | 1.81E-05 |
| | Peptic ulcer | 0.4442 | 0.0437 | 10.1554 | 3.14E-24 | 3.14E-23 |
| | Stool frequency | 0.191 | 0.0318 | 5.9988 | 1.99E-09 | 8.99E-09 |
| | Ulcerative colitis | 0.1237 | 0.0231 | 5.3557 | 8.52E-08 | 3.06E-07 |
| | Colorectal cancer | 0.0178 | 0.0213 | 0.8362 | 0.4031 | 0.455112903 |
| | Acute pancreatitis | 0.3321 | 0.0579 | 5.7348 | 9.77E-09 | 3.91E-08 |
| | Appendicitis | 0.1015 | 0.0666 | 1.5235 | 0.1276 | 0.168528302 |
| Neuroticism | Cholelithiasis and cholecystitis | 0.2084 | 0.0421 | 4.9519 | 7.35E-07 | 2.34E-06 |
| | Crohn's disease | 0.0972 | 0.0318 | 3.0555 | 0.0022 | 0.004597015 |
| | Diverticular disease | 0.2261 | 0.0278 | 8.1224 | 4.57E-16 | 2.91E-15 |
| | Gastritis and duodenitis | 0.3894 | 0.0527 | 8.5771 | 4.05E-19 | 3.15E-18 |
| | Gastroesophageal reflux disease | 0.4113 | 0.0237 | 17.3477 | 2.05E-67 | 4.10E-66 |
| | Inflammatory bowel disease | 0.119 | 0.0251 | 4.7448 | 2.09E-06 | 6.23E-06 |
| | Irritable bowel syndrome | 0.5881 | 0.0259 | 22.6839 | 6.45E-114 | 1.81E-112 |
| | Non-alcoholic fatty liver disease | 0.3497 | 0.1032 | 3.3869 | 0.0007 | 0.001555556 |
| | Peptic ulcer | 0.3397 | 0.059 | 5.7576 | 8.53E-09 | 3.51E-08 |
| | Stool frequency | 0.133 | 0.0337 | 3.9511 | 7.78E-05 | 0.000201704 |
| | Ulcerative colitis | 0.1088 | 0.0273 | 3.9816 | 6.84E-05 | 0.000180679 |
| | Colorectal cancer | 0.0527 | 0.0258 | 2.0441 | 0.0409 | 0.067364706 |
| | Acute pancreatitis | 0.4534 | 0.1252 | 3.6212 | 0.0003 | 0.000711864 |
| | Appendicitis | 0.3592 | 0.1876 | 1.9153 | 0.0554 | 0.086177778 |
| Post traumatic stress disorder | Cholelithiasis and cholecystitis | 0.2466 | 0.0851 | 2.8976 | 0.0038 | 0.007479452 |
| | Crohn's disease | 0.0274 | 0.0724 | 0.3793 | 0.7044 | 0.752793893 |
| | Diverticular disease | 0.2526 | 0.0655 | 3.8552 | 0.0001 | 0.00025 |
| | Gastritis and duodenitis | 0.4757 | 0.1136 | 4.5375 | 6.05E-07 | 2.02E-06 |
| | Gastroesophageal reflux disease | 0.5293 | 0.0638 | 8.2946 | 1.09E-16 | 8.03E-16 |
| | Inflammatory bowel disease | 0.1051 | 0.059 | 1.7797 | 0.0751 | 0.110673684 |
| | Irritable bowel syndrome | 0.4683 | 0.08 | 5.855 | 4.77E-09 | 2.09E-08 |
| | Non-alcoholic fatty liver disease | 0.4358 | 0.2208 | 1.9736 | 0.0484 | 0.077885057 |
| | Peptic ulcer | 0.5285 | 0.1105 | 4.7842 | 1.72E-06 | 5.23E-06 |
| | Stool frequency | 0.2727 | 0.0766 | 3.5597 | 0.0004 | 0.000933333 |
| | Ulcerative colitis | 0.1229 | 0.0569 | 2.1601 | 0.0308 | 0.052585366 |
| | Colorectal cancer | 0.0975 | 0.0562 | 1.7335 | 0.083 | 0.119793814 |
| | Acute pancreatitis | 0.027 | 0.0503 | 0.5369 | 0.5913 | 0.651826772 |
| | Appendicitis | -0.1272 | 0.0819 | -1.554 | 0.1202 | 0.160266667 |
| Schizophrenia | Cholelithiasis and cholecystitis | -0.0336 | 0.0346 | -0.9714 | 0.3314 | 0.389882353 |
| | Crohn's disease | 0.1496 | 0.0279 | 5.356 | 8.51E-08 | 3.06E-07 |
| | Diverticular disease | 0.0333 | 0.0241 | 1.383 | 0.1667 | 0.216092593 |
| | Gastritis and duodenitis | 0.084 | 0.0457 | 1.297 | 0.0125 | 0.021875 |
| | Gastroesophageal reflux disease | 0.0284 | 0.0227 | 1.2505 | 0.2111 | 0.261539823 |
| | Inflammatory bowel disease | 0.1431 | 0.0247 | 5.7975 | 6.73E-09 | 2.86E-08 |
| | Irritable bowel syndrome | 0.1715 | 0.0278 | 6.1738 | 6.67E-10 | 3.11E-09 |
| | Non-alcoholic fatty liver disease | 0.1305 | 0.0767 | 1.7003 | 0.0891 | 0.126 |
| | Peptic ulcer | 0.1074 | 0.0404 | 2.6603 | 0.0078 | 0.014 |
| | Stool frequency | 0.0518 | 0.027 | 1.9209 | 0.0548 | 0.086177778 |
| | Ulcerative colitis | 0.1191 | 0.0254 | 4.6963 | 2.65E-06 | 7.73E-06 |
| | Colorectal cancer | 0.0874 | 0.0229 | 3.8125 | 0.0001 | 0.00025 |
| | Acute pancreatitis | 0.4482 | 0.0551 | 8.1388 | 3.99E-16 | 2.66E-15 |
| | Appendicitis | 0.2512 | 0.082 | 3.0618 | 0.0022 | 0.004597015 |
| Depression | Cholelithiasis and cholecystitis | 0.2964 | 0.0297 | 9.9712 | 2.04E-23 | 1.90E-22 |
| | Crohn's disease | 0.0843 | 0.0305 | 2.7591 | 0.0058 | 0.010684211 |
| | Diverticular disease | 0.3157 | 0.0246 | 12.8521 | 8.37E-38 | 1.17E-36 |
| | Gastritis and duodenitis | 0.5217 | 0.034 | 15.3645 | 2.83E-53 | 4.95E-52 |
| | Gastroesophageal reflux disease | 0.5652 | 0.0184 | 30.6579 | 2.07E-206 | 2.90E-204 |

Depression

| | | | | | |
|-----------------------------------|--------|--------|---------|-----------|-------------|
| Inflammatory bowel disease | 0.1289 | 0.0255 | 5.0632 | 4.12E-07 | 1.41E-06 |
| Irritable bowel syndrome | 0.5588 | 0.0229 | 24.3675 | 3.79E-131 | 1.77E-129 |
| Non-alcoholic fatty liver disease | 0.534 | 0.1144 | 4.6671 | 3.05E-06 | 8.71E-06 |
| Peptic ulcer | 0.5165 | 0.0422 | 12.2435 | 1.82E-34 | 2.12E-33 |
| Stool frequency | 0.1806 | 0.0284 | 6.3642 | 1.96E-10 | 1.02E-09 |
| Ulcerative colitis | 0.1362 | 0.0243 | 5.6115 | 2.01E-08 | 7.80E-08 |
| Colorectal cancer | 0.0403 | 0.0199 | 2.0214 | 4.32E-02 | 0.070325581 |

Supplementary Table 3. Genetic correlation among psychiatric disorders pairwise.

| Trait1 | Trait2 | rg | SE | Z | P | FDR q-value |
|--|--|--------|--------|---------|-----------|-------------|
| Depression | Attention-deficit hyperactivity disorder | 0.6036 | 0.0222 | 27.1829 | 1.03E-162 | 3.88E-161 |
| Depression | Anorexia nervosa | 0.2783 | 0.0304 | 9.1395 | 6.27E-20 | 3.04E-19 |
| Depression | Anxiety, panic disorder | 0.5926 | 0.052 | 11.3892 | 4.73E-30 | 2.91E-29 |
| Depression | Autism spectrum disorder | 0.327 | 0.0274 | 11.9277 | 8.49E-33 | 5.68E-32 |
| Depression | Bipolar disorder | 0.4518 | 0.0203 | 22.2357 | 1.55E-109 | 3.11E-108 |
| Depression | Major depressive disorder | 0.9579 | 0.004 | 237.356 | 0 | 0 |
| Depression | Neuroticism | 0.8409 | 0.0122 | 68.8242 | 0 | 0 |
| Depression | Post traumatic stress disorder | 0.8255 | 0.0783 | 10.5376 | 5.80E-26 | 3.42E-25 |
| Depression | Schizophrenia | 0.3495 | 0.0186 | 18.8079 | 6.50E-79 | 8.89E-78 |
| Anorexia nervosa | Anxiety, panic disorder | 0.3527 | 0.0706 | 4.9951 | 5.88E-07 | 1.58E-06 |
| Anorexia nervosa | Autism spectrum disorder | 0.215 | 0.0505 | 4.2572 | 2.07E-05 | 4.72E-05 |
| Anorexia nervosa | Bipolar disorder | 0.2306 | 0.0294 | 7.8526 | 4.08E-15 | 1.55E-14 |
| Anorexia nervosa | Major depressive disorder | 0.287 | 0.0317 | 9.0493 | 1.44E-19 | 6.88E-19 |
| Anorexia nervosa | Neuroticism | 0.293 | 0.0303 | 9.6773 | 3.77E-22 | 1.92E-21 |
| Anorexia nervosa | Post traumatic stress disorder | 0.17 | 0.0665 | 2.5551 | 0.0106 | 0.016704712 |
| Anorexia nervosa | Schizophrenia | 0.2309 | 0.0259 | 8.9124 | 5.00E-19 | 2.25E-18 |
| Anxiety, panic disorder | Autism spectrum disorder | 0.1562 | 0.0734 | 2.1292 | 0.0332 | 0.050726904 |
| Anxiety, panic disorder | Bipolar disorder | 0.3018 | 0.0538 | 5.6133 | 1.98E-08 | 5.79E-08 |
| Anxiety, panic disorder | Major depressive disorder | 0.6427 | 0.0538 | 11.9429 | 7.07E-33 | 4.84E-32 |
| Anxiety, panic disorder | Neuroticism | 0.6527 | 0.0637 | 10.2409 | 1.30E-24 | 7.53E-24 |
| Anxiety, panic disorder | Post traumatic stress disorder | 0.3396 | 0.1168 | 2.9069 | 0.0037 | 0.006221788 |
| Anxiety, panic disorder | Schizophrenia | 0.3066 | 0.0445 | 6.8887 | 5.63E-12 | 1.88E-11 |
| Attention-deficit hyperactivity disorder | Anxiety, panic disorder | 0.1063 | 0.0595 | 1.7879 | 0.0738 | 0.100971818 |
| Attention-deficit hyperactivity disorder | Anorexia nervosa | 0.0969 | 0.0316 | 3.0678 | 0.0022 | 0.003872515 |
| Attention-deficit hyperactivity disorder | Autism spectrum disorder | 0.5347 | 0.0412 | 12.9874 | 1.44E-38 | 1.27E-37 |
| Attention-deficit hyperactivity disorder | Bipolar disorder | 0.2314 | 0.028 | 8.2652 | 1.39E-16 | 5.73E-16 |
| Attention-deficit hyperactivity disorder | Major depressive disorder | 0.5244 | 0.0251 | 20.8941 | 6.06E-97 | 1.01E-95 |
| Attention-deficit hyperactivity disorder | Neuroticism | 0.3808 | 0.0315 | 12.1085 | 9.53E-34 | 7.17E-33 |
| Attention-deficit hyperactivity disorder | Post traumatic stress disorder | 0.7158 | 0.0795 | 9.0024 | 2.21E-19 | 1.02E-18 |
| Attention-deficit hyperactivity disorder | Schizophrenia | 0.2015 | 0.0237 | 8.5133 | 1.69E-17 | 7.27E-17 |
| Autism spectrum disorder | Bipolar disorder | 0.219 | 0.0411 | 5.3328 | 9.67E-08 | 2.67E-07 |
| Autism spectrum disorder | Major depressive disorder | 0.3677 | 0.029 | 12.6642 | 9.34E-37 | 7.81E-36 |
| Autism spectrum disorder | Neuroticism | 0.3378 | 0.0374 | 9.0248 | 1.80E-19 | 8.47E-19 |
| Autism spectrum disorder | Post traumatic stress disorder | 0.3535 | 0.0786 | 4.4963 | 6.91E-06 | 1.61E-05 |
| Autism spectrum disorder | Schizophrenia | 0.2591 | 0.0347 | 7.4704 | 8.00E-14 | 3.01E-13 |
| Bipolar disorder | Major depressive disorder | 0.4499 | 0.0221 | 20.3512 | 4.53E-92 | 6.82E-91 |
| Bipolar disorder | Neuroticism | 0.3522 | 0.03 | 11.7595 | 6.31E-32 | 3.96E-31 |
| Bipolar disorder | Post traumatic stress disorder | 0.3947 | 0.0547 | 7.2168 | 5.32E-13 | 1.88E-12 |
| Bipolar disorder | Schizophrenia | 0.6993 | 0.0153 | 45.7962 | 0 | 0 |
| Major depressive disorder | Neuroticism | 0.851 | 0.0116 | 73.0889 | 0 | 0 |
| Major depressive disorder | Post traumatic stress disorder | 0.7159 | 0.0675 | 10.6132 | 2.59E-26 | 1.56E-25 |
| Major depressive disorder | Schizophrenia | 0.3426 | 0.0203 | 16.8479 | 1.09E-63 | 1.37E-62 |
| Neuroticism | Post traumatic stress disorder | 0.7232 | 0.0733 | 9.8599 | 6.21E-23 | 3.28E-22 |
| Neuroticism | Schizophrenia | 0.3293 | 0.0233 | 14.1513 | 1.83E-45 | 1.84E-44 |
| Post Traumatic Stress Disorder | Schizophrenia | 0.3145 | 0.0496 | 6.3368 | 2.35E-10 | 7.53E-10 |

Supplementary Table 4. Genetic correlation among digestive diseases pairwise.

| Trait1 | Trait2 | rg | SE | Z | P | FDR q-value |
|----------------------------------|-----------------------------------|---------|--------|---------|-----------|-------------|
| Gastritis-duodenitis | Acute pancreatitis | 0.5142 | 0.0936 | 5.4924 | 3.97E-08 | 1.25E-07 |
| Gastroesophageal reflux disease | Acute pancreatitis | 0.5518 | 0.0636 | 8.6712 | 4.28E-18 | 2.19E-17 |
| Irritable bowel syndrome | Acute pancreatitis | 0.2776 | 0.0661 | 4.2009 | 2.66E-05 | 6.50E-05 |
| Acute pancreatitis | Appendicitis | 0.2386 | 0.2004 | 1.1903 | 0.2339 | 0.283412017 |
| Gastritis-duodenitis | Appendicitis | 0.416 | 0.1376 | 3.0234 | 0.0025 | 0.004503205 |
| Gastroesophageal reflux disease | Appendicitis | 0.1728 | 0.0904 | 1.9128 | 0.0558 | 0.081665625 |
| Irritable bowel syndrome | Appendicitis | 0.1622 | 0.0976 | 1.6612 | 0.0967 | 0.130637981 |
| Acute pancreatitis | Cholelithiasis and cholecystitis | 0.8024 | 0.0846 | 9.4865 | 2.39E-21 | 1.43E-20 |
| Appendicitis | Cholelithiasis and cholecystitis | 0.2642 | 0.1277 | 2.0683 | 0.0386 | 0.059596703 |
| Gastritis-duodenitis | Cholelithiasis and cholecystitis | 0.4246 | 0.0586 | 7.2405 | 4.47E-13 | 1.82E-12 |
| Gastroesophageal reflux disease | Cholelithiasis and cholecystitis | 0.4938 | 0.037 | 13.3487 | 1.21E-40 | 1.36E-39 |
| Irritable bowel syndrome | Cholelithiasis and cholecystitis | 0.2427 | 0.0539 | 4.5063 | 6.60E-06 | 1.70E-05 |
| Acute pancreatitis | Crohn's disease | 0.0561 | 0.0756 | 0.7414 | 0.4584 | 0.5152416 |
| Appendicitis | Crohn's disease | -0.3446 | 0.1289 | -2.6739 | 0.0075 | 0.012544643 |
| Cholelithiasis and cholecystitis | Crohn's disease | 0.0034 | 0.0528 | 0.0638 | 0.9492 | 0.969909818 |
| Gastritis-duodenitis | Crohn's disease | 0.0786 | 0.0535 | 1.4694 | 0.1417 | 0.181500455 |
| Gastroesophageal reflux disease | Crohn's disease | 0.0737 | 0.0373 | 1.9794 | 4.78E-02 | 7.26E-02 |
| Irritable bowel syndrome | Crohn's disease | 0.1454 | 0.0383 | 3.796 | 0.0001 | 0.000223016 |
| Acute pancreatitis | Colorectal cancer | 0.0084 | 0.0565 | 0.1493 | 0.8813 | 0.910460662 |
| Appendicitis | Colorectal cancer | -0.1624 | 0.1106 | -1.4679 | 0.1421 | 0.181500455 |
| Cholelithiasis and cholecystitis | Colorectal cancer | 0.0587 | 0.0459 | 1.2786 | 0.2011 | 0.24784693 |
| Crohn's disease | Colorectal cancer | 0.0314 | 0.0471 | 0.6672 | 0.5046 | 0.558238583 |
| Gastritis-duodenitis | Colorectal cancer | 0.0037 | 0.0435 | 0.0859 | 0.9316 | 0.9554 |
| Gastroesophageal reflux disease | Colorectal cancer | 0.0955 | 0.0288 | 3.3143 | 0.0009 | 0.001744138 |
| Irritable bowel syndrome | Colorectal cancer | -0.0015 | 0.0351 | -0.0439 | 0.965 | 0.975413669 |
| Acute pancreatitis | Diverticular disease | 0.2604 | 0.0634 | 4.1058 | 4.03E-05 | 9.76E-05 |
| Appendicitis | Diverticular disease | -0.0762 | 0.1105 | -0.6903 | 0.49 | 0.546388889 |
| Cholelithiasis and cholecystitis | Diverticular disease | 0.3207 | 0.043 | 7.4527 | 9.15E-14 | 3.90E-13 |
| Crohn's disease | Diverticular disease | 0.0094 | 0.037 | 0.2548 | 0.7988 | 0.840684644 |
| Colorectal cancer | Diverticular disease | 0.115 | 0.0344 | 3.3441 | 0.0008 | 0.001594326 |
| Gastritis-duodenitis | Diverticular disease | 0.4389 | 0.0433 | 10.1436 | 3.54E-24 | 2.37E-23 |
| Gastroesophageal reflux disease | Diverticular disease | 0.4504 | 0.0277 | 16.2392 | 2.66E-59 | 3.93E-58 |
| Irritable bowel syndrome | Diverticular disease | 0.3849 | 0.0325 | 11.8553 | 2.02E-32 | 1.58E-31 |
| Gastroesophageal reflux disease | Gastritis-duodenitis | 0.882 | 0.0337 | 26.1656 | 6.55E-151 | 3.07E-149 |
| Irritable bowel syndrome | Gastritis-duodenitis | 0.5326 | 0.0443 | 12.0214 | 2.74E-33 | 2.41E-32 |
| Acute pancreatitis | Inflammatory bowel disease | 0.113 | 0.0634 | 1.7814 | 0.0748 | 0.104990547 |
| Appendicitis | Inflammatory bowel disease | -0.3783 | 0.1251 | -3.0249 | 0.0025 | 0.004503205 |
| Cholelithiasis and cholecystitis | Inflammatory bowel disease | 0.0459 | 0.0452 | 1.0154 | 0.3099 | 0.36284125 |
| Crohn's disease | Inflammatory bowel disease | 0.8981 | 0.0121 | 74.4996 | 0 | 0 |
| Colorectal cancer | Inflammatory bowel disease | -0.0304 | 0.0368 | -0.8252 | 0.4093 | 0.461900803 |
| Diverticular disease | Inflammatory bowel disease | 0.0425 | 0.0308 | 1.3819 | 0.167 | 0.211382883 |
| Gastritis-duodenitis | Inflammatory bowel disease | 0.1385 | 0.0451 | 3.0694 | 0.0021 | 0.003934 |
| Gastroesophageal reflux disease | Inflammatory bowel disease | 0.1027 | 0.0309 | 3.3267 | 0.0009 | 0.001744138 |
| Irritable bowel syndrome | Inflammatory bowel disease | 0.1692 | 0.0343 | 4.9293 | 8.25E-07 | 2.32E-06 |
| Gastroesophageal reflux disease | Irritable bowel syndrome | 0.6043 | 0.0273 | 22.1706 | 6.61E-109 | 1.69E-107 |
| Acute pancreatitis | Non-alcoholic fatty liver disease | 0.9115 | 0.2541 | 3.588 | 0.0003 | 0.000633835 |
| Appendicitis | Non-alcoholic fatty liver disease | 0.3676 | 0.3158 | 1.1639 | 0.2445 | 0.292359574 |
| Cholelithiasis and cholecystitis | Non-alcoholic fatty liver disease | 0.793 | 0.1947 | 4.0731 | 4.64E-05 | 1.11E-04 |
| Crohn's disease | Non-alcoholic fatty liver disease | 0.0492 | 0.1209 | 0.4069 | 0.6841 | 0.730920532 |
| Colorectal cancer | Non-alcoholic fatty liver disease | 0.0564 | 0.0997 | 0.5659 | 0.5715 | 0.627310547 |
| Diverticular disease | Non-alcoholic fatty liver disease | 0.4408 | 0.1266 | 3.4829 | 0.0005 | 0.001018116 |
| Gastritis-duodenitis | Non-alcoholic fatty liver disease | 0.5151 | 0.1676 | 3.0727 | 0.0021 | 0.003934 |
| Gastroesophageal reflux disease | Non-alcoholic fatty liver disease | 0.7101 | 0.1504 | 4.7215 | 2.34E-06 | 6.26E-06 |
| Inflammatory bowel disease | Non-alcoholic fatty liver disease | 0.2008 | 0.1091 | 1.8399 | 0.0658 | 0.094335714 |
| Irritable bowel syndrome | Non-alcoholic fatty liver disease | 0.3443 | 0.1145 | 3.0079 | 0.0026 | 0.004624051 |
| Acute pancreatitis | Peptic ulcer | 0.4783 | 0.0964 | 4.9602 | 7.04E-07 | 2.04E-06 |
| Appendicitis | Peptic ulcer | 0.1182 | 0.1608 | 0.7351 | 0.4623 | 0.51755498 |
| Cholelithiasis and cholecystitis | Peptic ulcer | 0.3222 | 0.0747 | 4.3122 | 1.62E-05 | 4.06E-05 |
| Crohn's disease | Peptic ulcer | 0.0288 | 0.0566 | 0.5092 | 0.6106 | 0.657389272 |
| Colorectal cancer | Peptic ulcer | 0.0711 | 0.0547 | 1.3007 | 0.1934 | 0.240466372 |
| Diverticular disease | Peptic ulcer | 0.3964 | 0.0478 | 8.2904 | 1.13E-16 | 5.47E-16 |
| Gastritis-duodenitis | Peptic ulcer | 0.8734 | 0.0694 | 12.5805 | 2.70E-36 | 2.71E-35 |

| | | | | | | |
|-----------------------------------|--------------------|---------|--------|---------|----------|-------------|
| Gastroesophageal reflux disease | Peptic ulcer | 0.6879 | 0.0435 | 15.8218 | 2.20E-56 | 2.94E-55 |
| Inflammatory bowel disease | Peptic ulcer | 0.0737 | 0.0482 | 1.5273 | 0.1267 | 0.164827315 |
| Irritable bowel syndrome | Peptic ulcer | 0.4221 | 0.0642 | 6.5801 | 4.70E-11 | 1.72E-10 |
| Non-alcoholic fatty liver disease | Peptic ulcer | 0.4583 | 0.1471 | 3.1158 | 0.0018 | 0.003417568 |
| Acute pancreatitis | Stool frequency | -0.0164 | 0.0703 | -0.2327 | 0.816 | 0.852401487 |
| Appendicitis | Stool frequency | 0.2293 | 0.1102 | 2.081 | 0.0374 | 0.058711732 |
| Cholelithiasis and cholecystitis | Stool frequency | 0.0607 | 0.0539 | 1.1259 | 0.2602 | 0.309814407 |
| Crohn's disease | Stool frequency | 0.0518 | 0.0405 | 1.2808 | 0.2002 | 0.24782467 |
| Colorectal cancer | Stool frequency | -0.0207 | 0.039 | -0.5307 | 0.5956 | 0.644462692 |
| Diverticular disease | Stool frequency | 0.3729 | 0.0376 | 9.908 | 3.84E-23 | 2.51E-22 |
| Gastritis-duodenitis | Stool frequency | 0.1001 | 0.0511 | 1.9581 | 0.0502 | 0.075434225 |
| Gastroesophageal reflux disease | Stool frequency | 0.2224 | 0.031 | 7.1721 | 7.38E-13 | 2.88E-12 |
| Inflammatory bowel disease | Stool frequency | 0.0381 | 0.0363 | 1.0497 | 0.2939 | 0.34699958 |
| Irritable bowel syndrome | Stool frequency | 0.2751 | 0.0379 | 7.2589 | 3.90E-13 | 1.61E-12 |
| Non-alcoholic fatty liver disease | Stool frequency | -0.072 | 0.1127 | -0.639 | 0.5229 | 0.576215294 |
| Peptic ulcer | Stool frequency | 0.2011 | 0.0573 | 3.5088 | 0.0005 | 0.001018116 |
| Acute pancreatitis | Ulcerative colitis | 0.1171 | 0.0645 | 1.8155 | 0.0694 | 0.098633838 |
| Appendicitis | Ulcerative colitis | -0.3872 | 0.1356 | -2.8565 | 0.0043 | 0.007367683 |
| Cholelithiasis and cholecystitis | Ulcerative colitis | 0.0774 | 0.0481 | 1.6077 | 0.1079 | 0.143018396 |
| Crohn's disease | Ulcerative colitis | 0.6272 | 0.0332 | 18.8722 | 1.93E-79 | 3.62E-78 |
| Colorectal cancer | Ulcerative colitis | -0.0549 | 0.0324 | -1.694 | 0.0903 | 0.123176214 |
| Diverticular disease | Ulcerative colitis | 0.0655 | 0.0315 | 2.0779 | 0.0377 | 0.058853889 |
| Gastritis-duodenitis | Ulcerative colitis | 0.1547 | 0.0437 | 3.5362 | 0.0004 | 0.000832593 |
| Gastroesophageal reflux disease | Ulcerative colitis | 0.1108 | 0.0298 | 3.7183 | 0.0002 | 0.000429008 |
| Inflammatory bowel disease | Ulcerative colitis | 0.9234 | 0.0105 | 87.6681 | 0 | 0 |
| Irritable bowel syndrome | Ulcerative colitis | 0.1481 | 0.0366 | 4.0416 | 5.31E-05 | 1.24E-04 |
| Non-alcoholic fatty liver disease | Ulcerative colitis | 0.2781 | 0.1099 | 2.53 | 0.0114 | 0.018624419 |
| Peptic ulcer | Ulcerative colitis | 0.1152 | 0.0537 | 2.1454 | 0.0319 | 0.05093125 |
| Stool frequency | Ulcerative colitis | 0.0282 | 0.0338 | 0.8338 | 0.4044 | 0.45821129 |

Supplementary Table 5. Tissue-specific contributions to 14 digestive diseases/traits (brain-specific)

| Trait Nickname | Tissue | prop_h2g ($\pi t'$, heritability) | prop_h2g se |
|----------------------------------|---------------------------------------|-------------------------------------|-------------|
| Acute pancreatitis | Brain Amygdala | 0.039445846 | 0.060078027 |
| Acute pancreatitis | Brain Anterior cingulate cortex BA24 | 0.075723848 | 0.073365672 |
| Acute pancreatitis | Brain Caudate basal ganglia | 0.116887803 | 0.090937072 |
| Acute pancreatitis | Brain Cerebellar Hemisphere | -0.06647903 | 0.067625273 |
| Acute pancreatitis | Brain Cerebellum | 0.074999508 | 0.097364208 |
| Acute pancreatitis | Brain Cortex | 0.08326188 | 0.069686205 |
| Acute pancreatitis | Brain Frontal Cortex BA9 | -0.025528472 | 0.068242908 |
| Acute pancreatitis | Brain Hippocampus | -0.052670634 | 0.057014457 |
| Acute pancreatitis | Brain Hypothalamus | -0.00993265 | 0.061105755 |
| Acute pancreatitis | Brain Nucleus accumbens basal ganglia | -0.194043292 | 0.05603175 |
| Acute pancreatitis | Brain Putamen basal ganglia | -0.00416267 | 0.068074055 |
| Acute pancreatitis | Brain Spinal cord cervical c-1 | 0.086707522 | 0.053564994 |
| Acute pancreatitis | Brain Substantia nigra | -0.043649483 | 0.036645103 |
| Acute pancreatitis | AllTissues | 0.080560176 | 0.072300495 |
| Appendicitis | Brain Amygdala | -0.159416171 | 0.101971258 |
| Appendicitis | Brain Anterior cingulate cortex BA24 | 0.012874613 | 0.128116121 |
| Appendicitis | Brain Caudate basal ganglia | -0.008431243 | 0.173477551 |
| Appendicitis | Brain Cerebellar Hemisphere | 0.082224395 | 0.179216089 |
| Appendicitis | Brain Cerebellum | -0.123740869 | 0.221328327 |
| Appendicitis | Brain Cortex | -0.076122416 | 0.164076458 |
| Appendicitis | Brain Frontal Cortex BA9 | 0.267460749 | 0.175122281 |
| Appendicitis | Brain Hippocampus | 0.116326091 | 0.176836801 |
| Appendicitis | Brain Hypothalamus | -0.153881739 | 0.129575558 |
| Appendicitis | Brain Nucleus accumbens basal ganglia | -0.023971988 | 0.162903785 |
| Appendicitis | Brain Putamen basal ganglia | 0.042035474 | 0.194721872 |
| Appendicitis | Brain Spinal cord cervical c-1 | 0.168404065 | 0.131117533 |
| Appendicitis | Brain Substantia nigra | -0.038641902 | 0.100168786 |
| Appendicitis | AllTissues | 0.105119059 | 0.145330802 |
| Crohn's disease | Brain Amygdala | -0.045207633 | 0.04430597 |
| Crohn's disease | Brain Anterior cingulate cortex BA24 | 0.044614316 | 0.043898497 |
| Crohn's disease | Brain Caudate basal ganglia | 0.071374538 | 0.07425187 |
| Crohn's disease | Brain Cerebellar Hemisphere | 0.079061764 | 0.0682527 |
| Crohn's disease | Brain Cerebellum | 0.101801181 | 0.079803004 |
| Crohn's disease | Brain Cortex | 0.086174189 | 0.066422085 |
| Crohn's disease | Brain Frontal Cortex BA9 | -0.003969159 | 0.063415364 |
| Crohn's disease | Brain Hippocampus | 0.00498361 | 0.04949325 |
| Crohn's disease | Brain Hypothalamus | 0.043151592 | 0.052353647 |
| Crohn's disease | Brain Nucleus accumbens basal ganglia | 0.042570665 | 0.066720723 |
| Crohn's disease | Brain Putamen basal ganglia | -0.02266138 | 0.064065129 |
| Crohn's disease | Brain Spinal cord cervical c-1 | 0.007559686 | 0.039937892 |
| Crohn's disease | Brain Substantia nigra | 0.036495536 | 0.043474603 |
| Crohn's disease | AllTissues | 0.445948905 | 0.083964498 |
| Cholelithiasis and cholecystitis | Brain Amygdala | -0.017636869 | 0.035029483 |
| Cholelithiasis and cholecystitis | Brain Anterior cingulate cortex BA24 | -0.025583254 | 0.031040797 |
| Cholelithiasis and cholecystitis | Brain Caudate basal ganglia | 0.067283959 | 0.045148221 |
| Cholelithiasis and cholecystitis | Brain Cerebellar Hemisphere | 0.014577662 | 0.043080171 |
| Cholelithiasis and cholecystitis | Brain Cerebellum | 0.051882869 | 0.048102366 |
| Cholelithiasis and cholecystitis | Brain Cortex | -0.032079703 | 0.040072207 |
| Cholelithiasis and cholecystitis | Brain Frontal Cortex BA9 | 0.027277648 | 0.038657148 |
| Cholelithiasis and cholecystitis | Brain Hippocampus | 0.000192292 | 0.038932695 |
| Cholelithiasis and cholecystitis | Brain Hypothalamus | 0.016518763 | 0.044313431 |
| Cholelithiasis and cholecystitis | Brain Nucleus accumbens basal ganglia | -0.011415768 | 0.042490423 |
| Cholelithiasis and cholecystitis | Brain Putamen basal ganglia | 0.055120186 | 0.04475545 |
| Cholelithiasis and cholecystitis | Brain Spinal cord cervical c-1 | 0.020702761 | 0.033036327 |
| Cholelithiasis and cholecystitis | Brain Substantia nigra | 0.004205681 | 0.032205403 |
| Cholelithiasis and cholecystitis | AllTissues | 0.171046228 | 0.054042675 |
| Colorectal cancer | Brain Amygdala | -0.010628755 | 0.020668538 |
| Colorectal cancer | Brain Anterior cingulate cortex BA24 | -0.017974495 | 0.021028001 |
| Colorectal cancer | Brain Caudate basal ganglia | 0.079958175 | 0.030499402 |
| Colorectal cancer | Brain Cerebellar Hemisphere | -0.0175495 | 0.032407542 |
| Colorectal cancer | Brain Cerebellum | 0.110341912 | 0.032959377 |
| Colorectal cancer | Brain Cortex | 0.078277145 | 0.046610593 |
| Colorectal cancer | Brain Frontal Cortex BA9 | -0.014337075 | 0.028188414 |
| Colorectal cancer | Brain Hippocampus | 0.013992666 | 0.023593138 |
| Colorectal cancer | Brain Hypothalamus | -0.015037678 | 0.024235901 |
| Colorectal cancer | Brain Nucleus accumbens basal ganglia | -0.031919439 | 0.029469622 |
| Colorectal cancer | Brain Putamen basal ganglia | -0.003350553 | 0.027534203 |
| Colorectal cancer | Brain Spinal cord cervical c-1 | 0.002298997 | 0.020467171 |
| Colorectal cancer | Brain Substantia nigra | -0.006388394 | 0.022354759 |
| Colorectal cancer | AllTissues | 0.167683006 | 0.037082489 |
| Diverticular disease | Brain Amygdala | -2.54E-05 | 0.017122443 |
| Diverticular disease | Brain Anterior cingulate cortex BA24 | -0.015038921 | 0.018583534 |

| | | | |
|-----------------------------------|---------------------------------------|--------------|-------------|
| Diverticular disease | Brain Caudate basal ganglia | 0.013491804 | 0.024133831 |
| Diverticular disease | Brain Cerebellar Hemisphere | -0.022635916 | 0.023214866 |
| Diverticular disease | Brain Cerebellum | 0.066981965 | 0.026712927 |
| Diverticular disease | Brain Cortex | 0.008523978 | 0.027671338 |
| Diverticular disease | Brain Frontal Cortex BA9 | 0.00894942 | 0.023499115 |
| Diverticular disease | Brain Hippocampus | 0.050028558 | 0.02481178 |
| Diverticular disease | Brain Hypothalamus | 0.016892406 | 0.025025659 |
| Diverticular disease | Brain Nucleus accumbens basal ganglia | 0.02048855 | 0.028582806 |
| Diverticular disease | Brain Putamen basal ganglia | 0.025463095 | 0.026139311 |
| Diverticular disease | Brain Spinal cord cervical c-1 | -0.02288309 | 0.016727104 |
| Diverticular disease | Brain Substantia nigra | -0.01501569 | 0.012495696 |
| Diverticular disease | AllTissues | 0.135220804 | 0.025196487 |
| Gastritis-duodenitis | Brain Amygdala | -0.006162965 | 0.027380977 |
| Gastritis-duodenitis | Brain Anterior cingulate cortex BA24 | -0.02077658 | 0.031056352 |
| Gastritis-duodenitis | Brain Caudate basal ganglia | 0.076183654 | 0.042308008 |
| Gastritis-duodenitis | Brain Cerebellar Hemisphere | 0.049159952 | 0.039588018 |
| Gastritis-duodenitis | Brain Cerebellum | -0.048821809 | 0.043808963 |
| Gastritis-duodenitis | Brain Cortex | 0.030020271 | 0.034717591 |
| Gastritis-duodenitis | Brain Frontal Cortex BA9 | 0.008380123 | 0.033678063 |
| Gastritis-duodenitis | Brain Hippocampus | -0.029827356 | 0.026931225 |
| Gastritis-duodenitis | Brain Hypothalamus | -0.018664332 | 0.029018054 |
| Gastritis-duodenitis | Brain Nucleus accumbens basal ganglia | 0.006067902 | 0.038608206 |
| Gastritis-duodenitis | Brain Putamen basal ganglia | 0.009319203 | 0.033892166 |
| Gastritis-duodenitis | Brain Spinal cord cervical c-1 | 0.010237613 | 0.033304557 |
| Gastritis-duodenitis | Brain Substantia nigra | 0.006903278 | 0.025586565 |
| Gastritis-duodenitis | AllTissues | 0.072018956 | 0.033556699 |
| Gastroesophageal reflux disease | Brain Amygdala | -0.003015599 | 0.012698176 |
| Gastroesophageal reflux disease | Brain Anterior cingulate cortex BA24 | -0.013100124 | 0.012932565 |
| Gastroesophageal reflux disease | Brain Caudate basal ganglia | 0.016651851 | 0.02173431 |
| Gastroesophageal reflux disease | Brain Cerebellar Hemisphere | -0.02020637 | 0.018815076 |
| Gastroesophageal reflux disease | Brain Cerebellum | 0.063289791 | 0.020691767 |
| Gastroesophageal reflux disease | Brain Cortex | 0.03816784 | 0.018657736 |
| Gastroesophageal reflux disease | Brain Frontal Cortex BA9 | 0.01623882 | 0.016814836 |
| Gastroesophageal reflux disease | Brain Hippocampus | 0.00543857 | 0.018331796 |
| Gastroesophageal reflux disease | Brain Hypothalamus | -0.017142433 | 0.013442517 |
| Gastroesophageal reflux disease | Brain Nucleus accumbens basal ganglia | -0.030640388 | 0.016663213 |
| Gastroesophageal reflux disease | Brain Putamen basal ganglia | -0.001062295 | 0.021177913 |
| Gastroesophageal reflux disease | Brain Spinal cord cervical c-1 | 0.016186749 | 0.013534731 |
| Gastroesophageal reflux disease | Brain Substantia nigra | -0.00153562 | 0.010518144 |
| Gastroesophageal reflux disease | AllTissues | 0.069270792 | 0.019282871 |
| Inflammatory bowel disease | Brain Amygdala | -0.019369341 | 0.023227865 |
| Inflammatory bowel disease | Brain Anterior cingulate cortex BA24 | -0.0016183 | 0.023199756 |
| Inflammatory bowel disease | Brain Caudate basal ganglia | 0.046076712 | 0.042680538 |
| Inflammatory bowel disease | Brain Cerebellar Hemisphere | 0.057530567 | 0.038372586 |
| Inflammatory bowel disease | Brain Cerebellum | 0.072411943 | 0.038518157 |
| Inflammatory bowel disease | Brain Cortex | 0.084636466 | 0.036003493 |
| Inflammatory bowel disease | Brain Frontal Cortex BA9 | -0.018599062 | 0.030645704 |
| Inflammatory bowel disease | Brain Hippocampus | -0.027615075 | 0.028489134 |
| Inflammatory bowel disease | Brain Hypothalamus | 0.045158033 | 0.033388679 |
| Inflammatory bowel disease | Brain Nucleus accumbens basal ganglia | -0.006508173 | 0.033388408 |
| Inflammatory bowel disease | Brain Putamen basal ganglia | 0.030235769 | 0.037865093 |
| Inflammatory bowel disease | Brain Spinal cord cervical c-1 | -0.002555337 | 0.019926886 |
| Inflammatory bowel disease | Brain Substantia nigra | 0.002575317 | 0.023613342 |
| Inflammatory bowel disease | AllTissues | 0.262359519 | 0.045970295 |
| Irritable bowel syndrome | Brain Amygdala | -0.023536635 | 0.01562157 |
| Irritable bowel syndrome | Brain Anterior cingulate cortex BA24 | 0.009897123 | 0.01663143 |
| Irritable bowel syndrome | Brain Caudate basal ganglia | 0.00970656 | 0.024033306 |
| Irritable bowel syndrome | Brain Cerebellar Hemisphere | 0.003966527 | 0.021637173 |
| Irritable bowel syndrome | Brain Cerebellum | 0.019367328 | 0.02594878 |
| Irritable bowel syndrome | Brain Cortex | 0.031061573 | 0.027459987 |
| Irritable bowel syndrome | Brain Frontal Cortex BA9 | 0.012709857 | 0.023760574 |
| Irritable bowel syndrome | Brain Hippocampus | 0.008484032 | 0.023298194 |
| Irritable bowel syndrome | Brain Hypothalamus | -0.015141852 | 0.018939603 |
| Irritable bowel syndrome | Brain Nucleus accumbens basal ganglia | 0.00976334 | 0.023960261 |
| Irritable bowel syndrome | Brain Putamen basal ganglia | -0.001362871 | 0.019313949 |
| Irritable bowel syndrome | Brain Spinal cord cervical c-1 | 0.032484412 | 0.019664529 |
| Irritable bowel syndrome | Brain Substantia nigra | -0.003984114 | 0.013170768 |
| Irritable bowel syndrome | AllTissues | 0.093415281 | 0.023851618 |
| Non-alcoholic fatty liver disease | Brain Amygdala | 0.043095569 | 0.112317982 |
| Non-alcoholic fatty liver disease | Brain Anterior cingulate cortex BA24 | 0.187053069 | 0.141757681 |
| Non-alcoholic fatty liver disease | Brain Caudate basal ganglia | 0.156511254 | 0.185481802 |
| Non-alcoholic fatty liver disease | Brain Cerebellar Hemisphere | 0.080359904 | 0.172712625 |
| Non-alcoholic fatty liver disease | Brain Cerebellum | 0.08296888 | 0.203980472 |
| Non-alcoholic fatty liver disease | Brain Cortex | 0.05941244 | 0.191022169 |
| Non-alcoholic fatty liver disease | Brain Frontal Cortex BA9 | -0.332774893 | 0.146305174 |

| | | | |
|-----------------------------------|---------------------------------------|--------------|-------------|
| Non-alcoholic fatty liver disease | Brain Hippocampus | -0.230623335 | 0.122371357 |
| Non-alcoholic fatty liver disease | Brain Hypothalamus | 0.139256426 | 0.140522924 |
| Non-alcoholic fatty liver disease | Brain Nucleus accumbens basal ganglia | -0.00544705 | 0.170875388 |
| Non-alcoholic fatty liver disease | Brain Putamen basal ganglia | 0.036202917 | 0.173701533 |
| Non-alcoholic fatty liver disease | Brain Spinal cord cervical c-1 | 0.098253976 | 0.108090668 |
| Non-alcoholic fatty liver disease | Brain Substantia nigra | -0.062480754 | 0.099157759 |
| Non-alcoholic fatty liver disease | AllTissues | 0.251788411 | 0.148210394 |
| Peptic ulcer | Brain Amygdala | -0.048961056 | 0.034729355 |
| Peptic ulcer | Brain Anterior cingulate cortex BA24 | -0.018035992 | 0.042370119 |
| Peptic ulcer | Brain Caudate basal ganglia | 0.057678509 | 0.046962283 |
| Peptic ulcer | Brain Cerebellar Hemisphere | -0.051915313 | 0.05001471 |
| Peptic ulcer | Brain Cerebellum | 0.074432795 | 0.054466007 |
| Peptic ulcer | Brain Cortex | 0.037797857 | 0.051909202 |
| Peptic ulcer | Brain Frontal Cortex BA9 | 0.020446834 | 0.047027748 |
| Peptic ulcer | Brain Hippocampus | 0.009166435 | 0.039847025 |
| Peptic ulcer | Brain Hypothalamus | -0.061611795 | 0.031437971 |
| Peptic ulcer | Brain Nucleus accumbens basal ganglia | 0.094325797 | 0.052438544 |
| Peptic ulcer | Brain Putamen basal ganglia | -0.014814926 | 0.040433567 |
| Peptic ulcer | Brain Spinal cord cervical c-1 | 0.039612592 | 0.031707184 |
| Peptic ulcer | Brain Substantia nigra | 0.014165414 | 0.02715103 |
| Peptic ulcer | AllTissues | 0.152287151 | 0.052364332 |
| Stool frequency | Brain Amygdala | -0.028517196 | 0.018410303 |
| Stool frequency | Brain Anterior cingulate cortex BA24 | 0.007997274 | 0.020554375 |
| Stool frequency | Brain Caudate basal ganglia | 0.007604632 | 0.029328249 |
| Stool frequency | Brain Cerebellar Hemisphere | -0.002390698 | 0.027763586 |
| Stool frequency | Brain Cerebellum | 0.057718573 | 0.032081666 |
| Stool frequency | Brain Cortex | 0.041294443 | 0.029342455 |
| Stool frequency | Brain Frontal Cortex BA9 | 0.006252501 | 0.025186542 |
| Stool frequency | Brain Hippocampus | -0.010613365 | 0.023555113 |
| Stool frequency | Brain Hypothalamus | 0.011771113 | 0.020873998 |
| Stool frequency | Brain Nucleus accumbens basal ganglia | -0.004939901 | 0.023762502 |
| Stool frequency | Brain Putamen basal ganglia | 0.024354184 | 0.028997253 |
| Stool frequency | Brain Spinal cord cervical c-1 | 0.02268599 | 0.019471798 |
| Stool frequency | Brain Substantia nigra | 0.010812246 | 0.014459021 |
| Stool frequency | AllTissues | 0.14402981 | 0.02943598 |
| Ulcerative colitis | Brain Amygdala | 0.004774711 | 0.018743986 |
| Ulcerative colitis | Brain Anterior cingulate cortex BA24 | -0.00044807 | 0.021288174 |
| Ulcerative colitis | Brain Caudate basal ganglia | 0.02595494 | 0.038131851 |
| Ulcerative colitis | Brain Cerebellar Hemisphere | 0.04302271 | 0.035680105 |
| Ulcerative colitis | Brain Cerebellum | 0.04207878 | 0.034066215 |
| Ulcerative colitis | Brain Cortex | 0.102126039 | 0.037304015 |
| Ulcerative colitis | Brain Frontal Cortex BA9 | -0.031432733 | 0.026621453 |
| Ulcerative colitis | Brain Hippocampus | -0.032969424 | 0.025035202 |
| Ulcerative colitis | Brain Hypothalamus | 0.034447225 | 0.026339256 |
| Ulcerative colitis | Brain Nucleus accumbens basal ganglia | -0.037650506 | 0.030504453 |
| Ulcerative colitis | Brain Putamen basal ganglia | 0.041584384 | 0.034709377 |
| Ulcerative colitis | Brain Spinal cord cervical c-1 | 0.005464139 | 0.016922447 |
| Ulcerative colitis | Brain Substantia nigra | -0.018308504 | 0.017632265 |
| Ulcerative colitis | AllTissues | 0.178643691 | 0.038017989 |

Supplementary Table 6. Multi-trait meta-analysis between psychiatric disorders and irritable bowel syndrome in Europeans

| Type of psychiatric disorders | SNP | CHR | BP | A1 | A2 | Psychiatric disorders (all) | Irritable bowel syndrome | MTAG | Genes | Cytogenetic band | Annotation |
|-------------------------------|------------|-----|-----------|-------|---------|-----------------------------|--------------------------|-----------|-------------|------------------|-------------|
| | | | | Beta | P-value | Beta | P-value | Beta-mtag | P-mtag | | |
| Major depressive disorder | rs301805 | 1 | 8420956 | T | G | 0.0225 | 0.00000236 | 0.0259 | 0.0001723 | 0.0090849 | 3.06E-08 |
| | rs6689451 | 1 | 66671769 | A | G | 0.0366 | 0.00000273 | 0.0429 | 0.0001638 | 0.0148349 | 0.000000026 |
| | rs1275507 | 1 | 176195729 | T | C | 0.0256 | 8.8E-09 | 0.032 | 0.00000814 | 0.0107553 | 1.25E-10 |
| | rs1290008 | 2 | 161016753 | T | C | 0.0173 | 0.0003146 | 0.0372 | 0.00000929 | 0.0100985 | 1.85E-08 |
| | rs2596915 | 3 | 9498000 | T | C | 0.0207 | 0.0000525 | 0.0365 | 0.0000697 | 0.0105161 | 2.62E-08 |
| | rs12513440 | 5 | 7259740 | A | G | 0.0226 | 0.0000067 | 0.0328 | 0.0000583 | 0.0102929 | 4.89E-08 |
| | rs3099439 | 5 | 88249501 | T | C | -0.0241 | 2.78E-08 | -0.0333 | 0.00000134 | -0.01074 | 3.72E-11 |
| | rs7446574 | 5 | 165043834 | A | G | -0.0274 | 3.16E-10 | -0.0253 | 0.01421 | -0.009353 | 7.88E-09 |
| | rs266244 | 6 | 31357915 | A | G | 0.0284 | 3.92E-09 | 0.0473 | 0.00000076 | 0.0127654 | 6.12E-13 |
| | rs2189246 | 7 | 82815036 | A | G | 0.0223 | 0.00000216 | 0.0287 | 0.000025 | 0.0096138 | 2.97E-09 |
| | rs1049973 | 7 | 109471061 | A | G | 0.0225 | 0.00000177 | 0.0246 | 0.0003142 | 0.0089263 | 0.000000039 |
| | rs13234249 | 7 | 146991927 | T | C | 0.0183 | 0.0001542 | 0.0363 | 0.0000211 | 0.0101412 | 2.19E-08 |
| | rs5017929 | 8 | 93641055 | A | G | 0.0163 | 0.0005439 | 0.0387 | 0.00000212 | 0.0101785 | 8.51E-11 |
| | rs10961656 | 9 | 14676885 | T | C | -0.0208 | 0.00000255 | -0.0274 | 0.000095 | -0.009123 | 4.77E-08 |
| | rs10761238 | 9 | 93588935 | T | C | -0.0173 | 0.0001357 | -0.0394 | 3.04E-08 | -0.010562 | 4.05E-10 |
| | rs4937872 | 11 | 31273187 | T | C | -0.0214 | 0.00000128 | -0.0387 | 3.21E-08 | -0.011132 | 1.31E-11 |
| | rs9530139 | 13 | 53069235 | A | C | -0.033 | 1.37E-09 | -0.0299 | 0.000554 | -0.011778 | 8.58E-09 |
| | rs2806933 | 13 | 53069235 | A | C | 0.0239 | 7.33E-08 | 0.0323 | 0.0000441 | 0.010531 | 1.98E-10 |
| | rs9597977 | 13 | 88609661 | T | G | -0.0219 | 0.0000115 | -0.0352 | 0.000088 | -0.010625 | 1.24E-08 |
| | rs67505447 | 14 | 41674028 | A | G | -0.0282 | 8.21E-11 | -0.0316 | 0.0000429 | -0.010631 | 5.45E-11 |
| | rs1862743 | 16 | 60709930 | A | C | -0.0214 | 0.00000686 | -0.0307 | 0.00000736 | -0.009794 | 1.45E-09 |
| | rs1877758 | 18 | 37558147 | T | G | -0.0292 | 3.37E-10 | -0.0269 | 0.000269 | -0.010554 | 1.75E-09 |
| | rs1740557 | 18 | 53250021 | T | C | -0.0267 | 1.42E-09 | -0.0235 | 0.0007611 | -0.009494 | 9.98E-09 |
| | rs7231748 | 18 | 55441804 | A | G | -0.0314 | 2.14E-11 | -0.0242 | 0.0111 | -0.010561 | 2.18E-09 |
| | rs2111530 | 19 | 31400100 | A | G | -0.0152 | 0.0005483 | -0.0351 | 0.00000587 | -0.009324 | 1.71E-08 |
| | rs8106322 | 19 | 31533324 | A | G | -0.0214 | 0.003411 | -0.0394 | 0.000001045 | -0.009377 | 3.01E-08 |
| | rs3746522 | 20 | 46015773 | T | C | 0.0294 | 2.99E-08 | 0.0317 | 0.001894 | 0.0121914 | 9.2E-09 |
| | rs20551 | 22 | 41152004 | A | G | -0.0209 | 0.00000114 | -0.0375 | 0.000000616 | -0.01093 | 1.08E-09 |
| Neuroticism | rs301806 | 1 | 8422018 | T | C | -0.0106968 | 1.73426E-11 | -0.0257 | 0.0001881 | -0.009434 | 7.8912E-10 |
| | rs4526571 | 1 | 176213586 | A | G | 0.0087679 | 6.44141E-07 | -0.0321 | 0.00007411 | -0.00899 | 9.2595E-09 |
| | rs2740505 | 1 | 197373250 | A | G | 0.0127731 | 5.97538E-11 | -0.0264 | 0.01391 | -0.010431 | 1.22184E-08 |
| | rs10746509 | 1 | 230101535 | T | C | 0.00860403 | 2.6961E-08 | 0.0274 | 0.0001752 | 0.008598 | 2.76568E-08 |
| | rs1484686 | 2 | 22625811 | A | G | 0.00880096 | 6.95577E-09 | 0.0252 | 0.0002774 | 0.00863 | 2.0775E-08 |
| | rs1829526 | 2 | 63237744 | A | G | 0.0137658 | 1.558E-13 | 0.0257 | 0.002147 | 0.012095 | 1.69958E-09 |
| | rs197261 | 2 | 161048312 | A | G | 0.00838452 | 1.022E-06 | 0.0335 | 0.0001047 | 0.0095238 | 1.50476E-08 |
| | rs79612564 | 2 | 211845660 | T | C | 0.0105471 | 4.01553E-11 | 0.0238 | 0.001987 | 0.020788E | ERBB4 |
| | rs1248857 | 3 | 84969461 | A | G | -0.0056913 | 0.00166712 | -0.0356 | 2.003E-07 | -0.008567 | 1.58106E-08 |
| | rs1729951 | 3 | 136781891 | T | G | -0.0121078 | 4.43822E-09 | -0.0304 | 0.0000128 | -0.009525 | 8.80294E-10 |
| | rs55854228 | 4 | 122465996 | A | C | -0.017075 | 5.25801E-08 | -0.0614 | 0.0000455 | -0.019012 | 9.95009E-09 |
| | rs12513440 | 5 | 7259740 | A | G | 0.00933915 | 4.85545E-08 | 0.0328 | 0.00005828 | 0.0100802 | 1.14208E-08 |
| | rs10044618 | 5 | 88485351 | T | C | 0.00956215 | 5.53438E-07 | 0.035 | 4.124E-07 | 0.0094674 | 6.00316E-10 |
| | rs1422192 | 5 | 88663205 | A | G | 0.0152619 | 5.71759E-12 | 0.0246 | 0.00863 | 0.0113607 | 4.94454E-08 |
| | rs11738752 | 5 | 125250418 | A | C | -0.0074582 | 5.76049E-06 | -0.0341 | 0.000009315 | -0.009212 | 4.00728E-08 |
| | rs72808985 | 5 | 166601172 | T | G | 0.0177735 | 2.63166E-08 | 0.0538 | 0.0002411 | 0.0177528 | 3.99079E-08 |
| | rs35526257 | 6 | 27074508 | A | C | -0.02021669 | 1.02217E-18 | -0.0299 | 0.003166 | -0.015108 | 1.86945E-11 |
| | rs78787316 | 7 | 43628488 | T | C | -0.00900921 | 1.35789E-06 | -0.0375 | 0.00001616 | -0.010768 | 2.65194E-08 |
| | rs2715147 | 7 | 82819089 | T | C | 0.00876658 | 3.35709E-09 | 0.0257 | 0.0000543 | 0.0090053 | 2.7825E-09 |
| | rs11249893 | 8 | 8843431 | T | C | -0.0206291 | 4.16386E-25 | -0.0251 | 0.0002454 | -0.012115 | 1.36363E-15 |
| | rs11757489 | 8 | 11179334 | T | C | -0.0167835 | 6.07992E-16 | -0.0317 | 0.00008774 | -0.011635 | 1.56663E-13 |
| | rs4478545 | 8 | 93660314 | A | G | 0.00865676 | 1.65004E-07 | -0.0366 | 0.00001363 | -0.010291 | 8.79114E-10 |
| | rs3793577 | 9 | 23737629 | A | G | -0.019321 | 1.83174E-13 | -0.0216 | 0.002931 | -0.009027 | 2.8121E-09 |
| | rs10125941 | 9 | 117755884 | T | C | -0.015975 | 2.81614E-08 | -0.028 | 0.0002445 | -0.010666 | 3.59641E-10 |
| | rs1806152 | 11 | 31829493 | T | C | 0.0135812 | 1.19599E-11 | 0.0258 | 0.003083 | 0.0109371 | 1.6769E-08 |
| | rs7937151 | 11 | 112964302 | T | G | -0.0113218 | 1.19374E-13 | -0.0376 | 9.184E-08 | -0.01191 | 1.77441E-14 |
| | rs8011321 | 14 | 41575903 | T | C | -0.0076774 | 3.80087E-07 | -0.0283 | 0.00004702 | -0.00854 | 2.91753E-08 |
| | rs2123209 | 15 | 73853574 | T | C | 0.012123 | 1.11568E-06 | 0.0509 | 0.00003329 | 0.0140899 | 6.39952E-09 |
| | rs2978362 | 18 | 355793433 | T | C | -0.0084427 | 1.47596E-08 | -0.0269 | 0.00008441 | -0.008726 | 8.38936E-09 |
| | rs15757341 | 18 | 37547464 | A | C | 0.0149063 | 2.0443E-15 | 0.024 | 0.001039 | 0.01571016 | ELAVL2 |
| | rs11659803 | 18 | 53108749 | A | G | 0.014654 | 4.56628E-14 | 0.0221 | 0.001481 | 0.0095431 | 5.60781E-10 |
| | rs9966430 | 18 | 55458133 | T | G | -0.0132558 | 3.38834E-13 | -0.024 | 0.001174 | -0.010068 | 1.70656E-09 |
| | rs2024568 | 20 | 46103450 | T | C | 0.00997912 | 1.36796E-08 | 0.0296 | 0.0001882 | 0.0098702 | 2.00757E-08 |
| | rs2179744 | 22 | 41225710 | A | G | 0.0115799 | 2.04057E-12 | 0.0355 | 0.000002624 | 0.0117898 | 2.29284E-12 |
| Bipolar disorder | rs1052486 | 6 | 31642909 | A | G | -0.0182856 | 0.000001026 | -0.044 | 4.178E-10 | -0.013478 | 1.71007E-11 |
| | rs10761229 | 9 | 93475094 | A | G | 0.0150701 | 0.0007132 | 0.0404 | 1.762E-08 | 0.0124805 | PHF2 |
| | rs7106434 | 11 | 112989857 | T | C | 0.01441972 | 0.000496 | 0.0384 | 3.189E-07 | 0.0102323 | NCAM1 |
| | rs2813573 | 13 | 53631969 | T | C | -0.0112489 | 0.005551 | -0.0378 | 3.308E-08 | -0.011662 | OLFM4 |
| | rs622871 | 6 | 31910718 | A | G | -0.0185878 | 0.0095456 | -0.0434 | 1.286E-08 | -0.013044 | 1.78889E-09 |
| | rs10156602 | 9 | 93583046 | A | G | 0.01880448 | 0.005119 | 0.0417 | 4.355E-09 | 0.0129029 | MFHAS1 |
| | rs4937872 | 11 | 112956992 | A | G | -0.0212372 | 0.0010229 | -0.0387 | 3.207E-08 | -0.01212 | 1.72818E-09 |
| | rs2517621 | 6 | 30178990 | T | C | -0.0010175 | 0.000175 | 0.0017 | -0.05032 | 8.7427E-07 | NCAM1 |
| | rs20551 | 22 | 4152004 | A | C | -0.0007384 | 0.00447 | -0.0375 | 6.156E-07 | -0.011973 | 3.92075E-08 |
| | rs10156602 | 9 | 93583046 | A | G | 0.01633122 | 0.00009212 | 0.0417 | 4.355E-09 | 0.0132481 | L3MBTL2 |
| | rs7106434 | 11 | 112989857 | T | C | 0.01832595 | 0.000009809 | 0.0384 | 3.189E-08 | 0.0125988 | NCAM1 |
| | rs301807 | 1 | 8424763 | A | G | 0.0166014 | 2.591E-07 | 0.0259 | 0.000175 | 0.008443 | 4.8178E-08 |
| | rs6693299 | 1 | 175933524 | A | G | 0.0182033 | 2.8426E-08 | 0.033 | 0.00002997 | 0.0095977 | 4.75111E-10 |
| | rs12713172 | 2 | 5209415 | T | C | 0.01503203 | 0.00001615 | 0.0275 | 0.00005992 | 0.0083693 | 4.8618E-08 |
| | rs2157963 | 2 | 160483453 | T | C | -0.0187955 | 4.969E-09 | -0.0225 | 0.001094 | -0.008424 | 4.78824E-08 |
| | rs1267079 | 2 | 161177343 | T | C | 0.0218000 | 1.945E-10 | 0.0303 | 0.00003655 | 0.0106083 | 1.78919E-10 |
| | rs71298375 | 3 | 71281926 | T</td | | | | | | | |

Supplementary Table 7. Multi-trait meta-analysis between digestive diseases and irritable bowel syndrome in Europeans

| Type of digestive diseases | SNP | CHR | BP | A1 | A2 | Digestive diseases (all) Beta | P-value | Irritable bowel syndrome Beta | P-value | MTAG Beta-mtag | P-mtag | Genes | Cytogenetic band | Annotation |
|----------------------------------|------------|-----|-----------|----|----|-------------------------------|-------------|-------------------------------|-----------|----------------|---------|------------|------------------|------------|
| Gastroesophageal reflux disease | rs2357977 | 2 | 161010370 | T | C | -0.0283 | 0.00002809 | -0.0414 | 2.124E-06 | -0.010786 | 9.1E-09 | TANK | 2q24.2 | known |
| | rs35975336 | 3 | 58465907 | A | G | 0.0415 | 2.834E-07 | 0.0361 | 0.000132 | 0.012851 | 3.7E-08 | KCTD6 | 3p14.3 | known |
| | rs1248825 | 3 | 84944260 | A | C | 0.0169 | 0.007426 | 0.0444 | 1.204E-09 | 0.010906 | 1.4E-09 | CADM2 | 3p12.1 | known |
| | rs2308604 | 6 | 31271074 | T | C | -0.0343 | 7.193E-08 | -0.0455 | 8.552E-08 | -0.012154 | 1.1E-11 | MHC region | | known |
| | rs10992729 | 9 | 93418793 | T | C | -0.0184 | 0.003368 | -0.0402 | 2.844E-08 | -0.010341 | 7.4E-09 | PHF2 | 9q22.31 | known |
| | rs4937872 | 11 | 112956992 | A | G | -0.0255 | 0.00002352 | -0.0387 | 3.207E-08 | -0.010963 | 1.7E-10 | NCAM1 | 11q23.2 | known |
| | rs2813573 | 13 | 53369198 | T | C | -0.0209 | 0.0004136 | -0.0378 | 3.308E-08 | -0.010247 | 1.3E-09 | OLFM4 | 13q14.3 | known |
| Diverticular disease | rs34865566 | 17 | 52256990 | T | G | -0.036 | 4.807E-09 | -0.0248 | 0.0005181 | -0.00978 | 2.6E-08 | CA10 | 17q21.33-q22 | new |
| | rs8106322 | 19 | 31533324 | A | G | -0.0251 | 0.00005608 | -0.0394 | 1.452E-07 | -0.010271 | 1.2E-09 | TSHZ3 | 19q12 | new |
| Peptic ulcer | rs57810551 | 1 | 214353269 | T | G | -0.002671 | 0.0000021 | -0.0336 | 2.285E-06 | -0.0114 | 1.3E-08 | SMYD2 | 1q32.3 | new |
| | rs4414623 | 2 | 143592402 | A | G | 0.009344 | 1.3E-46 | -0.022 | 0.007811 | -0.014783 | 2.2E-10 | ARHGAP15 | 2q22.2-q22.3 | new |
| | rs28810515 | 3 | 151221539 | A | G | 0.0042819 | 0.00000011 | 0.0487 | 2.455E-07 | 0.016798 | 1.8E-10 | GPR171 | 3q25.1 | new |
| | rs7766089 | 6 | 31281816 | A | G | -0.002185 | 0.00014 | 0.0451 | 4.461E-08 | 0.01212 | 9.3E-10 | MHC region | | known |
| | rs10156602 | 9 | 93583046 | A | G | 0.0022839 | 0.000054 | 0.0417 | 4.355E-09 | 0.013088 | 5.5E-11 | PHF2 | 9q22.31 | known |
| Cholelithiasis and cholecystitis | rs726972 | 19 | 31543925 | A | C | -0.001634 | 0.0045 | 0.0388 | 2.553E-07 | 0.011461 | 2.4E-08 | TSHZ3 | 19q12 | new |
| | rs1248857 | 3 | 84969461 | A | G | -0.042759 | 0.00012 | -0.0356 | 2.003E-07 | -0.01647 | 3E-09 | CADM2 | 3p12.1 | known |
| | rs10761226 | 9 | 93461754 | T | C | -0.037034 | 0.00095 | -0.0402 | 5.68E-09 | -0.012684 | 1.7E-10 | PHF2 | 9q22.31 | known |
| | rs10891481 | 11 | 112959839 | A | G | -0.034075 | 0.003 | -0.0376 | 9.084E-08 | -0.011845 | 4.4E-09 | NCAM1 | 11q23.2 | known |
| Stool frequency | rs2813573 | 13 | 53369198 | T | C | -0.032379 | 0.0038 | -0.0378 | 3.308E-08 | -0.011853 | 1.6E-09 | OLFM4 | 13q14.3 | known |
| | rs1248825 | 3 | 84944260 | A | C | 0.0397 | 0.00149 | 0.0444 | 1.204E-09 | 0.013613 | 2E-10 | CADM2 | 3p12.1 | known |
| | rs12549729 | 8 | 8666402 | T | G | 0.0359 | 0.00558 | 0.0475 | 2.881E-08 | 0.011849 | 8.3E-09 | CLDN23 | 8p23.1 | new |
| Gastritis-duodenitis | rs10156602 | 9 | 93583046 | A | G | 0.0381 | 0.00184 | 0.0417 | 4.355E-09 | 0.012789 | 8E-10 | PHF2 | 9q22.31 | known |
| | rs1248860 | 3 | 84966628 | A | G | -0.0088 | 0.001654 | -0.0356 | 2.024E-07 | -0.010983 | 4.7E-08 | CADM2 | 3p12.1 | known |
| | rs2077491 | 6 | 31638599 | T | C | -0.0074 | 0.007885 | -0.0423 | 1.964E-09 | -0.011527 | 1E-08 | MHC region | | known |
| | rs10761226 | 9 | 93461754 | T | C | -0.0078 | 0.00532 | -0.0402 | 5.68E-09 | -0.012229 | 1.8E-09 | PHF2 | 9q22.31 | known |
| Inflammatory bowel disease | rs7106434 | 11 | 112989857 | T | C | -0.0312 | 0.000563 | 0.0384 | 3.189E-08 | 0.012222 | 7.7E-10 | NCAM1 | 11q23.2 | known |
| | rs2813573 | 13 | 53369198 | T | C | -0.0261 | 0.00346 | -0.0378 | 3.308E-08 | -0.011771 | 1.7E-09 | OLFM4 | 13q14.3 | known |
| Crohn's disease | rs622871 | 6 | 31910718 | A | G | -0.0182 | 0.000001139 | -0.0434 | 1.286E-08 | -0.013639 | 2.4E-10 | MHC region | | known |

Supplementary Table 8. Multi-trait meta-analysis between psychiatric disorders and gastroesophageal reflux disease in Europeans

| Type of psychiatric disorders | SNP | CHR | BP | A1 | A2 | Psychiatric disorders (all) Beta | P-value | Gastroesophageal reflux disease Beta | P-value | MTAG Beta-mtag | P-mtag | Genes | Cytogenetic band | Annotation |
|--|------------|-----|----------|----|----|----------------------------------|-------------|--------------------------------------|-------------|----------------|----------|------------|------------------|------------|
| Major depressive disorder | rs2815757 | 1 | 72764289 | T | C | 0.035 | 1.91E-10 | 0.0283 | 0.0001492 | 0.012574 | 2.73E-08 | NEGR1 | 1p31.1 | known |
| | rs61787782 | 1 | 98310239 | A | G | -0.0153 | 0.003811 | -0.0404 | 1.27E-08 | -0.015649 | 3.5E-09 | DPYD | 1p21.3 | known |
| | rs6683411 | 1 | 1.91E+08 | A | G | 0.0137 | 0.0159 | 0.0324 | 4.82E-08 | 0.01642 | 4.99E-09 | BRINP3 | 1q31.1 | known |
| | rs67446571 | 2 | 22554648 | A | G | -0.023 | 0.00000209 | -0.0256 | 0.00002406 | -0.012453 | 3.82E-08 | KLHL29 | 2p24.1 | known |
| | rs1186066 | 2 | 1.25E+08 | T | C | -0.0218 | 4.73E-07 | -0.025 | 0.00002586 | -0.013446 | 4.37E-08 | CNTNAP5 | 2q14.3 | known |
| | rs3774745 | 3 | 50204745 | T | C | -0.017 | 0.00009735 | -0.031 | 1.637E-07 | -0.017332 | 3.74E-09 | SEMA3F | 3p21.31 | known |
| | rs56254492 | 3 | 70920168 | T | C | 0.0122 | 0.009525 | 0.038 | 4.011E-09 | 0.014163 | 3E-09 | MDFIC2 | 3p13 | known |
| | rs1510719 | 4 | 1.41E+08 | T | C | 0.0187 | 0.00002567 | 0.0354 | 5.21E-09 | 0.014718 | 7.76E-11 | MAML3 | 4q31.1 | known |
| | rs9390489 | 6 | 1.48E+08 | T | C | 0.0222 | 0.00004556 | 0.03 | 0.00005787 | 0.032770 | 3.05E-08 | SAMDS | 6q24.3 | known |
| | rs11762545 | 7 | 2060775 | T | C | -0.0288 | 1.967E-07 | -0.0414 | 6.84E-08 | -0.021443 | 7.72E-11 | MADIL1 | 7p22.3 | known |
| | rs12705605 | 7 | 1.09E+08 | T | C | -0.0228 | 1.268E-07 | -0.0254 | 0.00001857 | -0.014486 | 1.92E-08 | DNAJB9 | 7q31.1 | known |
| | rs2894699 | 7 | 1.14E+08 | T | C | -0.0226 | 2.163E-07 | -0.0282 | 0.00002507 | -0.013886 | 3.78E-09 | FOXP2 | 7q31.1 | known |
| | rs12707646 | 7 | 1.26E+08 | A | G | 0.0124 | 0.007071 | 0.0369 | 4.243E-09 | 0.014426 | 2.26E-09 | GRM8 | 7q31.33 | known |
| | rs6991878 | 8 | 73907806 | T | C | -0.0169 | 0.0001159 | -0.0338 | 2.705E-08 | -0.013871 | 8.73E-10 | TERF1 | 8q21.11 | known |
| | rs1021363 | 10 | 1.07E+08 | A | G | 0.03 | 2.287E-11 | 0.0256 | 0.00003196 | 0.013667 | 2.34E-09 | SORCS3 | 10q25.1 | known |
| | rs761777 | 10 | 1.35E+08 | A | G | -0.0202 | 0.00007113 | -0.0324 | 0.00001658 | -0.015682 | 3.49E-08 | KNDCL | 10q26.3 | known |
| | rs10831546 | 11 | 88732956 | T | C | 0.0294 | 3.353E-11 | 0.0232 | 0.001487 | 0.012897 | 1.19E-08 | GRM5 | 11q14.2-q14.3 | new |
| | rs62046253 | 16 | 60644621 | T | C | -0.0204 | 0.000006196 | -0.0352 | 1.297E-08 | -0.015487 | 7.9E-11 | CDH8 | 16q21 | known |
| | rs7194442 | 16 | 77139145 | T | C | 0.014 | 0.001907 | 0.033 | 8.319E-08 | 0.012852 | 1.38E-08 | MON1B | 16q23.1 | new |
| | rs11665070 | 18 | 35152563 | A | G | -0.0293 | 1.413E-10 | -0.0261 | 0.00003136 | -0.014244 | 4.25E-09 | CELF4 | 18q12.2 | known |
| | rs12971913 | 19 | 18441704 | A | G | -0.0197 | 0.000008458 | -0.0276 | 0.00000349 | -0.0128 | 1.79E-08 | LSM4 | 19p13.11 | new |
| | rs66715932 | 17 | 50333704 | T | G | -0.0124 | 0.005963 | -0.0361 | 4.501E-09 | -0.017225 | 2.37E-09 | CA10 | 17q21.33-q22 | known |
| Attention-deficit hyperactivity disorder | rs2050256 | 1 | 32204683 | A | G | -0.021586643 | 0.0000488 | -0.037 | 0.00000243 | -0.017829 | 2.34E-08 | ADGRB2 | 1p35.2 | known |
| | rs11691381 | 2 | 80716019 | T | C | -0.024666244 | 0.0000247 | -0.0368 | 0.00000559 | -0.013056 | 3.71E-08 | LRRTM1 | 2p12 | new |
| | rs11123802 | 2 | 1E+08 | T | C | -0.017242085 | 0.000024 | -0.0373 | 4.03E-10 | -0.016348 | 4.24E-12 | AFF3 | 2q11.2 | known |
| | rs3749313 | 3 | 18568261 | A | G | -0.015243224 | 0.0005765 | -0.0311 | 0.00000101 | -0.014734 | 3.27E-08 | SATB1 | 3p24 | known |
| | rs55964255 | 3 | 20742291 | T | C | -0.026663983 | 2.89E-09 | -0.0266 | 0.0000582 | -0.019984 | 1.68E-08 | SGO1 | 3p24.3 | new |
| | rs74652506 | 3 | 43443878 | T | C | 0.030141631 | 0.00000405 | 0.0422 | 0.00000121 | 0.01459 | 1.26E-09 | SNRK | 3p22.1 | known |
| | rs1858828 | 3 | 50242387 | T | G | 0.012986561 | 0.001625 | 0.0327 | 3.23E-08 | 0.013967 | 1.56E-09 | SLC38A3 | 3p21.31 | known |
| | rs809955 | 4 | 1.41E+08 | A | G | -0.015636341 | 0.0002095 | -0.0373 | 1.06E-09 | -0.030752 | 1.55E-11 | MAML3 | 4q31.1 | known |
| | rs62442944 | 7 | 2015047 | T | G | 0.022844731 | 0.0000928 | 0.0418 | 3.49E-08 | 0.020056 | 1.24E-10 | MADIL1 | 7p22.3 | known |
| | rs1202229 | 7 | 3648483 | A | C | -0.011945189 | 0.003964 | -0.0331 | 3.27E-08 | -0.013934 | 3.05E-09 | SDK1 | 7p22.2 | known |
| | rs7794413 | 7 | 1.14E+08 | T | C | -0.025534364 | 2.67E-10 | -0.03 | 0.00000397 | -0.016753 | 1.95E-11 | MDFIC | 7q31.1-q31.2 | known |
| | rs7861421 | 9 | 1.28E+08 | A | G | -0.01676182 | 0.0002814 | -0.0316 | 0.00000154 | -0.016377 | 3.2E-08 | GAPVD1 | 9q33.3 | known |
| | rs7096296 | 10 | 1.07E+08 | T | C | -0.015502261 | 0.0002497 | -0.029 | 0.00000131 | -0.058219 | 2.35E-08 | SORCS3 | 10q25.1 | known |
| | rs10789931 | 11 | 1.13E+08 | T | C | 0.022976401 | 0.001929 | 0.0455 | 0.00000727 | 0.030682 | 1.19E-08 | NCAM1 | 11q23.2 | known |
| | rs11171710 | 12 | 56368078 | A | G | 0.016852016 | 0.0000754 | 0.0351 | 4.17E-09 | 0.010918 | 4.39E-11 | RAB5B | 12q13.2 | known |
| | rs7194442 | 16 | 77139145 | T | C | 0.010274665 | 0.004364 | 0.033 | 8.32E-08 | 0.013261 | 9.74E-09 | MON1B | 16q23.1 | new |
| | rs12939066 | 17 | 50270268 | T | C | 0.013855535 | 0.001033 | 0.0415 | 3.13E-11 | 0.017509 | 1.1E-12 | CA10 | 17q21.33-q22 | known |
| | rs11754773 | 6 | 34577257 | A | G | -0.021062069 | 0.005159 | -0.0501 | 0.00000079 | -0.021176 | 3.31E-08 | SPDEF | 6p21.31 | known |
| Neuroticism | rs2503185 | 1 | 66461401 | A | G | 0.00657191 | 9.62527E-06 | 0.0291 | 9.601E-07 | 0.013538 | 3.82E-08 | PDE4B | 1p31.3 | known |
| | rs1858828 | 3 | 50242387 | T | G | 0.00531994 | 0.001783863 | 0.0327 | 3.232E-08 | 0.013503 | 1.14E-08 | SLC38A3 | 3p21.31 | known |
| | rs809955 | 4 | 1.41E+08 | A | G | -0.00428528 | 0.008743633 | -0.0373 | 1.064E-09 | -0.028392 | 1.15E-09 | MAML3 | 4q31.1 | known |
| | rs11766944 | 7 | 1888051 | A | G | -0.00961175 | 2.49011E-06 | -0.0417 | 4.788E-08 | -0.017372 | 1.34E-09 | ELFN1 | 7p22.3 | known |
| | rs2016535 | 7 | 1.27E+08 | T | G | 0.0103642 | 8.26427E-09 | 0.0397 | 1.508E-08 | 0.018547 | 8.29E-11 | GRM8 | 7q31.33 | known |
| | rs3863241 | 8 | 73890335 | T | C | 0.00647698 | 1.53019E-05 | 0.0318 | 6.713E-08 | 0.022693 | 4.13E-09 | TERF1 | 8q21.11 | known |
| | rs1806152 | 11 | 31851040 | T | C | 0.0135812 | 1.19599E-11 | 0.034 | 0.000006851 | 0.01933 | 1.25E-09 | PAX6 | 11p13 | new |
| | rs10789929 | 11 | 1.13E+08 | T | C | 0.0112615 | 1.62205E-13 | 0.0263 | 0.000001538 | 0.016038 | 1.19E-08 | NCAM1 | 11q23.2 | known |
| | rs719732 | 14 | 75119057 | A | G | -0.0138226 | 2.56342E-11 | -0.0306 | 0.00000456 | -0.013996 | 1.28E-08 | LTBP2 | 14q24.3 | known |
| | rs62046253 | 16 | 60644621 | T | C | -0.00651408 | 3.14722E-05 | -0.0306 | 1.297E-08 | -0.015154 | 1.11E-09 | CDH8 | 16q21 | known |
| | rs7194442 | 16 | 77139145 | T | C | -0.010782 | 8.08466E-13 | -0.0288 | 0.000001296 | -0.02043 | 1.21E-09 | TCF4 | 18q21.2 | known |
| | rs3922717 | 6 | 27030924 | A | G | 0.0137001 | 1.56278E-14 | 0.0429 | 5.554E-10 | 0.043872 | 8.13E-14 | MHC region | known | known |
| Anxiety, panic disorder | rs17802799 | 3 | 70967054 | A | G | 0.000674094 | 0.0088 | 0.0344 | 0.000000076 | 0.01486 | 4.47E-08 | MDFIC2 | 3p13 | known |
| | rs7555997 | 6 | 26483048 | A | G | 0.00657778 | 0.0061 | 0.0376 | 3.23E-10 | 0.018963 | 4.21E-10 | MHC region | known | known |
| | rs4851239 | 2 | 1E+08 | T | C | -0.0400005 | 0.008485 | -0.0387 | 1.81E-10 | -0.021709 | 7.16E-11 | AFF3 | 2q11.2 | known |
| | rs7743491 | 6 | 1.65E+08 | T | C | -0.0452003 | 0.003206 | -0.0324 | 0.000000127 | -0.018005 | 2.57E-08 | C6orf18 | 6q27 | known |
| | rs11766944 | 7 | 1888051 | A | G | -0.0518998 | 0.005496 | -0.0417 | 4.79E-08 | -0.017111 | 1.12E-08 | ELFN1 | 7p22.3 | known |
| | rs11766962 | 7 | 1.26E+08 | T | C | -0.0459005 | 0.009658 | -0.0371 | 0.000000128 | -0.017042 | 3.72E-08 | GRM8 | 7q31.33 | known |
| | rs9941110 | 16 | 60654164 | T | C | -0.0494004 | 0.002713 | -0.0353 | 9.13E-08 | -0.015248 | 2.02E-08 | CDH8 | 16q21 | known |
| | rs2503185 | 1 | 66461401 | A | G | 0.0124028 | 0.0001089 | 0.0291 | 9.601E-07 | 0.012375 | 2.37E-08 | PDE4B | 1p31.3 | known |
| | rs782214 | 1 | 72945128 | A | G | 0.0292966 | 8.881E-13 | 0.0282 | 0.00001217 | 0.013039 | 9.82E-10 | NEGR1 | 1p31.1 | known |
| | rs12136984 | 1 | 73725998 | T | G | -0.0263953 | 2.527E-16 | -0.0186 | 0.001617 | -0.02854 | 1.84E-09 | LRRK3 | 1p31.1 | new |
| | rs61787782 | 1 | 98310239 | A | G | -0.0119005 | 0.005468 | -0.0404 | 1.27E-08 | -0.01425 | 1.07E-08 | DPYD | 1p21.3 | known |
| | rs12074276 | 1 | 1.74E+08 | T | G | 0.0134985 | 0.0002037 | 0.032 | 0.00000143 | 0.011653 | 4.61E-08 | RABGAP1L | 1q25.1 | known |
| | rs6683411 | 1 | 1.91E+08 | A | G | 0.0105959 | 0.0009082 | 0.0324 | 4.823E-08 | 0.015291 | 7.09E-11 | BRINP3 | 1q31.1 | known |
| | rs12125521 | 1 | 2.14E+08 | T | C | 0.0194006 | 5.282E-08 | 0.0276 | 0.000002396 | 0.020974 | 1.39E-08 | SMYD2 | 1q32.3 | new |
| | rs67446571 | 2 | 22554648 | A | G | -0.0212032 | 9.628E-11 | -0.0256 | 0.00002406 | -0.012935 | 1.25E-09 | KLHL29 | 2p24.1 | known |
| | | | | | | | | | | | | | | |

Supplementary Table 9. Multi-trait meta-analysis between digestive diseases and gastroesophageal reflux disease in Europeans

| Type of digestive diseases | SNP | CHR | BP | A1 | A2 | Digestive diseases (all) Beta | P_value | Beta | P_value | M TAG | P_mtag | Genes | Cytogenetic band | Annotation |
|----------------------------------|-------------|-----|-----------|----|----|-------------------------------|-------------|---------|-------------|-------------|-------------|------------|------------------|------------|
| Irritable bowel syndrome | rs35975336 | 3 | 58451634 | A | G | 0.0361 | 0.000132 | 0.0415 | 2.834E-07 | 0.013962754 | 8.8902E-09 | KCTD6 | 3p14.3 | new |
| | rs13092463 | 3 | 70959754 | A | G | 0.0194 | 0.009461 | 0.0361 | 2.301E-08 | 0.02917814 | 8.948E-09 | MDFIC2 | 3p13 | known |
| | rs9266197 | 6 | 31324830 | A | G | 0.0401 | 0.000001872 | 0.0394 | 3.604E-10 | 0.016675437 | 1.8419E-12 | MHC region | | known |
| | rs4728049 | 7 | 126344575 | A | G | -0.0213 | 0.002179 | -0.0334 | 2.816E-08 | -0.0155863 | 3.326E-09 | GRM8 | 7q31.33 | known |
| | rs171113729 | 8 | 68391710 | T | C | 0.0652 | 0.001865 | 0.0969 | 5.88E-08 | 0.014629091 | 7.3218E-09 | ARFGEF1 | 8q13.2 | new |
| | rs10789929 | 11 | 112830663 | T | C | 0.0376 | 9.429E-08 | 0.0263 | 0.00001538 | 0.01548624 | 3.8748E-08 | NCAM1 | 11q23.2 | known |
| | rs62046253 | 16 | 60644621 | T | C | -0.0205 | 0.0042 | -0.0352 | 1.297E-08 | -0.01479923 | 2.8535E-09 | CDH9 | 16q21 | known |
| | rs11647182 | 16 | 82896398 | A | G | -0.0235 | 0.00229 | -0.0334 | 4.636E-07 | -0.01309921 | 4.9697E-08 | CDH13 | 16q23.3 | known |
| Gastritis-duodenitis | rs12939066 | 17 | 50270268 | T | C | 0.0209 | 0.003879 | 0.0415 | 3.132E-11 | 0.017296583 | 6.7218E-12 | CA10 | 17q21.33-q22 | known |
| | rs66588412 | 1 | 98309251 | A | C | -0.0279 | 0.00917 | 0.0404 | 1.19E-08 | 0.015058273 | 1.64E-08 | DPYD | 1p21.3 | known |
| | rs1858828 | 3 | 50242387 | T | G | 0.0247 | 0.00579 | 0.0327 | 3.23E-08 | 0.013714685 | 3.19E-08 | SLC38A3 | 3p21.31 | known |
| | rs6809836 | 3 | 70940892 | A | G | 0.0295 | 0.00264 | 0.0383 | 3.7E-09 | 0.018255905 | 3.85E-09 | MDFIC2 | 3p13 | known |
| | rs769671 | 4 | 140883618 | T | C | -0.0248 | 0.00913 | -0.0385 | 9.28E-10 | -0.01665023 | 1.56E-09 | MAML3 | 4q31.1 | known |
| | rs12705982 | 7 | 114336114 | T | C | 0.0282 | 0.00163 | 0.0326 | 3.67E-08 | 0.014695047 | 2.55E-08 | MDFIC | 7q31.1-q31.2 | known |
| | rs773109 | 12 | 56376495 | A | G | -0.0247 | 0.00877 | -0.0341 | 4.86E-08 | -0.01589014 | 4.44E-08 | RAB5B | 12q13.2 | known |
| | rs6544623 | 16 | 60644621 | T | C | -0.0305 | 0.0011 | -0.0352 | 0.00000013 | -0.01492994 | 1.03E-08 | CDH9 | 16q21 | known |
| Diverticular disease | rs79286782 | 19 | 18716550 | A | G | 0.0503 | 0.00366 | 0.0664 | 8.58E-09 | 0.014298653 | 8.11E-09 | TMEM59L | 19p13.11 | new |
| | rs953988 | 17 | 50311047 | T | C | 0.0391 | 0.0000183 | -0.0398 | 4.61E-11 | -0.01675493 | 1.42E-11 | CA10 | 17q21.33-q22 | known |
| | rs7755997 | 6 | 26483048 | A | G | 0.0281 | 0.00182 | 0.0376 | 3.23E-10 | 0.018575597 | 4.02E-10 | MHC region | | known |
| | rs3072 | 2 | 20878406 | T | C | -0.0023035 | 0.000052 | -0.0345 | 1.863E-08 | -0.01618376 | 2.6379E-09 | GDF7 | 2p24.1 | new |
| | rs9309272 | 2 | 56095366 | T | G | 0.00703876 | 6.4E-19 | 0.0441 | 4.203E-07 | 0.015237362 | 7.5442E-10 | EFEMP1 | 2p16.1 | new |
| | rs7609078 | 2 | 100490363 | A | G | -0.0017223 | 0.0023 | -0.039 | 1.626E-10 | -0.01646839 | 8.9811E-11 | AF3 | 2q11.2 | known |
| | rs6762606 | 3 | 134379752 | T | C | -0.00197149 | 0.0013 | -0.0359 | 4.181E-08 | -0.01415244 | 1.2003E-08 | KY | 3q22.2 | known |
| | rs56051594 | 5 | 4940464 | T | C | 0.00177969 | 0.0012 | 0.0329 | 4.179E-08 | 0.017542801 | 1.567E-08 | SLC9A3 | 5p15.33 | new |
| Peptic ulcer | rs6969188 | 7 | 114160742 | A | G | 0.0236916 | 0.000016 | 0.0317 | 1.012E-07 | 0.023018006 | 1.0234E-08 | MDFIC | 7q31.1-q31.2 | known |
| | rs1050458 | 6 | 31324925 | A | G | -0.00177329 | 0.0022 | -0.0393 | 3.117E-10 | -0.01852619 | 1.2259E-10 | MHC region | | known |
| | rs809955 | 4 | 140874760 | A | G | -0.03163404 | 0.0064 | -0.0373 | 1.064E-09 | -0.0300865 | 8.3914E-10 | MAML3 | 4q31.1 | known |
| | rs9800013 | 5 | 542023 | A | G | -0.039164627 | 0.0027 | -0.0372 | 8.803E-08 | -0.01379482 | 4.044E-08 | SLC9A3 | 5p15.33 | new |
| | rs2344609 | 11 | 6270056 | T | C | -0.08900029 | 9.8E-12 | -0.0376 | 1.168E-07 | -0.01982084 | 3.5887E-09 | CCKBR | 11p15.4 | known |
| | rs7189865 | 16 | 60630724 | A | G | -0.03514064 | 0.0024 | -0.0325 | 7.025E-08 | -0.02128225 | 3.323E-08 | CDH9 | 16q21 | known |
| | rs2009780 | 6 | 27852011 | T | C | -0.04371402 | 0.0022 | -0.0443 | 4.778E-09 | -0.01468003 | 3.39E-09 | MHC region | | known |
| | rs75331444 | 2 | 44069772 | A | G | 0.767 | 4.16E-201 | 0.0498 | 0.0000353 | 0.02875756 | 1.22E-12 | ABCG5 | 2p21 | new |
| Cholelithiasis and cholecystitis | rs2861695 | 2 | 67846727 | A | G | 0.0412 | 0.00526 | 0.0424 | 1.18E-08 | -0.03688570 | 7.21E-09 | ETAA1 | 2p14 | known |
| | rs10250103 | 7 | 114294942 | T | C | 0.0357 | 0.00237 | 0.0325 | 4.11E-08 | 0.022810512 | 2.13E-08 | MDFIC | 7q31.1-q31.2 | known |
| | rs11717170 | 12 | 56368078 | A | G | 0.0376 | 0.0015 | 0.0351 | 4.179E-08 | 0.016756822 | 2.8E-09 | RAB5B | 12q13.2 | known |
| | rs4888844 | 19 | 18811966 | A | G | 0.036 | 0.00258 | 0.0341 | 0.000000016 | 0.016237789 | 8.11E-09 | CRT1 | 19p13.11 | new |
| | rs75331444 | 2 | 44069772 | A | G | 0.0266862 | 4.081E-28 | 0.0498 | 0.0000353 | 0.022089517 | 4.37E-08 | ABCG5 | 2p21 | new |
| | rs7194442 | 16 | 77139145 | T | C | 0.0149077 | 0.00389 | 0.033 | 8.319E-08 | 0.013705595 | 3.1836E-08 | MON1B | 16q23.1 | new |
| | rs7609078 | 2 | 100490363 | A | G | -0.0522793 | 0.001701 | -0.039 | 1.63E-10 | -0.01685795 | 4.57E-11 | AF3 | 2q11.2 | known |
| | rs4688745 | 3 | 50240338 | T | C | -0.0425995 | 0.009278 | -0.0316 | 9.57E-08 | -0.0174351 | 3.54E-08 | SLC38A3 | 3p21.31 | known |
| Inflammatory bowel disease | rs7509 | 6 | 27418847 | T | G | -0.0438781 | 0.008958 | -0.0316 | 0.000000085 | -0.01785114 | 3.51E-08 | MHC region | | known |
| | rs6724133 | 2 | 67858671 | A | G | 0.0655 | 0.0000211 | 0.0449 | 4.113E-09 | 0.015148646 | 1.1357E-09 | ETAA1 | 2p14 | known |
| | rs11065987 | 12 | 112072424 | A | G | -0.0779 | 1.74E-09 | -0.031 | 2.124E-07 | -0.01638733 | 3.7907E-08 | ATXN2 | 12q24.12 | new |
| | rs11649417 | 16 | 82881108 | A | G | -0.0523 | 0.0000717 | -0.0336 | 8.711E-08 | -0.01891980 | 3.6715E-08 | CDH13 | 16q23.3 | known |
| | rs72846794 | 6 | 28137499 | A | G | -0.0548 | 0.009212 | -0.0543 | 6.707E-08 | -0.01452662 | 5.2501E-09 | MHC region | | known |
| | rs6710685 | 2 | 67858666 | T | C | 0.0626 | 0.0002513 | 0.0391 | 1.958E-09 | 0.015390008 | 5.7446E-10 | ETAA1 | 2p14 | known |
| | rs1265564 | 12 | 111708458 | A | C | -0.0651 | 0.0000895 | -0.0319 | 1.232E-07 | -0.04200059 | 2.9999E-08 | PHET1 | 12q24.12 | new |
| | rs11649417 | 16 | 82881108 | A | G | -0.0972 | 9.859E-09 | -0.0336 | 8.711E-08 | -0.01961124 | 1.0812E-08 | CDH13 | 16q23.3 | known |
| Stool frequency | rs3922717 | 6 | 27030924 | A | G | 0.0728 | 0.0002219 | 0.0429 | 5.554E-10 | 0.039502415 | 1.58E-10 | MHC region | | known |
| | rs6696188 | 7 | 114160742 | A | G | 0.0074 | 0.008363 | 0.0317 | 0.000000101 | 0.022145628 | 0.000000005 | MDFIC | 7q31.1-q31.2 | known |
| | rs12939066 | 17 | 50270268 | T | C | 0.0096 | 0.001168 | 0.0415 | 3.13E-11 | 0.018015595 | 1.1E-11 | CA10 | 17q21.33-q22 | known |
| | rs4713177 | 6 | 28673998 | A | G | -0.0168 | 0.0001033 | -0.0544 | 2.16E-09 | -0.01846486 | 3.81E-08 | MHC region | | known |
| | rs13097265 | 3 | 70943143 | A | G | 0.0250505 | 0.00200844 | 0.0383 | 3.969E-09 | 0.022996943 | 1.8573E-08 | MDFIC2 | 3p13 | known |
| | rs15071 | 5 | 82877689 | T | C | -0.0486971 | 1.24337E-07 | -0.0428 | 1.007E-08 | -0.01614768 | 5.6685E-09 | VCAN | 5q14.2 | known |
| | rs1050458 | 6 | 31324925 | A | G | -0.0247638 | 0.00213623 | -0.0393 | 3.117E-10 | -0.01767609 | 1.3404E-09 | MHC region | | known |

Supplementary Table 10. Multi-trait meta-analysis between psychiatric disorders and gastritis-duodenitis in Europeans

| Type of psychiatric disorders | SNP | CHR | BP | A1 | A2 | Psychiatric disorders (all) | | Gastritis-duodenitis | | MTAG | | Genes | Cytogenetic band | Annotation |
|--|-------------|-----|-----------|----|----|-----------------------------|------------|----------------------|----------|-----------|-----------|------------|------------------|------------|
| | | | | | | Beta | P-value | Beta | P-value | Beta-mtag | P-mtag | | | |
| Major depressive disorder | rs10035289 | 5 | 153095918 | G | A | -0.0168 | 0.0009845 | -0.0418 | 2.59E-06 | -0.009866 | 2.588E-08 | GRIA1 | 5q33.2 | known |
| | rs4713692 | 6 | 33807638 | T | C | -0.0188 | 0.0000268 | -0.0411 | 7.82E-06 | -0.010156 | 3.076E-08 | MHC region | | known |
| | rs1020006 | 7 | 12255664 | A | G | 0.0295 | 1.137E-11 | 0.0275 | 0.0022 | 0.010548 | 3.982E-09 | TMEM106B | 7p21.3 | known |
| | rs2396133 | 7 | 109197067 | G | A | 0.0227 | 1.323E-07 | 0.0325 | 0.000265 | 0.0097356 | 3.827E-08 | DNAJB9 | 7q31.1 | known |
| | rs6539062 | 12 | 103552910 | A | C | 0.02 | 0.00000365 | 0.0379 | 2.17E-05 | 0.0099523 | 1.899E-08 | PAH | 12q23.2 | known |
| | rs17488531 | 18 | 50754996 | A | G | 0.0237 | 4.31E-08 | 0.0342 | 0.000132 | 0.0102238 | 9.062E-09 | DCC | 18q21.2 | known |
| Attention-deficit hyperactivity disorder | rs2924321 | 18 | 53125435 | A | G | -0.0282 | 7.155E-11 | -0.0265 | 0.00309 | -0.010037 | 1.553E-08 | TCF4 | 18q21.2 | known |
| | rs62369151 | 5 | 87883503 | C | T | 0.03040239 | 1.379E-13 | 0.0251 | 0.00602 | 0.0107845 | 1.007E-08 | MEF2C | 5q14.3 | new |
| | rs9969232 | 7 | 114158954 | A | G | 0.02966242 | 9.983E-12 | 0.033 | 0.00042 | 0.0113906 | 2.116E-11 | MDFIC | 7q31.1-q31.2 | known |
| | rs11255912 | 10 | 8808327 | A | C | -0.0228859 | 5.144E-08 | -0.0306 | 0.000811 | -0.009535 | 1.114E-08 | GATA3 | 10p14 | known |
| | rs525101 | 13 | 111969728 | C | T | 0.01850304 | 0.00001117 | 0.0378 | 4.04E-05 | 0.009418 | 1.984E-08 | TEX29 | 13q34 | known |
| Neuroticism | rs7260067 | 19 | 57517611 | A | G | 0.03044432 | 0.0002434 | 0.0823 | 5.51E-06 | 0.0179744 | 4.106E-08 | USP29 | 19q13.43 | known |
| | rs10487459 | 7 | 126378255 | G | A | 0.0102133 | 3.388E-11 | 0.0316 | 0.000513 | 0.0103205 | 3.204E-08 | GRM8 | 7q31.3 | known |
| | rs10891490 | 11 | 112885527 | C | T | -0.0110313 | 9.183E-13 | -0.0315 | 0.0005 | -0.010695 | 8.256E-09 | NCAM1 | 11q23.2 | known |
| | rs8089828 | 18 | 50669725 | C | T | -0.0119605 | 2.0922E-15 | -0.034 | 0.00014 | -0.011609 | 2.012E-10 | DCC | 18q21.2 | known |
| Post traumatic stress disorder | rs1262465 | 18 | 52857732 | G | A | 0.0109108 | 4.4337E-13 | 0.0318 | 0.0003 | 0.0106775 | 4.748E-09 | CCDC68 | 18q21.2 | known |
| | rs12894125 | 14 | 34301824 | A | G | -0.0286202 | 0.005578 | -0.0763 | 2.19E-08 | -0.01974 | 1.65E-09 | SPTSSA | 14q13.1 | known |
| | rs144877686 | 16 | 4689686 | A | C | 0.06905358 | 0.004346 | 0.161 | 3.93E-07 | 0.040868 | 3.28E-08 | MGRN1 | 16p13.3 | known |
| Depression | rs2102341 | 1 | 37193908 | C | T | -0.0230034 | 6.802E-11 | -0.0257 | 0.00877 | -0.009242 | 4.33E-08 | CSF3R | 1p34.3 | new |
| | rs12466671 | 2 | 22583435 | G | A | 0.0208968 | 1.412E-10 | 0.0265 | 0.00377 | 0.0086774 | 3.447E-08 | KLHL29 | 2p24.1 | new |
| | rs6441859 | 3 | 44625897 | A | G | 0.0242005 | 9.838E-13 | 0.026 | 0.00664 | 0.0096545 | 4.932E-09 | ZNF197 | 3p21.31 | known |
| | rs39654 | 3 | 173095123 | G | A | 0.0181029 | 2.331E-08 | 0.0347 | 0.000103 | 0.0088802 | 8.072E-09 | NLGN1 | 3q26.31 | known |
| | rs4273649 | 5 | 153120048 | G | A | -0.0178989 | 2.995E-06 | -0.0394 | 9.48E-06 | -0.009252 | 1.017E-08 | GRIA1 | 5q33.2 | known |
| | rs2219498 | 5 | 167059459 | T | C | 0.0182047 | 1.06E-08 | 0.0302 | 0.000707 | 0.0083966 | 4.607E-08 | TENM2 | 5q34 | known |
| | rs2523734 | 6 | 30129676 | C | A | 0.0337016 | 2.069E-12 | 0.0358 | 0.00582 | 0.0130905 | 5.955E-09 | MHC region | | known |
| | rs4869748 | 6 | 152225383 | G | T | -0.0248975 | 6.65E-14 | -0.0239 | 0.00945 | -0.009566 | 1.835E-09 | ESR1 | 6q25.1-q25.2 | known |
| | rs62435650 | 7 | 1823265 | G | A | -0.0226026 | 6.096E-09 | -0.0394 | 0.000372 | -0.010727 | 1.792E-08 | ELFN1 | 7p22.3 | known |
| | rs6460905 | 7 | 12283227 | G | A | 0.0226035 | 3.326E-12 | 0.0277 | 0.00208 | 0.009418 | 1.445E-09 | TMEM106B | 7p21.3 | known |
| | rs1476535 | 7 | 114071035 | T | C | 0.0222967 | 4.793E-11 | 0.0287 | 0.00144 | 0.009657 | 2.958E-09 | FOXP2 | 7q31.1 | known |
| | rs7105462 | 11 | 112912048 | A | G | -0.020998 | 1.626E-10 | -0.0316 | 0.000479 | -0.009266 | 3.168E-09 | NCAM1 | 11q23.2 | known |
| | rs6539062 | 12 | 103552910 | A | C | 0.0175023 | 5.389E-08 | 0.0379 | 2.17E-05 | 0.0090595 | 3.685E-09 | PAH | 12q23.2 | known |
| | rs17488531 | 18 | 50754996 | A | G | 0.0253999 | 1.994E-15 | 0.0342 | 0.000132 | 0.0108555 | 2.006E-12 | DCC | 18q21.2 | known |
| | rs12454204 | 18 | 52500011 | T | G | -0.0270995 | 3.958E-13 | -0.0325 | 0.00196 | -0.01126 | 5.18E-10 | CCDC68 | 18q21.2 | known |

Supplementary Table 11. Multi-trait meta-analysis between digestive diseases and gastritis-duodenitis in Europeans

| Type of digestive diseases | SNP | CHR | BP | A1 | A2 | Gastritis diseases (all) | | Gastritis-duodenitis | | MTAG | | Genes | Cytogenetic band | Annotation |
|----------------------------------|------------|-----|-----------|----|----|--------------------------|----------|----------------------|-----------|-----------|-------------|------------|------------------|------------|
| | | | | | | Beta | P-value | Beta | P-value | Beta-mtag | P-mtag | | | |
| Peptic ulcer | rs2976388 | 8 | 143760256 | A | G | -0.08673 | 1.8E-14 | -0.0296 | 0.000998 | -0.012322 | 8.91659E-10 | JRK | 8q24.3 | known |
| | rs2344609 | 11 | 6270056 | C | T | 0.0890003 | 9.8E-12 | 0.0315 | 0.00322 | 0.01303 | 4.71769E-08 | CCKBR | 11p15.4 | known |
| | rs681343 | 19 | 49206462 | T | C | 0.0887658 | 1.9E-15 | 0.0311 | 0.000488 | 0.01275 | 1.38759E-10 | FUT2 | 19q13.33 | known |
| Diverticular disease | rs7595012 | 2 | 144356358 | T | C | 0.0109587 | 1.8E-14 | -0.0364 | 0.000998 | -0.012322 | 2.2E-19 | ARHGAP15 | 2q22.2-q22.3 | known |
| | rs1047989 | 6 | 32605257 | A | C | -0.001499 | 9.8E-12 | 0.0497 | 0.00322 | 0.01303 | 8.44E-09 | MHC region | known | known |
| Cholelithiasis and cholecystitis | rs75331444 | 2 | 44069772 | A | G | 0.767 | 4.2E-201 | 0.0575 | 0.00136 | 0.035077 | 4.68722E-15 | ABCG5 | 2p21 | known |
| | rs9272722 | 6 | 32609404 | T | C | 0.0334 | 0.0057 | 0.0505 | 3.72E-08 | 0.012782 | 1.06307E-08 | MHC region | known | known |
| | rs75331444 | 2 | 44069772 | A | G | 0.29339 | 4.08E-28 | 0.0575 | 0.00136 | 0.026844 | 5.58598E-10 | ABCG5 | 2p21 | known |
| Gastroesophageal reflux disease | rs6809836 | 3 | 70940892 | A | G | 0.0383 | 3.7E-09 | 0.0295 | 0.00264 | 0.008876 | 2.27028E-08 | MDFIC2 | 3p13 | known |
| | rs13143388 | 4 | 140917009 | C | T | 0.0355 | 4.75E-09 | -0.0302 | 0.00095 | 0.008387 | 1.5762E-08 | MAML3 | 4q31.1 | known |
| | rs7755997 | 6 | 26483048 | A | G | 0.0376 | 3.23E-10 | 0.0281 | 0.00182 | 0.008661 | 3.38245E-09 | MHC region | known | known |
| | rs62046253 | 16 | 60644621 | T | C | -0.0352 | 1.3E-08 | -0.0305 | 0.0011 | -0.008398 | 3.14315E-08 | CDH8 | 16q21 | known |
| | rs953988 | 17 | 50311047 | C | T | -0.0398 | 4.61E-11 | 0.0391 | 0.0000183 | -0.00982 | 2.83181E-11 | CA10 | 17q21.33-q22 | known |
| | rs79286782 | 19 | 18716550 | A | G | 0.0664 | 8.58E-09 | 0.0503 | 0.00366 | 0.015359 | 4.74257E-08 | TMEM59L | 19p13.11 | known |

Supplementary Table 12. Multi-trait meta-analysis between psychiatric disorders and peptic ulcer in Europeans

| Type of psychiatric disorders | SNP | CHR | BP | A1 | A2 | Psychiatric disorders (all) | | Peptic ulcer | | MTAG | | Genes | Cytogenetic band | Annotation |
|--|------------|-----|-----------|----|----|-----------------------------|-------------|--------------|---------|-----------|-------------|------------|------------------|------------|
| | | | | | | Beta | P-value | Beta | P-value | Beta-mtag | P-mtag | | | |
| Attention-deficit hyperactivity disorder | rs2906471 | 1 | 44306422 | C | T | 0.0673034 | 1.582E-10 | 0.04046 | 0.0011 | 0.010816 | 7.53267E-10 | ARTN | 1p34.1 | new |
| | rs72671494 | 8 | 93195457 | T | C | -0.0691036 | 3.727E-07 | -0.06289 | 0.0001 | -0.013342 | 5.58826E-09 | RUNX1T1 | 8q21.3 | new |
| | rs10965176 | 9 | 2198424 | G | T | 0.0619978 | 5.903E-08 | 0.0469 | 0.0011 | 0.011055 | 2.29443E-08 | SMARCA2 | 9p24.3 | new |
| | rs770082 | 12 | 89776485 | G | A | -0.0507987 | 6.582E-08 | -0.03848 | 0.00065 | -0.008942 | 1.43157E-08 | DUSP6 | 12q21.33 | new |
| Neuroticism | rs169287 | 6 | 27854760 | C | A | 0.016426 | 1.48633E-15 | 0.04387 | 0.0021 | 0.01266 | 6.03194E-09 | MHC region | | known |
| | rs2071754 | 11 | 31812582 | C | T | 0.0135339 | 3.78606E-12 | 0.04425 | 0.0012 | 0.011781 | 3.69696E-08 | PAX6 | 11p13 | new |
| | rs7948789 | 11 | 112839532 | A | G | -0.0113381 | 1.12999E-13 | -0.03514 | 0.0022 | -0.009829 | 2.45446E-08 | NCAM1 | 11q23.2 | new |
| | rs1875140 | 12 | 117672339 | T | C | -0.0143882 | 3.86062E-15 | -0.04465 | 0.0013 | -0.012731 | 4.09202E-09 | FBXO21 | 12q24.22 | new |
| Major depressive disorder | rs601338 | 19 | 49206674 | G | A | -0.0044037 | 0.003004862 | -0.08848 | 2.4E-15 | -0.0129 | 5.66709E-14 | FUT2 | 19q13.33 | known |
| | rs2568957 | 1 | 72764430 | A | G | -0.0349 | 2.156E-10 | -0.03809 | 0.0076 | -0.010626 | 2.15448E-08 | NEGR1 | 1p31.1 | new |
| | rs9536383 | 13 | 53865563 | T | C | 0.0255 | 3.883E-08 | -0.04308 | 0.00032 | 0.009297 | 8.36922E-09 | OLFM4 | 13q14.3 | new |
| | rs200973 | 6 | 27858421 | A | G | 0.0433 | 9.392E-15 | 0.04607 | 0.0013 | 0.012903 | 1.00273E-11 | MHC region | | known |
| Depression | rs2815757 | 1 | 72764289 | C | T | -0.0296039 | 9.159E-13 | -0.03772 | 0.0082 | -0.010018 | 1.77309E-09 | NEGR1 | 1p31.1 | new |
| | rs2341392 | 1 | 73986097 | G | A | 0.0262037 | 1.308E-14 | 0.03117 | 0.0051 | 0.00914 | 5.42175E-11 | LRRKQ3 | 1p31.1 | new |
| | rs1267067 | 2 | 162007748 | T | C | 0.0215951 | 3.519E-10 | 0.03219 | 0.0084 | 0.007849 | 4.24119E-08 | TANK | 2q24.2 | known |
| | rs12694079 | 2 | 208041399 | A | G | 0.0222995 | 3.398E-11 | 0.03074 | 0.009 | 0.00778 | 2.2395E-08 | KLF7 | 2q33.3 | new |
| | rs7629352 | 3 | 16848835 | A | G | -0.022399 | 6.798E-11 | -0.04204 | 0.00048 | -0.008796 | 8.31405E-10 | PLCL2 | 3p24.3 | new |
| | rs200973 | 6 | 27858421 | A | G | 0.0323994 | 1.609E-13 | 0.04607 | 0.0013 | 0.01074 | 1.07513E-10 | MHC region | | known |
| | rs10268609 | 7 | 1962163 | G | T | -0.0332983 | 1.125E-15 | -0.04212 | 0.0058 | -0.011564 | 6.98347E-11 | ELFN1 | 7p22.3 | new |
| | rs12575544 | 11 | 112918985 | G | A | -0.0243952 | 2.206E-10 | -0.04651 | 0.00073 | -0.00984 | 2.34331E-09 | NCAM1 | 11q23.2 | new |
| | rs1923773 | 13 | 53750354 | A | G | -0.0208968 | 2.515E-09 | -0.04236 | 0.00052 | -0.008235 | 8.99932E-09 | OLFM4 | 13q14.3 | new |
| | rs281276 | 15 | 47660070 | A | G | -0.0262002 | 7.005E-07 | -0.06099 | 6.7E-05 | -0.010887 | 2.21801E-08 | SEMA6D | 15q21.1 | new |

Supplementary Table 13. Multi-trait meta-analysis between digestive diseases and peptic ulcer in Europeans

| Type of digestive diseases | SNP | CHR | BP | A1 | A2 | Digestive diseases (all) | | Peptic ulcer | | MTAG | | Genes | Cytogenetic band | Annotation |
|----------------------------------|------------|-----|-----------|----|----|--------------------------|-----------|--------------|---------|-----------|-------------|------------|------------------|------------|
| | | | | | | Beta | P-value | Beta | P-value | Beta-mtag | P-mtag | | | |
| Diverticular disease | rs2484242 | 6 | 160772171 | G | A | 0.001807 | 0.0063 | 0.07488 | 1.5E-07 | 0.012763 | 2.29215E-08 | SLC22A3 | 6q25.3 | known |
| | rs687621 | 9 | 136137065 | A | G | 0.0044938 | 8.5E-15 | 0.07354 | 1.3E-09 | 0.016754 | 1.03292E-17 | ABO | 9q34.2 | new |
| | rs281393 | 19 | 49224484 | C | T | 0.0016643 | 0.0034 | 0.06843 | 1E-08 | 0.011775 | 1.10772E-09 | FUT2 | 19q13.33 | known |
| Cholelithiasis and cholecystitis | rs10794340 | 11 | 918339 | C | T | 0.0609 | 0.000968 | 0.11366 | 5.5E-10 | 0.021316 | 1.62592E-11 | CHID1 | 11p15.5 | known |
| | rs681343 | 19 | 49206462 | T | C | -0.0925 | 2.97E-15 | -0.08877 | 1.9E-15 | -0.01945 | 2.45762E-22 | FUT2 | 19q13.33 | known |
| | rs2976388 | 8 | 143760256 | G | A | -0.0296 | 0.000998 | -0.08673 | 1.8E-14 | -0.011854 | 1.90196E-12 | PSCA | 8q24.3 | known |
| Gastritis-duodenitis | rs10500661 | 11 | 6273744 | T | C | 0.0329 | 0.00288 | 0.10157 | 4.1E-14 | 0.014019 | 1.11469E-11 | CCKBR | 11p15.4 | known |
| | rs681343 | 19 | 49206462 | C | T | 0.0311 | 0.000488 | 0.08877 | 1.9E-15 | 0.01223 | 1.95982E-13 | FUT2 | 19q13.33 | known |
| | rs809955 | 4 | 140874760 | G | A | -0.0373 | 1.064E-09 | 0.03163 | 0.0064 | -0.007714 | 1.38855E-08 | MAML3 | 4q31.1 | new |
| Gastroesophageal reflux disease | rs55660354 | 5 | 684888 | A | C | -0.038 | 3.702E-07 | 0.0583 | 2.8E-05 | -0.009382 | 1.8687E-08 | TPPP | 5p15.33 | known |
| | rs200980 | 6 | 27852011 | C | T | -0.0443 | 4.778E-09 | 0.04371 | 0.0022 | -0.009354 | 1.80074E-08 | MHC region | | |
| | rs695174 | 6 | 160775510 | G | A | -0.0279 | 2.291E-06 | 0.05037 | 6.9E-06 | -0.007247 | 3.25605E-08 | SLC22A3 | 6q25.3 | known |
| | rs2978977 | 8 | 143755720 | C | A | -0.0212 | 0.0003939 | 0.08489 | 8.8E-14 | -0.008082 | 1.17073E-09 | PSCA | 8q24.3 | known |
| Irritable bowel syndrome | rs10500661 | 11 | 6273744 | T | C | -0.0373 | 3.58E-07 | 0.10157 | 4.1E-14 | -0.0118 | 3.86759E-13 | CCKBR | 11p15.4 | known |
| | rs1248857 | 3 | 84969461 | G | A | -0.0356 | 2.003E-07 | -0.04276 | 0.00012 | -0.010194 | 6.52999E-09 | CADM2 | 3p12.1 | new |
| | rs10512225 | 9 | 93464818 | G | A | 0.0401 | 6.429E-09 | 0.03768 | 0.00078 | 0.010123 | 1.13913E-08 | FAM120AOS | 9q22.31 | new |
| | rs2587363 | 13 | 53341798 | G | A | -0.0348 | 4.298E-07 | -0.0464 | 3.6E-05 | -0.010531 | 2.84575E-09 | OLFM4 | 13q14.3 | new |

Supplementary Table 14. Multi-trait meta-analysis between psychiatric disorders and colorectal cancer in European.

| Type of psychiatric disorders | SNP | CHR | BP | A1 | A2 | Psychiatric disorders (all) | | Peptic ulcer | | MTAG | | Genes | Cytogenetic band | Annotation |
|--|-------------|-----|-----------|----|----|-----------------------------|-----------|--------------|-------------|-----------|---------|----------------|------------------|------------|
| | | | | | | Beta | P-value | Beta | P-value | Beta-mtag | P-mtag | | | |
| Attention-deficit hyperactivity disorder | rs9425569 | 1 | 182942202 | A | G | -0.032203 | 0.0008976 | -0.06498 | 1.43502E-17 | -0.026366 | 2.2E-14 | SHCBP1L | 1q25.3 | new |
| | rs2790760 | 1 | 222109518 | A | G | 0.0253999 | 0.006427 | 0.04345 | 3.33251E-09 | 0.02008 | 6E-09 | DUSP10 | 1q41 | known |
| | rs11692435 | 2 | 98275354 | A | G | -0.0416974 | 0.007819 | -0.09104 | 7.16234E-12 | -0.021185 | 8.4E-10 | ACTR1B | 2q11.2 | known |
| | rs116607676 | 6 | 32604139 | A | C | -0.0882032 | 0.004678 | -0.17466 | 8.7338E-13 | -0.024102 | 2.9E-12 | MHC region | | known |
| | rs145623959 | 8 | 117669894 | C | T | 0.111103 | 0.008568 | 0.33966 | 5.35012E-35 | 0.038917 | 1.8E-29 | UTP23 | 8q24.11 | known |
| | rs78932310 | 8 | 118050835 | A | G | 0.0667985 | 0.0009188 | 0.10629 | 4.94352E-11 | 0.020036 | 6.5E-09 | SLC30A8 | 8q24.11 | known |
| | rs1250569 | 10 | 81045207 | C | T | 0.0256974 | 0.006114 | 0.04808 | 1.45554E-10 | 0.021681 | 3.4E-10 | PPIF | 10q22.3 | known |
| | rs206482 | 13 | 73692738 | G | A | 0.0292023 | 0.008166 | 0.0425 | 1.59044E-08 | 0.019193 | 2.7E-08 | KLF5 | 13q22.1 | new |
| | rs1562929 | 15 | 33168075 | T | G | -0.0243023 | 0.009599 | -0.06002 | 2.85617E-16 | -0.027342 | 2.4E-15 | GREM1 | 15q13.3 | known |
| | rs11647839 | 16 | 80036384 | G | A | -0.0246048 | 0.009597 | -0.05855 | 3.60196E-15 | -0.026332 | 2.3E-14 | MAF | 16q23.2 | known |
| Schizophrenia | rs10423689 | 19 | 33505101 | C | T | -0.031799 | 0.008045 | -0.05244 | 1.72184E-08 | -0.019158 | 2.9E-08 | FAAP24 | 19q13.11 | new |
| | rs6126017 | 20 | 49093789 | C | T | -0.0366983 | 7.459E-05 | -0.0497 | 9.82576E-12 | -0.023404 | 1.2E-11 | PTPN1 | 20q13.13 | known |
| | rs11692435 | 2 | 98275354 | A | G | -0.0863979 | 3.176E-08 | -0.09104 | 7.16234E-12 | -0.022721 | 5.7E-11 | ACTR1B | 2q11.2 | known |
| | rs4675033 | 2 | 199824567 | T | C | 0.02510245 | 0.00645 | 0.06269 | 1.22736E-15 | 0.02636 | 3E-14 | SATB2 | 2q33.1 | known |
| | rs2001732 | 3 | 52880740 | T | C | -0.0469981 | 0.001696 | -0.07592 | 1.46699E-12 | -0.023375 | 1.6E-11 | MUSTN1 | 3p21.1 | new |
| | rs1529544 | 3 | 53039455 | A | G | -0.0226035 | 0.009685 | -0.05044 | 1.58916E-11 | -0.021987 | 2.3E-10 | SFMBT1 | 3p21.1 | known |
| | rs10049390 | 3 | 133701119 | A | G | 0.02849999 | 0.004129 | 0.05287 | 7.79088E-10 | 0.020038 | 7.6E-09 | SLCO2A1 | 3q22.1-22.2 | known |
| | rs6533183 | 4 | 106133184 | T | C | 0.02439989 | 0.006039 | 0.05676 | 1.13848E-13 | 0.024224 | 2.9E-12 | TET2 | 4q24 | known |
| | rs112082449 | 5 | 40225064 | A | G | 0.02599496 | 0.005902 | 0.08106 | 3.68401E-24 | 0.033372 | 6.5E-22 | PTGER4 | 5p13.1 | known |
| | rs1559050 | 5 | 134470030 | A | G | -0.0270995 | 0.004549 | -0.05558 | 1.28221E-11 | -0.022328 | 1.2E-10 | PITX1 | 5q31.1 | known |
| Depression | rs9271770 | 6 | 32594248 | A | G | 0.03649585 | 0.001893 | 0.08389 | 9.35407E-18 | 0.028009 | 6.7E-16 | MHC region | | known |
| | rs72874231 | 6 | 55925194 | A | G | 0.060504 | 0.008194 | 0.10584 | 3.98483E-09 | 0.019414 | 2.2E-08 | BMP5 | 6p12.1 | known |
| | rs56057462 | 8 | 117577255 | A | G | 0.05210415 | 0.004064 | 0.13986 | 6.32168E-21 | 0.030901 | 5.1E-19 | UTP23 | 8q24.11 | known |
| | rs141408842 | 8 | 118215090 | A | G | 0.080309957 | 0.00652 | 0.17571 | 7.90172E-13 | 0.023375 | 1.6E-11 | SLC30A8 | 8q24.11 | known |
| | rs4871790 | 8 | 128441535 | C | A | -0.0235041 | 0.006998 | -0.08347 | 3.32729E-29 | -0.036669 | 4E-26 | POU5F1B | 8q24.21 | known |
| | rs174564 | 11 | 61588305 | G | A | -0.0243952 | 0.007007 | -0.05357 | 6.23888E-12 | -0.022424 | 4E-10 | FADS1 | 11q12.2 | known |
| | rs7304445 | 12 | 50685741 | C | A | 0.0353961 | 0.001114 | 0.0731 | 3.17615E-21 | 0.030843 | 6E-19 | LIMA1 | 12q13.12 | known |
| | rs11169572 | 12 | 51216890 | C | T | 0.02770271 | 0.001896 | 0.08601 | 2.72401E-30 | 0.037369 | 4.6E-27 | TMPRSS12 | 12q13.12 | known |
| | rs324015 | 12 | 57490100 | C | T | 0.06480522 | 2.048E-10 | 0.05369 | 6.95151E-10 | 0.020504 | 3.4E-09 | NAB2 | 12q13.3 | known |
| | rs10879238 | 12 | 71429938 | G | A | 0.0260355 | 0.009153 | 0.04359 | 3.21221E-09 | 0.019529 | 1.8E-08 | PTPRR | 12q15 | known |
| Schizophrenia | rs7311331 | 12 | 96064549 | G | A | 0.0260976 | 0.002875 | 0.04898 | 5.95644E-11 | 0.021594 | 4.8E-10 | USP44 | 12q22 | known |
| | rs4943114 | 13 | 34083781 | C | T | -0.0267004 | 0.002067 | -0.04894 | 4.76406E-11 | -0.021707 | 3.9E-10 | STARD13 | 13q13.1 | new |
| | rs1919360 | 15 | 33043455 | T | C | 0.036303 | 0.001157 | 0.10278 | 1.5551E-28 | 0.036193 | 1.7E-25 | GREM1 | 15q13.3 | known |
| | rs62202951 | 20 | 49055858 | G | A | 0.02470261 | 0.007669 | 0.06793 | 5.50332E-18 | 0.028458 | 2.3E-16 | PTPN1 | 20q13.13 | known |
| | rs2839223 | 21 | 47777063 | A | G | -0.0451961 | 0.0005218 | -0.06060 | 1.62525E-09 | -0.019626 | 1.5E-08 | PCNT | 21q22.3 | new |
| | rs17241778 | 2 | 199766411 | C | T | 0.00900038 | 0.008225 | 0.06148 | 1.65284E-14 | 0.025344 | 2.9E-13 | SATB2 | 2q33.1 | known |
| | rs6808387 | 3 | 53079732 | T | C | -0.0141001 | 3.315E-05 | 0.05267 | 2.258E-12 | 0.02277 | 5.5E-11 | SFMBT1 | 3p21.1 | known |
| | rs2905746 | 6 | 31451849 | G | T | 0.014799 | 0.0001014 | -0.05553 | 2.61736E-10 | -0.020477 | 3.7E-09 | MHC region | | known |
| | rs72550838 | 8 | 128413087 | C | T | 0.0299027 | 0.005174 | 0.15833 | 8.03188E-11 | 0.0215 | 6E-10 | POU5F1B | 8q24.21 | known |
| | rs10116277 | 9 | 22081397 | T | G | 0.00940408 | 0.003082 | -0.0554 | 5.41874E-14 | -0.02448 | 1.8E-12 | CDKN2B | 9p21.3 | known |
| Depression | rs11195986 | 10 | 114289017 | T | G | 0.0139975 | 0.009695 | 0.10033 | 3.72408E-16 | 0.026889 | 9.6E-15 | ZDHHC6 | 10q25.2 | known |
| | rs174583 | 11 | 61609750 | T | C | 0.0178992 | 6.793E-08 | -0.05403 | 4.11489E-12 | -0.02239 | 1.1E-10 | FADS1 | 11q12.2 | known |
| | rs9665746 | 11 | 74288886 | A | G | 0.0102019 | 0.009441 | 0.06105 | 2.64323E-12 | 0.023106 | 2.9E-11 | POLD3 | 11q13.4 | known |
| | rs10859923 | 12 | 96069858 | C | T | -0.0889994 | 0.005755 | 0.05086 | 1.95529E-11 | 0.02183 | 3.2E-10 | USP44 | 12q22 | known |
| | rs11670192 | 19 | 59017640 | A | G | -0.0147999 | 0.0003434 | 0.06004 | 1.7978E-10 | 0.020685 | 2.6E-09 | SLC27A5 | 19q13.43 | known |
| | rs6126017 | 20 | 49093789 | C | T | -0.0118001 | 0.0002162 | -0.0497 | 9.82576E-12 | -0.022571 | 8E-11 | PTPN1 | 20q13.13 | known |
| | rs2738783 | 20 | 62308612 | G | T | 0.0128016 | 0.001799 | -0.06247 | 1.70471E-11 | -0.02187 | 3E-10 | RTEL1-TNFRSF6B | 20q13.33 | known |
| | rs2839224 | 21 | 47777222 | G | A | -0.0141987 | 0.006934 | -0.06923 | 9.00583E-09 | -0.019027 | 4.3E-08 | PCNT | 21q22.3 | new |

Supplementary Table 15. Multi-trait meta-analysis between digestive diseases and colorectal cancer in Europeans

| Type of digestive diseases | SNP | CHR | BP | A1 | A2 | Digestive diseases (all) | | Colorectal cancer | | MTAG | | Genes | Cytogenetic band | Annotation |
|---------------------------------|-------------|-----|-----------|----|----|--------------------------|-----------|-------------------|--------------|-----------|-------------|----------------|------------------|------------|
| | | | | | | Beta | P-value | Beta | P-value | Beta-mtag | P-mtag | | | |
| Gastroesophageal reflux disease | rs12404594 | 1 | 182988027 | A | G | -0.0193 | 0.001121 | -0.07726 | 3.54379E-23 | -0.033072 | 9.77823E-22 | LAMC1 | 1q25.3 | known |
| | rs1119401 | 2 | 199843454 | C | T | 0.0216 | 0.0005625 | 0.06275 | 1.26699E-15 | 0.026868 | 7.12296E-15 | SATB2 | 2q33.1 | known |
| | rs77572134 | 3 | 52895934 | C | T | -0.023 | 0.006693 | -0.07589 | 2.00548E-12 | -0.023554 | 8.94487E-12 | MUSTN1 | 3p21.1 | new |
| | rs280097 | 4 | 94937860 | C | T | 0.0158 | 0.00901 | 0.052 | 4.92625E-12 | 0.023125 | 2.10929E-11 | ATOH1 | 4q22.2 | known |
| | rs75686861 | 4 | 145621328 | A | G | 0.0267 | 0.009381 | 0.09019 | 1.57958E-12 | 0.023635 | 7.6067E-12 | HHIP | 4q31.21 | known |
| | rs62329683 | 5 | 1299087 | T | C | 0.026 | 0.002749 | 0.06969 | 4.81788E-11 | 0.020666 | 2.15053E-09 | TERT | 5p15.33 | known |
| | rs617578 | 6 | 32574603 | A | G | 0.0296 | 0.004639 | 0.06413 | 3.40955E-09 | 0.019926 | 7.85182E-09 | MHC region | | |
| | rs16878812 | 6 | 35569562 | G | A | -0.0244 | 0.006548 | -0.08758 | 6.71949E-14 | -0.020505 | 3.99624E-13 | TULP1 | 6p21.31 | known |
| | rs6958168 | 7 | 45019814 | G | T | -0.024 | 0.0007734 | -0.05585 | 1.51974E-09 | -0.018832 | 4.98087E-08 | MYO1G | 7p13 | known |
| | rs2015069 | 8 | 117639532 | T | C | 0.028 | 0.002711 | 0.07984 | 1.14886E-12 | 0.023881 | 4.60933E-12 | UTP23 | 8q24.11 | known |
| | rs28626202 | 8 | 128464353 | A | C | -0.0228 | 0.003053 | -0.07002 | 6.69286E-13 | -0.022655 | 5.30651E-11 | POUSF1B | 8q24.21 | known |
| | rs1537372 | 9 | 22103183 | T | G | -0.0179 | 0.002733 | -0.06315 | 2.74696E-17 | -0.026787 | 5.77578E-15 | CDKN2B | 9p21.3 | known |
| | rs11213811 | 11 | 111136809 | T | C | -0.0177 | 0.006902 | -0.0563 | 9.46358E-12 | -0.022834 | 3.74556E-11 | C11orf53 | 11q23.1 | new |
| | rs1316442 | 12 | 51114427 | A | C | 0.0159 | 0.009564 | 0.08057 | 1.65129E-25 | 0.034609 | 1.18946E-23 | ATF1 | 12q13.12 | known |
| | rs653178 | 12 | 121007756 | T | C | 0.0305 | 2.311E-07 | 0.07573 | 2.29129E-24 | 0.031876 | 2.63393E-20 | ATXN2 | 12q24.12 | known |
| | rs35107139 | 14 | 54419106 | C | A | 0.0245 | 7.795E-05 | 0.08934 | 2.87062E-26 | 0.035476 | 9.08188E-25 | BMP4 | 14q22.2 | new |
| | rs2600521 | 15 | 33054229 | A | G | 0.0193 | 0.006311 | 0.05013 | 1.32569E-08 | 0.01916 | 2.86163E-08 | GREM1 | 15q13.3 | known |
| | rs4776316 | 15 | 67007813 | G | A | -0.0193 | 0.003671 | -0.05564 | 1.89535E-11 | -0.022564 | 6.30737E-11 | SMAD6 | 15q22.31 | new |
| | rs7179095 | 15 | 91186461 | A | G | 0.0229 | 0.003536 | 0.06248 | 2.09635E-10 | 0.021389 | 5.81528E-10 | BLM | 15q26.1 | new |
| | rs73975588 | 17 | 816741 | C | A | -0.0243 | 0.006191 | -0.08912 | 6.61966E-16 | -0.026955 | 5.82948E-15 | NXN | 17p13.3 | known |
| | rs6507874 | 18 | 46448805 | C | T | -0.0173 | 0.003762 | -0.16694 | 2.67678E-111 | -0.073764 | 2.7759E-101 | SMAD7 | 18q21.1 | known |
| | rs6091189 | 20 | 49256285 | T | C | 0.0225 | 0.006837 | 0.05921 | 8.97559E-09 | 0.019374 | 2.00375E-08 | RIPOR3 | 20q13.13 | known |
| | rs2427296 | 20 | 60927475 | A | G | -0.0173 | 0.009707 | -0.10936 | 4.04845E-36 | -0.041469 | 3.09318E-33 | LAMAS | 20q13.33 | known |
| | rs2738783 | 20 | 62308612 | G | T | -0.02 | 0.005781 | -0.06247 | 1.70471E-11 | -0.021215 | 7.99269E-10 | RTEL1-TNFRSF6B | 20q13.33 | known |
| Diverticular disease | rs4072980 | 1 | 38456106 | A | G | 0.0016113 | 0.0028 | 0.05456 | 2.4903E-13 | 0.02448 | 1.43299E-12 | SF3A3 | 1p34.3 | known |
| | rs12144319 | 1 | 55246035 | C | T | 0.018901 | 0.0035 | 0.06429 | 6.26464E-14 | 0.025086 | 3.9871E-13 | PARS2 | 1p32.3 | known |
| | rs994261 | 2 | 199908378 | C | T | 0.0015583 | 0.006 | 0.05139 | 1.16782E-11 | 0.022716 | 5.01077E-11 | SATB2 | 2q33.1 | known |
| | rs4974053 | 3 | 40957939 | C | T | 0.0017718 | 0.0078 | 0.06448 | 3.23199E-13 | 0.024314 | 2.02547E-12 | CTNNB1 | 3p22.1 | new |
| | rs2001732 | 3 | 52880740 | T | C | -0.00297 | 0.00018 | -0.07592 | 1.46699E-12 | -0.023881 | 4.92872E-12 | MUSTN1 | 3p21.1 | new |
| | rs2736108 | 5 | 1297488 | T | C | -0.001506 | 0.01 | -0.05962 | 6.14369E-13 | -0.022916 | 3.3933E-11 | TERT | 5p15.33 | known |
| | rs9986145 | 5 | 134453390 | A | G | 0.014592 | 0.00955 | 0.04658 | 5.19221E-09 | 0.019277 | 2.46194E-08 | PITX1 | 5q31.1 | known |
| | rs11752007 | 6 | 7242605 | C | T | -0.002281 | 0.0045 | -0.06808 | 2.57483E-09 | -0.02001 | 7.12965E-09 | SSR1 | 6p24.3 | new |
| | rs28724138 | 6 | 32552617 | A | G | 0.0023563 | 0.000661 | 0.05588 | 5.65965E-10 | 0.02105 | 1.13839E-09 | MHC region | | |
| | rs6939861 | 6 | 41703041 | A | G | -0.001706 | 0.0057 | -0.05217 | 2.28266E-09 | -0.020062 | 6.5196E-09 | TFEB | 6p21.1 | known |
| | rs17686932 | 7 | 130600748 | G | A | -0.003017 | 0.0092 | -0.11264 | 1.59135E-11 | -0.022539 | 7.05855E-11 | KLF14 | 7q32.2 | known |
| | rs7834164 | 8 | 117644462 | G | A | 0.0018383 | 0.0099 | 0.06481 | 1.12022E-11 | 0.022682 | 5.35629E-11 | UTP23 | 8q24.11 | known |
| | rs7894531 | 10 | 8734761 | A | G | -0.001661 | 0.0059 | -0.09692 | 2.84327E-34 | -0.040398 | 5.12323E-31 | GATA3 | 10p14 | known |
| | rs17578234 | 10 | 101343317 | T | C | 0.0018067 | 0.0084 | 0.0933 | 1.78255E-23 | 0.033105 | 1.01273E-21 | SLC25A28 | 10q24.2 | known |
| | rs56188434 | 10 | 114305761 | A | G | 0.0024263 | 0.0089 | 0.010221 | 3.46048E-16 | 0.021748 | 4.07647E-15 | ZDHHC6 | 10q25.2 | known |
| | rs10160763 | 11 | 10238173 | T | G | -0.001814 | 0.0011 | -0.04151 | 2.60957E-08 | -0.018847 | 4.9977E-08 | SFB2 | 11p15.4 | new |
| | rs35905518 | 11 | 74220395 | C | T | -0.00321 | 0.00066 | -0.10658 | 7.03645E-17 | -0.027927 | 6.60032E-16 | POLD3 | 11q13.4 | known |
| | rs59830047 | 11 | 74338535 | A | G | 0.0016829 | 0.0017 | 0.07859 | 7.34434E-27 | 0.035636 | 6.51197E-25 | CHRD2 | 11q13.4 | known |
| | rs117042741 | 11 | 74628743 | T | C | -0.004464 | 0.0011 | -0.22612 | 1.43443E-30 | -0.038157 | 2.54076E-28 | XRR1 | 11q13.4 | known |
| | rs11169572 | 12 | 51216890 | C | T | 0.0019555 | 0.00045 | 0.08601 | 2.72401E-30 | 0.038033 | 3.78296E-28 | ATF1 | 12q13.12 | known |
| | rs2870841 | 12 | 71476684 | G | T | -0.00177 | 0.0015 | -0.04494 | 1.37789E-09 | -0.020433 | 3.41748E-09 | PTPRR | 12q15 | known |
| | rs7298851 | 12 | 115882695 | T | G | -0.001503 | 0.0073 | -0.05366 | 3.06371E-12 | -0.023297 | 1.60012E-11 | TBX3 | 12q24.21 | known |
| | rs11621479 | 14 | 54500492 | A | G | -0.00154 | 0.0071 | -0.05114 | 1.86052E-09 | -0.020158 | 5.51764E-09 | BMP4 | 14q22.2 | known |
| | rs3812927 | 15 | 33059225 | A | C | 0.0020855 | 0.0078 | 0.10266 | 2.15743E-22 | 0.032282 | 9.86368E-21 | GREM1 | 15q13.3 | known |
| | rs199483 | 16 | 86697008 | T | C | 0.0025591 | 0.00021 | 0.06159 | 2.14683E-11 | 0.022610 | 6.05229E-11 | FOXL1 | 16q24.1 | known |
| | rs7226855 | 18 | 46454048 | G | A | -0.002439 | 0.000065 | -0.16808 | 2.546E-114 | -0.075026 | 2.0038E-104 | SMAD7 | 18q21.1 | known |
| | rs2216595 | 19 | 33533292 | T | C | -0.001839 | 0.0093 | -0.07005 | 9.7235E-14 | -0.024815 | 7.08793E-13 | RHPN2 | 19q13.11 | new |
| | rs2064278 | 20 | 49363182 | T | G | 0.001575 | 0.0093 | 0.05534 | 1.87551E-11 | 0.022437 | 8.60132E-11 | RIPOR3 | 20q13.13 | known |
| | rs6014965 | 20 | 55831203 | G | A | -0.001598 | 0.0033 | -0.04661 | 2.89258E-10 | -0.02176 | 9.06289E-10 | BMP7 | 20q13.31 | known |
| | rs2738783 | 20 | 62308612 | G | T | -0.00232 | 0.00039 | -0.06247 | 1.70471E-11 | -0.022675 | 5.43382E-11 | RTEL1-TNFRSF6B | 20q13.33 | known |
| | rs3747239 | 22 | 45740126 | C | A | 0.0016875 | 0.0034 | 0.04876 | 4.02891E-10 | 0.019763 | 1.08912E-08 | FAM118A | 22q13.31 | known |

Supplementary Table 16. Multi-trait meta-analysis between psychiatric disorders and stool frequency in Europeans

| Type of psychiatric disorders | SNP | CHR | BP | A1 | A2 | Psychiatric disorders (all) | | Stool frequency | | MTAG | | Genes | Cytogenetic band | Annotation |
|--|------------|-----|-----------|------|---------|-----------------------------|------------|-----------------|------------|--------------|-------------|---------|------------------|------------|
| | | | | Beta | P-value | Beta | P-value | Beta | P-value | Beta-mtag | P-mtag | | | |
| Attention-deficit hyperactivity disorder | rs12273363 | 11 | 27723312 | T | C | 0.0352956 | 0.002113 | 0.0324 | 4.792E-21 | 0.037803577 | 6.02074E-19 | BDNF | 11p14.1 | known |
| | rs5995603 | 22 | 38644728 | A | G | 0.0409991 | 0.0001502 | 0.0174 | 6.073E-08 | 0.023260217 | 4.91356E-09 | FAM227A | 22q13.1 | known |
| Bipolar disorder | rs60712207 | 5 | 141378509 | T | C | -0.035203 | 0.0006806 | -0.016 | 1.127E-07 | -0.021370409 | 8.51807E-09 | PCDHGA7 | 5q31 | new |
| | rs11030108 | 11 | 27673917 | A | G | -0.0263985 | 0.008661 | -0.0193 | 8.657E-11 | -0.02117846 | 6.80694E-09 | BDNF | 11p14.1 | known |
| Major depressive disorder | rs2932277 | 3 | 87900306 | A | G | -0.0191 | 0.0003005 | -0.0169 | 7.125E-07 | -0.022736939 | 4.59273E-08 | HTR1F | 3p12 | new |
| | rs4880051 | 9 | 37007478 | T | G | -0.017 | 0.0001121 | -0.0139 | 8.025E-07 | -0.018970547 | 3.59E-08 | PAX5 | 9p13.2 | new |
| | rs56133711 | 11 | 27701787 | A | G | -0.0142 | 0.003794 | -0.0281 | 6.6545E-19 | -0.03475225 | 2.35311E-19 | BDNF | 11p14.1 | known |
| Neuroticism | rs596668 | 18 | 55597112 | A | G | -0.0245 | 0.0000629 | -0.0194 | 6.865E-07 | -0.02637484 | 2.87734E-08 | TCF4 | 18q21.2 | new |
| | rs5995603 | 22 | 38597365 | A | G | 0.0144 | 0.003734 | 0.0174 | 6.073E-08 | 0.022633541 | 7.59452E-09 | FAM227A | 22q13.1 | known |
| Neuroticism | rs879620 | 16 | 3965728 | T | C | -0.00655554 | 0.00071781 | -0.0153 | 1.002E-07 | -0.019507338 | 3.39557E-08 | CREBBP | 16p13.3 | new |
| | rs56192752 | 17 | 45477887 | A | G | -0.0212518 | 9.4454E-18 | -0.0223 | 4.212E-10 | -0.03107485 | 2.62606E-12 | PLEKHM1 | 17q21.31 | new |
| | rs596668 | 18 | 55597112 | A | G | -0.0136617 | 6.1173E-11 | -0.0194 | 6.865E-07 | -0.026999121 | 2.41556E-08 | TCF4 | 18q21.2 | new |
| Depression | rs5757162 | 22 | 38597365 | T | C | 0.00506403 | 0.00852059 | 0.0169 | 4.041E-08 | 0.021358261 | 2.0605E-08 | FAM227A | 22q13.1 | known |
| | rs1538686 | 1 | 196428689 | A | G | 0.00950503 | 0.003245 | 0.0146 | 2.541E-07 | 0.01894309 | 3.05532E-08 | KCNIT2 | 1q31.3 | new |
| | rs2932277 | 3 | 87900306 | A | G | -0.0170037 | 0.00001 | -0.0169 | 7.125E-07 | -0.023067754 | 2.56489E-08 | HTR1F | 3p12 | new |
| Depression | rs60712207 | 5 | 141378509 | T | C | 0.00950469 | 0.006359 | -0.016 | 1.127E-07 | -0.020571605 | 2.09938E-08 | PCDHGA7 | 5q31 | new |
| | rs4880051 | 9 | 37007478 | T | G | 0.0189984 | 5.379E-09 | -0.0139 | 8.025E-07 | -0.019981054 | 5.63134E-09 | PAX5 | 9p13.2 | new |
| | rs10835211 | 11 | 27679818 | A | G | 0.0109988 | 0.005688 | -0.0281 | 9.799E-19 | -0.034211386 | 5.76693E-19 | BDNF | 11p14.1 | known |
| Depression | rs879620 | 16 | 3965728 | T | C | 0.00999983 | 0.002324 | -0.0153 | 1.002E-07 | -0.019388751 | 2.04278E-08 | CREBBP | 16p13.3 | new |
| | rs2732706 | 17 | 46274320 | T | C | -0.011597 | 0.003883 | 0.0235 | 4.421E-12 | 0.028993909 | 8.98319E-13 | LRRC37A | 17q21.31 | new |
| | rs596668 | 18 | 55597112 | A | G | -0.0221025 | 0.00000179 | -0.0194 | 6.865E-07 | -0.026777367 | 1.54346E-08 | TCF4 | 18q21.2 | new |
| Depression | rs5995603 | 22 | 38644728 | A | G | -0.00959589 | 0.009208 | 0.0174 | 6.073E-08 | 0.022160793 | 1.34788E-08 | FAM227A | 22q13.1 | known |

Supplementary Table 17. Multi-trait meta-analysis between digestive diseases and stool frequency in Europeans

| Type of digestive diseases | SNP | CHR | BP | A1 | A2 | Digestive diseases (all) | | Stool frequency | | MTAG | | Genes | Cytogenetic band | Annotation |
|---------------------------------|------------|-----|-----------|----|----|--------------------------|-----------|-----------------|------------|-----------|-------------|------------|------------------|------------|
| | | | | | | Beta | P-value | Beta | P-value | Beta-mtag | P-mtag | | | |
| Diverticular disease | rs1538686 | 1 | 196428689 | A | G | 0.0015278 | 0.0051 | 0.0146 | 2.541E-07 | 0.018911 | 1.86834E-08 | KCNT2 | 1q31.3 | new |
| | rs4333882 | 1 | 234217153 | A | G | -0.0069955 | 2.5E-24 | -0.0118 | 0.0009542 | -0.024395 | 5.23898E-09 | COA6 | 1q42.2 | new |
| | rs13409480 | 2 | 143646227 | A | G | -0.0056006 | 1.6E-25 | -0.0083 | 0.002785 | -0.018651 | 1.7964E-08 | ARHGAP15 | 2q22.2-q22.3 | new |
| | rs60570941 | 3 | 15404374 | T | C | -0.0049345 | 1.7E-07 | -0.0229 | 1.344E-06 | -0.034109 | 1.74408E-09 | EAF1 | 3p25.1 | new |
| | rs75686861 | 4 | 144700176 | A | G | -0.0041857 | 0.000011 | -0.0238 | 0.00000083 | -0.03347 | 4.97569E-09 | HHIP | 4q31.21 | new |
| | rs39819 | 5 | 122965981 | A | G | 0.003071 | 6.5E-08 | 0.0179 | 1.153E-09 | 0.025462 | 5.05528E-13 | PPIC | 5q23.2 | new |
| | rs78566116 | 6 | 32428369 | T | G | -0.0053388 | 4.8E-07 | -0.0249 | 3.566E-06 | -0.036125 | 1.38376E-08 | MHC region | | known |
| | rs3113037 | 7 | 96449252 | T | C | 0.004142 | 1E-10 | 0.0154 | 2.501E-06 | 0.023986 | 8.47896E-10 | SLC25A13 | 7q21.3 | new |
| | rs4556017 | 7 | 100989509 | T | C | 0.0027802 | 0.00015 | 0.024 | 1.02E-09 | 0.0315 | 1.66686E-11 | MUC12 | 7q22.1 | known |
| | rs6472566 | 8 | 71088249 | A | G | 0.0016412 | 0.0029 | 0.0162 | 1.676E-08 | 0.020639 | 1.8552E-09 | XKR9 | 8q13.3 | new |
| | rs2588992 | 10 | 61754913 | T | C | 0.0018819 | 0.005 | 0.0172 | 4.325E-07 | 0.022323 | 3.90592E-08 | CABCOCO1 | 10q21.2 | new |
| Irritable bowel syndrome | rs6486216 | 11 | 15032243 | T | C | 0.0038743 | 2.9E-10 | 0.0183 | 1.135E-08 | 0.026139 | 1.75574E-12 | CALCA | 11p15.2 | new |
| | rs12273363 | 11 | 27723312 | T | C | 0.0055924 | 1.2E-16 | 0.0324 | 4.792E-21 | 0.045897 | 4.5701E-29 | BDNF | 11p14.1 | known |
| | rs9938120 | 16 | 19966411 | T | C | 0.0029199 | 0.0002 | 0.0214 | 8.808E-08 | 0.02835 | 1.78321E-09 | GPRC5B | 16p12.3 | new |
| | rs759555 | 18 | 57223332 | T | C | 0.0031915 | 2.6E-07 | 0.0145 | 7.667E-06 | 0.021645 | 1.88707E-08 | BODIL2 | 18q21.31 | new |
| | rs5757236 | 22 | 38677819 | T | C | -0.0031318 | 3.7E-07 | -0.0168 | 9.521E-08 | -0.023922 | 1.02009E-10 | FAM227A | 22q13.1 | known |
| | rs11264871 | 1 | 154018414 | A | C | -0.0253 | 0.000679 | -0.0161 | 1.217E-07 | -0.021151 | 2.06639E-08 | RPS27 | 1q21.3 | new |
| | rs6472566 | 8 | 71088249 | A | G | 0.0199 | 0.004992 | 0.0162 | 1.676E-08 | 0.020579 | 8.98658E-09 | XKR9 | 8q13.3 | new |
| Gastroesophageal reflux disease | rs383638 | 5 | 122988983 | A | C | 0.0174 | 0.005539 | 0.0176 | 2.459E-09 | 0.022983 | 2.60466E-10 | PPIC | 5q23.2 | new |
| | rs2732706 | 17 | 46274320 | T | C | -0.0215 | 0.002938 | 0.0235 | 4.421E-12 | 0.025605 | 4.9232E-10 | LRRC37A | 17q21.31 | new |
| | rs5757162 | 22 | 38597365 | T | C | 0.0237 | 0.0002812 | 0.0169 | 4.041E-08 | 0.022163 | 4.53693E-09 | FAM227A | 22q13.1 | known |

Supplementary Table 18. Multi-trait meta-analysis between psychiatric disorders and diverticular disease in Europeans

| Type of psychiatric disorders | SNP | CHR | BP | A1 | A2 | Psychiatric disorders (all) | | Diverticular disease | | MTAG | | Genes | Cytogenetic band | Annotation |
|--|-------------|-----|-----------|----|----|-----------------------------|-----------|----------------------|----------|-----------|-------------|------------|------------------|------------|
| | | | | | | Beta | P-value | Beta | P-value | Beta-mtag | P-mtag | | | |
| Attention-deficit hyperactivity disorder | rs7606067 | 2 | 144477751 | G | A | 0.0271968 | 0.004347 | 0.00435 | 3.1E-15 | 0.017131 | 1.64172E-16 | ARHGPAP15 | 2q22.2-q22.3 | known |
| | rs2226917 | 11 | 15111580 | T | C | 0.0305001 | 0.00142 | 0.00284 | 3.1E-07 | 0.011802 | 3.3646E-08 | INSC | 11p15.2 | known |
| | rs1730930 | 11 | 27748493 | C | A | 0.0350988 | 0.002269 | 0.00564 | 6.8E-17 | 0.019327 | 3.68426E-14 | BDNF | 11p14.1 | known |
| | rs2289328 | 15 | 40705417 | G | A | -0.0366017 | 0.003131 | -0.00476 | 7.5E-11 | -0.01919 | 5.2019E-12 | DISP2 | 15q15.1 | known |
| | rs2935536 | 16 | 84973880 | A | C | 0.0338989 | 0.0003834 | 0.00277 | 2.3E-07 | 0.011695 | 1.57927E-08 | ZDHHC7 | 16q24.1 | known |
| | rs12942267 | 17 | 7372637 | C | T | -0.0322959 | 0.0004272 | -0.0037 | 6.7E-11 | -0.015129 | 2.1101E-12 | ZBTB4 | 17p13.1 | known |
| Anxiety, panic disorder | rs138699 | 22 | 39129708 | G | A | -0.0347985 | 0.001487 | -0.00342 | 6.3E-08 | -0.014119 | 3.8413E-09 | GTPBP1 | 22q13.1 | known |
| | rs59098711 | 22 | 40877004 | T | C | -0.0303974 | 0.008113 | -0.00371 | 2.6E-07 | -0.015118 | 3.8184E-08 | ADSL | 22q13.1 | known |
| | rs11899888 | 2 | 56102744 | A | G | -0.00106693 | 0.0012 | -0.00612 | 1.4E-16 | -0.024198 | 9.24305E-17 | EFEMP1 | 2p16.1 | known |
| Bipolar disorder | rs17615220 | 6 | 32677413 | A | G | 0.00149027 | 0.0074 | 0.007 | 2.6E-08 | 0.026017 | 2.8929E-08 | MHC region | known | known |
| | rs9520339 | 13 | 107897823 | C | T | 0.000741298 | 0.0077 | 0.00492 | 1.1E-14 | 0.019443 | 5.97956E-15 | NALF1 | 13q33.3 | known |
| | rs9287353 | 2 | 144383727 | C | T | -0.0295005 | 0.002957 | -0.0057 | 3.3E-23 | -0.021673 | 1.38074E-21 | ARHGPAP15 | 2q22.2-q22.3 | known |
| | rs7640510 | 3 | 15417197 | C | T | 0.040201 | 0.007095 | 0.00458 | 1.2E-07 | 0.018278 | 3.87427E-08 | METTL6 | 3p25.1 | known |
| | rs3775010 | 4 | 95821419 | T | C | -0.0254046 | 0.009675 | -0.0035 | 6.8E-10 | -0.013233 | 2.20964E-09 | BMPR1B | 4q22.3 | known |
| | rs4839715 | 6 | 98365289 | G | A | 0.0449032 | 3.336E-03 | 0.00377 | 1.4E-11 | 0.014001 | 1.80348E-10 | MMS22L | 6q16.1 | known |
| | rs6465554 | 7 | 96498284 | T | C | -0.0296039 | 0.002005 | -0.00295 | 9.6E-08 | -0.011857 | 4.82443E-08 | DLX6 | 7q21.3 | known |
| | rs7077800 | 10 | 25819228 | C | T | 0.0272993 | 0.003608 | 0.00526 | 1.7E-22 | 0.020082 | 3.30362E-21 | GPR158 | 10p12.1 | known |
| | rs11030108 | 11 | 27695464 | A | G | -0.0263985 | 0.008661 | -0.00452 | 5.2E-15 | -0.017196 | 3.60747E-14 | BDNF | 11p14.1 | known |
| | rs12942267 | 17 | 7372637 | C | T | -0.0310986 | 0.00152 | -0.0037 | 6.7E-11 | -0.014768 | 2.33659E-11 | ZBTB4 | 17p13.1 | known |
| Major depressive disorder | rs8074740 | 17 | 42312778 | G | A | -0.055703 | 2.393E-08 | -0.00365 | 2.4E-10 | -0.01495 | 4.386E-11 | UBTF | 17q21.31 | known |
| | rs138699 | 22 | 39129708 | G | A | -0.0306963 | 0.005 | -0.00342 | 6.3E-08 | -0.013697 | 2.57544E-08 | GTPBP1 | 22q13.1 | known |
| | rs7691139 | 2 | 144557317 | G | A | -0.0151 | 0.008885 | -0.00378 | 1.6E-07 | -0.01504 | 2.8041E-08 | ARHGPAP15 | 2q22.2-q22.3 | known |
| | rs11736215 | 4 | 7762502 | A | C | 0.0177 | 7.745E-05 | 0.00272 | 5.2E-07 | 0.011538 | 1.21139E-08 | AFAP1 | 4p16.1 | known |
| | rs2049865 | 8 | 116588546 | C | A | -0.0152 | 0.000556 | -0.00302 | 4.9E-08 | -0.012284 | 1.79828E-09 | TRPS1 | 8q23.3 | known |
| | rs187535429 | 10 | 69614235 | C | T | -0.0168 | 0.0003058 | 0.00291 | 4.1E-07 | 0.012064 | 1.31783E-08 | DNAJC12 | 10q21.3 | new |
| Neuroticism | rs61888800 | 11 | 27722278 | G | T | 0.0141 | 0.004045 | 0.0048 | 7.6E-15 | 0.018422 | 9.73799E-16 | BDNF | 11p14.1 | known |
| | rs11078680 | 17 | 7386428 | G | A | -0.0122 | 0.005571 | -0.00323 | 6.8E-09 | -0.012732 | 6.10551E-10 | ZBTB4 | 17p13.1 | known |
| | rs5752717 | 22 | 39055303 | C | T | -0.0128 | 0.007232 | -0.00307 | 3.4E-07 | -0.012297 | 3.64081E-08 | GTPBP1 | 22q13.1 | known |
| | rs6001870 | 22 | 40695172 | A | C | -0.0145 | 0.002249 | -0.00338 | 4.3E-09 | -0.013386 | 3.0335E-10 | ADSL | 22q13.1 | known |
| | rs9490003 | 6 | 98331316 | A | G | 0.00770711 | 0.000174 | 0.00291 | 6.2E-08 | 0.01198 | 6.84917E-09 | MMS22L | 6q16.1 | known |
| | rs2049865 | 8 | 116588546 | C | A | -0.00652299 | 1.972E-05 | -0.00302 | 4.9E-08 | -0.012501 | 2.18272E-09 | TRPS1 | 8q23.3 | known |
| Depression | rs12942267 | 17 | 7372637 | C | T | -0.00545516 | 0.0004256 | -0.0037 | 6.7E-11 | -0.014768 | 6.22576E-12 | ZBTB4 | 17p13.1 | known |
| | rs759555 | 18 | 54890563 | T | C | 0.0087614 | 2.372E-06 | 0.00319 | 2.6E-07 | 0.013636 | 1.28393E-08 | BODIL2 | 18q21.31 | known |
| | rs138699 | 22 | 39129708 | G | A | -0.00586016 | 0.0011279 | -0.00342 | 6.3E-08 | -0.013816 | 7.60941E-09 | GTPBP1 | 22q13.1 | known |
| | rs4470425 | 22 | 40716488 | C | A | -0.00461145 | 0.0056337 | -0.0032 | 3.8E-08 | -0.012665 | 1.04427E-08 | ADSL | 22q13.1 | known |
| | rs11679600 | 2 | 144394398 | G | A | -0.0104039 | 0.002381 | -0.00659 | 2.2E-29 | -0.023872 | 1.5008E-28 | ARHGPAP15 | 2q22.2-q22.3 | known |
| | rs11736215 | 4 | 7762502 | A | C | 0.0156962 | 9.105E-07 | 0.00272 | 5.2E-07 | 0.011807 | 2.70346E-09 | AFAP1 | 4p16.1 | known |
| Schizophrenia | rs2049865 | 8 | 116588546 | C | A | -0.00979784 | 0.002537 | -0.00302 | 4.9E-08 | -0.011747 | 4.39701E-09 | TRPS1 | 8q23.3 | known |
| | rs7864396 | 9 | 96251318 | A | C | 0.0200967 | 1.476E-09 | 0.00242 | 0.00021 | 0.011572 | 1.90522E-08 | FAM120A | 9q22.31 | known |
| | rs7072763 | 10 | 69632512 | T | C | 0.0118989 | 0.0008319 | 0.00283 | 8.6E-07 | 0.011618 | 4.63855E-08 | DNAJC12 | 10q21.3 | new |
| | rs61888800 | 11 | 27722278 | G | T | 0.0099983 | 0.006152 | 0.0048 | 7.6E-15 | 0.017759 | 2.83839E-15 | BDNF | 11p14.1 | known |
| | rs7993272 | 13 | 107898340 | T | C | 0.00880116 | 0.009103 | 0.00323 | 1.8E-08 | 0.012312 | 4.45217E-09 | NALF1 | 13q33.3 | known |
| | rs7209131 | 17 | 7376411 | C | T | -0.00910129 | 0.009283 | -0.00358 | 2.4E-10 | -0.013741 | 4.05254E-11 | ZBTB4 | 17p13.1 | known |
| | r5929 | 17 | 46669430 | C | T | 0.0156962 | 2.317E-06 | 0.00265 | 3.2E-06 | 0.011646 | 2.2414E-08 | HOXB5 | 17q21.32 | known |
| | rs11877758 | 18 | 35138110 | T | G | -0.0289037 | 1.672E-16 | -0.00224 | 0.00016 | -0.012409 | 5.97149E-09 | CELF4 | 18q12.2 | new |
| | rs1262465 | 18 | 52857732 | A | G | -0.0202027 | 2.645E-10 | -0.00235 | 0.000016 | -0.011282 | 1.16375E-08 | CCDC68 | 18q21.2 | known |
| | rs9880967 | 21 | 47033905 | C | A | -0.0131967 | 0.007086 | -0.00418 | 2.5E-07 | -0.016166 | 4.25133E-08 | COL6A1 | 21q22.3 | known |
| Osteoporosis | rs4470425 | 22 | 40716488 | C | A | -0.0182964 | 9.91E-08 | -0.0032 | 3.8E-08 | -0.013858 | 6.30813E-11 | ADSL | 22q13.1 | known |

Supplementary Table 19. Multi-trait meta-analysis between digestive diseases and diverticular disease in Europeans

| Type of digestive diseases | SNP | CHR | BP | A1 | A2 | Digestive diseases (all) Beta | P-value | Stool frequency Beta | P-value | MTAG Beta-mtag | P-mtag | Genes | Cytogenetic band | Annotation |
|-----------------------------------|-------------|-----|------------|----|----|----------------------------------|-----------|-------------------------|---------|-------------------|--------------|------------|------------------|------------|
| Cholelithiasis and cholecystitis | rs4333882 | 1 | 234352899 | A | G | -0.0399 | 0.00802 | -0.007 | 2.5E-24 | -0.027055 | 2.44472E-24 | COA6 | 1q42.2 | known |
| | rs113481311 | 2 | 5615285 | G | A | -0.0507 | 0.00847 | -0.00554 | 7.6E-10 | -0.022216 | 1.21619E-10 | EFEMP1 | 2p16.1 | known |
| | rs12989517 | 2 | 144498693 | G | A | -0.0368 | 0.0024 | -0.0054 | 3.3E-22 | -0.021334 | 1.12159E-22 | GTDC1 | 2q22.3 | known |
| | rs6764973 | 3 | 148686636 | C | T | 0.0405 | 0.00377 | 0.00338 | 2.2E-07 | 0.013776 | 3.8538E-08 | GYG1 | 3q24 | known |
| | rs36151380 | 6 | 32608886 | T | C | -0.0465 | 0.00709 | -0.00429 | 8E-08 | -0.014992 | 2.27426E-08 | MHC region | | known |
| | rs2056544 | 15 | 76826003 | G | A | -0.0356 | 0.00308 | -0.00361 | 9.8E-11 | -0.014336 | 1.49526E-11 | ISL2 | 1q42.2 | known |
| | rs12457603 | 18 | 2003165 | T | C | -0.0381 | 0.00991 | -0.00373 | 3.7E-08 | -0.015112 | 1.22307E-08 | CTAGE1 | 18q11.2 | known |
| | rs8102454 | 19 | 38735480 | G | A | 0.0308 | 0.00918 | 0.00399 | 1.7E-13 | 0.014064 | 2.43763E-11 | SPINT2 | 19q13.2 | known |
| | rs138699 | 22 | 39129708 | G | A | -0.0649 | 1.74E-06 | -0.00342 | 6.3E-08 | -0.014665 | 1.68216E-09 | GTPBP1 | 22q13.1 | known |
| | rs6001872 | 22 | 40703245 | A | G | -0.045 | 0.000236 | -0.00316 | 2.6E-08 | -0.01314 | 2.35189E-09 | ADSL | 22q13.1 | known |
| | rs5995886 | 22 | 41033801 | G | A | -0.0471 | 0.00185 | -0.00369 | 1.3E-07 | -0.015222 | 2.09215E-08 | MRTFA | 22q13.1-q13.2 | known |
| Colorectal cancer | rs10910384 | 1 | 234353053 | A | C | -0.05247 | 0.009512 | -0.00712 | 9.4E-23 | -0.027016 | 3.84522E-21 | COA6 | 1q42.2 | known |
| | rs59985551 | 2 | 56106928 | C | T | 0.0231251 | 0.00731 | 0.00429 | 2.1E-11 | 0.017067 | 1.80552E-11 | EFEMP1 | 2p16.1 | known |
| | rs4662338 | 2 | 1444284096 | A | G | -0.064811 | 0.00981 | -0.00938 | 5.6E-09 | -0.0354 | 4.04941E-08 | ARHIGAP15 | 2q22.2-q22.3 | known |
| | rs35133416 | 3 | 52359040 | C | T | 0.0522728 | 1.5E-07 | 0.00379 | 1.7E-07 | 0.015591 | 2.19814E-08 | DNAH1 | 3p21.1 | known |
| | rs10472291 | 5 | 37772780 | C | A | -0.026766 | 0.00555 | -0.00378 | 3.8E-11 | -0.014212 | 2.72819E-10 | GDNF | 5p13.2 | known |
| | rs2395163 | 6 | 32387809 | T | C | -0.0444 | 8.68E-07 | -0.00362 | 2.2E-08 | -0.014772 | 7.25862E-09 | MHC region | | known |
| | rs9482094 | 6 | 98364895 | A | G | -0.022597 | 0.002993 | -0.00377 | 1.4E-11 | -0.014987 | 8.76549E-12 | MMS22L | 6q16.1 | known |
| | rs1553506 | 8 | 122267821 | G | T | -0.026344 | 0.0019 | -0.00386 | 1.2E-09 | -0.014452 | 7.30787E-09 | HAS2 | 8q24.13 | known |
| | rs1886693 | 10 | 18440444 | G | A | 0.0277855 | 0.000307 | 0.00356 | 2.7E-10 | 0.013326 | 2.4712E-09 | CACNB2 | 10p12 | known |
| | rs7077800 | 10 | 25819228 | C | T | 0.0232263 | 0.001537 | 0.00526 | 1.7E-22 | 0.020033 | 4.22944E-21 | GPR158 | 10p12.1 | known |
| Gastritis-duodenitis | rs11190202 | 10 | 101394821 | A | G | 0.0351725 | 0.001676 | 0.00609 | 6.1E-14 | 0.023024 | 7.16775E-13 | SLC25A28 | 10q24.2 | known |
| | rs10748858 | 10 | 105639514 | T | G | 0.0278528 | 0.000207 | -0.00298 | 6.4E-08 | -0.011964 | 2.91481E-08 | SH3PXD2A | 10q24.33 | known |
| | rs117166824 | 16 | 84929945 | G | A | 0.0387405 | 0.00663 | 0.006 | 1.8E-08 | 0.023575 | 8.37966E-09 | CRISPLD2 | 16q24.1 | known |
| | rs267970 | 16 | 86229438 | G | A | -0.033499 | 0.004152 | -0.00502 | 1.5E-10 | -0.019621 | 9.99154E-11 | IRF8 | 16q24.1 | known |
| | rs6507874 | 18 | 46448805 | T | C | 0.166935 | 1.3E-111 | 0.00248 | 5.4E-06 | 0.01235 | 6.22233E-09 | SMAD7 | 18q21.1 | known |
| | rs74735775 | 2 | 56226642 | G | A | 0.0703 | 0.00321 | 0.00901 | 3.4E-10 | 0.03562 | 9.06422E-11 | EFEMP1 | 2p16.1 | known |
| | rs12992706 | 2 | 144363659 | C | T | -0.0356 | 0.00231 | -0.011 | 6.6E-55 | -0.04216 | 2.04535E-53 | ARHIGAP15 | 2q22.2-q22.3 | known |
| | rs7634096 | 3 | 151087637 | C | T | 0.031 | 0.00632 | 0.00428 | 3.5E-10 | 0.01704 | 1.20013E-10 | P2RY12 | 3q25.1 | known |
| | rs113253021 | 6 | 32497671 | G | A | -0.0332 | 0.00293 | -0.00372 | 3.7E-08 | -0.012348 | 8.68246E-09 | MHC region | | known |
| | rs10488465 | 7 | 134561819 | T | C | 0.0383 | 7.74E-05 | 0.00315 | 1.4E-07 | 0.013123 | 7.40306E-09 | AGBL3 | 7q33 | known |
| Gastroesophageal reflux disease | rs2049865 | 8 | 116588546 | C | A | -0.029 | 0.00133 | -0.00302 | 4.9E-08 | -0.012297 | 6.68528E-09 | TRPS1 | 8q23.3 | known |
| | rs1381333 | 8 | 120427596 | C | T | 0.033 | 0.00145 | 0.0045 | 8.8E-13 | 0.015419 | 2.79495E-10 | CCN3 | 8q24.12 | known |
| | rs875107 | 11 | 70005374 | C | A | 0.0231 | 0.0094 | 0.00319 | 3.7E-09 | 0.012793 | 1.01145E-09 | FADD | 11q13.3 | known |
| | rs387505 | 15 | 68238462 | T | C | 0.03 | 0.000852 | 0.00303 | 2.9E-08 | 0.012414 | 4.01024E-09 | PIAS1 | 15q23 | known |
| | rs11899380 | 2 | 56079609 | G | A | 0.0433 | 6.3E-07 | 0.00705 | 4.6E-19 | -0.027629 | 1.617478E-20 | EFEMP1 | 2p16.1 | known |
| | rs35133416 | 3 | 52359040 | C | T | -0.0273 | 0.000396 | -0.00379 | 1.7E-07 | -0.015276 | 9.14002E-09 | DNAH1 | 3p21.1 | known |
| | rs3732760 | 3 | 151074941 | A | C | -0.0222 | 0.000278 | -0.00379 | 1.7E-11 | -0.014734 | 1.89729E-12 | P2RY12 | 3q25.1 | known |
| | rs371604 | 5 | 122318432 | C | T | -0.0175 | 0.005258 | -0.00317 | 2.9E-08 | -0.012233 | 1.49395E-08 | PPIC | 5q23.2 | known |
| | rs2395163 | 6 | 32387809 | T | C | -0.0294 | 3.29E-05 | -0.00362 | 2.2E-08 | -0.014851 | 1.09661E-09 | MHC region | | known |
| | rs4839715 | 6 | 98365289 | G | A | -0.0269 | 1.05E-05 | -0.00377 | 1.4E-11 | -0.015123 | 5.35754E-13 | MMS22L | 6q16.1 | known |
| Irritable bowel syndrome | rs56044859 | 7 | 73441539 | G | A | 0.0494 | 0.00144 | 0.00786 | 3.7E-11 | 0.030893 | 4.59555E-12 | ELN | 7q11.23 | known |
| | rs6965122 | 7 | 96133319 | A | G | -0.018 | 0.004052 | -0.00309 | 8.2E-08 | -0.021023 | 2.33667E-08 | SLC25A13 | 7q21.3 | known |
| | rs10488465 | 7 | 134561819 | T | C | 0.0174 | 0.0066781 | 0.00315 | 1.4E-07 | 0.012074 | 3.81334E-08 | AGBL3 | 7q33 | known |
| | rs587707823 | 9 | 136145409 | C | A | -0.0231 | 0.004191 | -0.00542 | 7E-14 | -0.018803 | 8.80463E-14 | ABO | 9q34.2 | known |
| | rs117181194 | 10 | 124143523 | G | A | 0.0428 | 0.000843 | -0.00648 | 2.1E-08 | -0.025544 | 3.56968E-09 | PLEKH1 | 10q26.13 | known |
| | rs7993272 | 13 | 107898340 | T | C | 0.0173 | 0.005791 | 0.00323 | 1.8E-08 | 0.012406 | 8.00678E-09 | NALF1 | 13q33.3 | known |
| | rs2289328 | 15 | 40705417 | G | A | 0.0258 | 0.001119 | 0.00476 | 7.5E-11 | 0.018355 | 1.62178E-11 | DISP2 | 15q15.1 | known |
| | rs387505 | 15 | 68238462 | T | C | 0.0218 | 0.00026 | 0.00303 | 2.9E-08 | 0.012113 | 2.92912E-09 | PIAS1 | 15q23 | known |
| | rs2056544 | 15 | 76826003 | G | A | 0.0164 | 0.006817 | 0.00361 | 9.8E-11 | 0.013388 | 6.49513E-11 | ISL2 | 1q42.2 | known |
| | rs75041563 | 16 | 84938209 | A | C | -0.0186 | 0.002595 | -0.00378 | 1.3E-11 | -0.014046 | 4.90264E-12 | CRISPLD2 | 16q24.1 | known |
| Non-alcoholic fatty liver disease | rs138699 | 22 | 39129708 | G | A | 0.0271 | 7.92E-05 | 0.00342 | 6.3E-08 | 0.013945 | 2.87157E-09 | GTPBP1 | 22q13.1 | known |
| | rs6001870 | 22 | 40695172 | A | C | -0.0186 | 0.003545 | -0.00338 | 4.3E-09 | -0.012915 | 1.4594E-09 | ADSL | 22q13.1 | known |
| | rs57810551 | 1 | 214526612 | T | G | -0.0336 | 2.29E-06 | -0.00267 | 2.1E-06 | -0.01186 | 3.08472E-08 | SMYD2 | 1q32.3 | known |
| | rs10187329 | 2 | 56061813 | T | C | -0.0414 | 0.001338 | -0.00648 | 1.1E-10 | -0.026006 | 2.02324E-11 | EFEMP1 | 2p16.1 | known |
| | rs4233568 | 2 | 144329180 | G | A | -0.0215 | 0.005969 | -0.00937 | 8E-47 | -0.034941 | 3.74989E-44 | ARHIGAP15 | 2q22.2-q22.3 | known |
| | rs17474056 | 2 | 203987554 | C | T | 0.0182 | 0.009062 | 0.00287 | 1.2E-07 | 0.011508 | 3.00175E-08 | WDR12 | | known |
| | rs73157991 | 3 | 151080807 | T | C | 0.0449 | 8.95E-07 | 0.00466 | 1.3E-10 | 0.019768 | 8.00118E-13 | P2RY12 | 3q25.1 | known |
| | rs7990 | 6 | 32609695 | C | A | 0.0383 | 0.001782 | 0.00472 | 1.4E-08 | 0.018428 | 1.22334E-09 | MHC region | | known |
| | rs7800387 | 7 | 102430522 | G | T | 0.0257 | 0.008451 | 0.00434 | 9.5E-09 | 0.017145 | 3.18604E-09 | FAM185A | 7q22.1 | known |
| | rs2049856 | 8 | 116588546 | C | A | 0.0186 | 0.007451 | 0.00302 | 4.9E-08 | 0.011986 | 9.33303E-09 | TRPS1 | 8q23.3 | known |
| Peptic ulcer | rs1381333 | 8 | 120427596 | C | T | -0.0284 | 0.000378 | -0.0045 | 8.8E-13 | -0.018037 | 6.43028E-14 | CCN3 | 8q24.12 | known |
| | rs875107 | 11 | 70005374 | C | A | -0.0182 | 0.007658 | -0.00319 | 3.7E-09 | -0.012676 | 7.81562E-10 | FADD | 11q13.3 | known |
| | rs12908421 | 15 | 76881794 | T | G | -0.019 | 0.005321 | -0.00321 | 3.7E-09 | -0.012791 | 5.39615E-10 | ISL2 | 1q42.2 | known |
| | rs725998 | 17 | 46353134 | G | A | 0.0338 | 9.69E-06 | 0.0029 | 1.5E-06 | 0.012762 | 3.76944E-08 | SKAP1 | 17q21.32 | known |
| | rs61823192 | 1 | 219294570 | C | T | 0.0263 | 0.002405 | 0.01268 | 4.6E-14 | 0.04011 | 5.79887E-11 | LYPLAL1 | 1q41 | known |
| | rs62170309 | 2 | 144426357 | C | A | -0.079619 | 0.006938 | -0.00926 | 2.3E-19 | -0.03438 | 4.16781E-17 | ARHIGAP15 | 2q22.2-q22.3 | known |
| | rs17615220 | 6 | 32677413 | A | | | | | | | | | | |

Supplementary Table 20. Multi-trait meta-analysis between psychiatric disorders and cholelithiasis and cholecystitis in Europeans

| Type of psychiatric disorders | SNP | CHR | BP | A1 | A2 | Psychiatric disorders (all) | Cholelithiasis and cholecystitis | MTAG | Genes | Cytogenetic band | Annotation |
|--|-------------|-----|-----------|------|---------|-----------------------------|----------------------------------|-----------|-------------|------------------|-------------|
| | | | | Beta | P-value | Beta | P-value | Beta-mtag | P-mtag | | |
| Attention-deficit hyperactivity disorder | rs142761319 | 2 | 43944191 | T | G | 0.1144 | 0.02952 | 0.452 | 4.81E-14 | 0.058882715 | 3.79705E-09 |
| | rs2290846 | 4 | 151199080 | A | G | 0.035981 | 0.001065 | 0.114 | 1.44E-18 | 0.020835478 | 1.1588E-19 |
| | rs836536 | 7 | 6475091 | T | G | 0.0263953 | 0.004623 | 0.0651 | 0.000000028 | 0.012484275 | 2.42122E-09 |
| | rs28507397 | 8 | 94928911 | A | C | 0.0246001 | 0.009824 | 0.0635 | 0.000000107 | 0.012078535 | 1.34897E-08 |
| | rs9738226 | 12 | 121423659 | G | A | 0.0282959 | 0.003106 | 0.095 | 3.61E-15 | 0.013295631 | 6.04034E-10 |
| | rs112635299 | 14 | 94838142 | T | G | 0.0908004 | 0.007016 | 0.248 | 1.95E-09 | 0.045809796 | 2.5976E-10 |
| Major depressive disorder | rs35866622 | 19 | 49218060 | T | C | 0.0254046 | 0.007297 | 0.0954 | 5.05E-16 | 0.0131516791 | SERPINA2 |
| | rs138430 | 22 | 38874396 | T | C | -0.0361005 | 0.0003378 | -0.0654 | 8.72E-08 | -0.01302659 | FUT2 |
| | rs1200161 | 1 | 169117533 | G | A | -0.0177 | 0.0000731 | -0.0629 | 0.000000221 | -0.01276893 | DDX17 |
| | rs4952682 | 2 | 44036491 | G | A | 0.0142 | 0.009497 | 0.133 | 8.13E-19 | 0.01887715 | ATP1B1 |
| | rs143861800 | 2 | 44425237 | T | C | 0.1033 | 0.0008854 | 0.398 | 0.00000045 | 0.067975052 | PPM1B |
| | rs3905238 | 4 | 3078937 | G | A | -0.0236 | 1.97E-07 | -0.0556 | 0.0000031 | -0.01241273 | HIT1 |
| Neuroticism | rs10109419 | 8 | 94912072 | G | A | 0.0132 | 0.002808 | 0.0627 | 0.000000159 | 0.011920596 | PDP1 |
| | rs174566 | 11 | 61592362 | G | A | 0.0155 | 0.000609 | 0.0685 | 2.19E-08 | 0.01338278 | FADS1 |
| | rs34514836 | 19 | 46385438 | C | A | 0.0195 | 0.003537 | 0.113 | 3.55E-10 | 0.021036167 | IRF2BP1 |
| | rs763121 | 22 | 38879940 | G | A | 0.0135 | 0.00291 | 0.0678 | 3.78E-08 | 0.012951096 | DDX17 |
| | rs1200161 | 1 | 169117533 | G | A | -0.005269 | 0.001311993 | -0.0629 | 0.000000221 | -0.01198292 | ATP1B1 |
| | rs11891859 | 2 | 44044680 | A | C | 0.00664261 | 0.009190619 | 0.171 | 3.8E-20 | 0.024551858 | ABCG8 |
| Depression | rs2979160 | 8 | 8307666 | G | A | -0.0194558 | 8.36415E-23 | -0.0514 | 0.0000121 | -0.01393197 | PRAG1 |
| | rs7844163 | 8 | 94920742 | T | C | 0.00427115 | 0.005407328 | 0.0635 | 0.000000107 | 0.011810568 | PPM1B |
| | rs1169286 | 12 | 121419056 | C | T | -0.0042425 | 0.006648174 | -0.0865 | 2.87E-13 | -0.0122088 | HIF1A |
| | rs633372 | 19 | 49209226 | A | G | 0.00472125 | 0.001458389 | 0.0929 | 2.68E-15 | 0.016566781 | FUT2 |
| | rs138457 | 22 | 38898051 | C | T | -0.005365 | 0.00186477 | -0.0639 | 0.000000147 | -0.01205252 | DDX17 |
| | rs2815753 | 1 | 72812324 | A | G | 0.0292949 | 2.165E-19 | 0.034 | 0.00436 | 0.011432229 | NEGR1 |
| Anxiety | rs1200161 | 1 | 169117533 | G | A | -0.0134985 | 0.00005525 | -0.0629 | 0.000000221 | -0.01195914 | ATP1B1 |
| | rs11891859 | 2 | 44044680 | A | C | -0.0128965 | 0.008972 | 0.171 | 3.8E-20 | 0.020724647 | ABCG8 |
| | rs3905238 | 4 | 3078937 | G | A | -0.0167981 | 2.679E-07 | -0.0556 | 0.0000031 | -0.01159343 | HIT1 |
| | rs7864396 | 9 | 96251318 | C | A | -0.0200967 | 1.476E-09 | -0.0472 | 0.00011 | -0.01127537 | FAM120A |
| | rs12783517 | 10 | 21878407 | T | C | 0.00920221 | 0.007641 | 0.0703 | 0.000000034 | 0.012061708 | SKIDA1 |
| | rs174564 | 11 | 61588305 | G | A | 0.0186019 | 1.916E-08 | 0.0684 | 2.29E-08 | 0.013992727 | FADS1 |
| Schizophrenia | rs11065363 | 12 | 121388498 | T | C | 0.0145047 | 0.001414 | 0.0821 | 0.000000299 | 0.014786835 | HIF1A |
| | rs12929503 | 16 | 69565461 | C | T | -0.0103958 | 0.002313 | -0.0613 | 0.000000275 | -0.011277 | NFAT5 |
| | rs12967855 | 18 | 35138245 | G | A | -0.0282959 | 1.643E-16 | -0.037 | 0.00303 | -0.01165634 | CELF4 |
| | rs7231742 | 18 | 50762502 | A | G | 0.0338981 | 1.39E-12 | 0.0638 | 0.000378 | 0.01693281 | DCC |
| | rs2815753 | 1 | 72812324 | A | G | 0.0292949 | 2.165E-19 | 0.034 | 0.00436 | 0.011432229 | NEGR1 |
| | rs1200161 | 1 | 169117533 | G | A | -0.0134985 | 0.00005525 | -0.0629 | 0.000000221 | -0.01195914 | ATP1B1 |

Supplementary Table 21. Multi-trait meta-analysis between digestive diseases and cholelithiasis and cholecystitis in Europeans

| Type of digestive diseases | SNP | CHR | BP | A1 | A2 | Digestive diseases (all) Beta | P-value | Cholelithiasis and cholecystitis Beta | P-value | MTAG Beta-mtag | P-mtag | Genes | Cytogenetic band | Annotation |
|-----------------------------------|-------------|-----|-----------|----|----|----------------------------------|------------|--|-------------|-------------------|-------------|-----------|------------------|------------|
| Diverticular disease | rs4333882 | 1 | 234352899 | G | A | 0.006996 | 2.5E-24 | 0.0399 | 0.00802 | 0.015313 | 5.51137E-09 | COA6 | 1q42.2 | new |
| | rs11677892 | 2 | 144430711 | G | A | 0.005421 | 4E-22 | 0.0384 | 0.00165 | 0.013247 | 9.5497E-10 | ARHGAP15 | 2q22.2-q22.3 | known |
| | rs2290846 | 4 | 151199080 | A | G | 0.002165 | 0.00036 | 0.114 | 1.44E-18 | 0.020888 | 5.99707E-20 | DCLK2 | 4q31.23-q31.3 | known |
| | rs8191528 | 8 | 11628649 | T | C | 0.001729 | 0.0064 | 0.0794 | 1.23E-08 | 0.014816 | 1.66389E-09 | NEIL2 | 8p23.1 | known |
| | rs12783517 | 10 | 21878407 | T | C | 0.001809 | 0.0024 | 0.0703 | 0.00000034 | 0.013542 | 1.9588E-09 | SKIDAI | 10p12.31 | known |
| | rs11239595 | 10 | 46217082 | T | G | 0.002198 | 0.0017 | 0.125 | 5.66E-17 | 0.016595 | 2.1605E-10 | WASHC2C | 10q11.22 | known |
| | rs169292 | 12 | 121426478 | T | C | -0.001485 | 0.0084 | -0.0985 | 9.19E-15 | -0.013594 | 1.40452E-09 | HNF1A | 12q24.31 | known |
| | rs4886824 | 15 | 76969256 | G | A | 0.003097 | 1.2E-08 | 0.0516 | 0.00001 | 0.012262 | 3.30749E-09 | SCAPER | 15q24.3 | known |
| | rs35318830 | 19 | 46380325 | G | T | 0.002196 | 0.0082 | 0.113 | 7.81E-10 | 0.020767 | 1.48527E-10 | IRF2BP1 | 19q13.32 | known |
| Gastritis-duodenitis | rs281393 | 19 | 49224484 | T | C | -0.001664 | 0.0034 | -0.065 | 0.000000172 | -0.012489 | 1.32834E-08 | FUT2 | 19q13.33 | known |
| | rs1043402 | 22 | 38879688 | A | G | 0.002508 | 0.00026 | 0.0707 | 3.28E-08 | 0.014523 | 1.62113E-10 | DDX17 | 22q13.1 | known |
| Gastroesophageal reflux disease | rs75331444 | 2 | 44069772 | A | G | 0.0575 | 0.00136 | 0.767 | 4.16E-201 | 0.120697 | 3.1567E-175 | ABCG5 | 2p21 | known |
| | rs4681515 | 3 | 149212076 | G | A | -0.0243 | 0.0004519 | -0.106 | 2.82E-19 | -0.016637 | 2.02084E-18 | TM4SF4 | 3q25.1 | known |
| | rs2290846 | 4 | 151199080 | A | G | 0.0201 | 0.00195 | 0.114 | 1.44E-18 | 0.016945 | 3.39547E-16 | DCLK2 | 4q31.23-q31.3 | known |
| | rs45502492 | 7 | 87089898 | T | C | -0.0277 | 0.001078 | -0.147 | 1.12E-08 | 0.015884 | 1.1976E-09 | ABC4B | 7q21.12 | known |
| | rs9297994 | 8 | 59392324 | A | G | -0.0258 | 0.0000366 | -0.105 | 1.7E-17 | -0.022007 | 5.79766E-16 | CYP7A1 | 8q12.1 | known |
| | rs1243189 | 10 | 21935248 | G | A | 0.0234 | 0.0002291 | 0.0679 | 6.46E-08 | 0.011834 | 5.11985E-09 | SKIDAI | 10p12.31 | known |
| | rs34851490 | 19 | 46384554 | G | A | 0.031 | 0.0007671 | 0.114 | 4.81E-10 | 0.018569 | 2.68558E-10 | IRF2BP1 | 19q13.32 | known |
| | rs1043402 | 22 | 38879688 | A | G | 0.0224 | 0.0005436 | 0.0707 | 3.28E-08 | 0.012017 | 5.96939E-09 | DDX17 | 22q13.1 | known |
| Irritable bowel syndrome | rs56374126 | 4 | 151243864 | T | C | 0.0215 | 0.008362 | 0.11 | 2.43E-15 | 0.020867 | 7.21875E-16 | DCLK2 | 4q31.23-q31.3 | known |
| | rs10275443 | 7 | 107462440 | T | C | -0.0199 | 0.005539 | -0.0638 | 0.000000219 | -0.012449 | 3.50764E-08 | SLC26A3 | 7q22.3-q31.1 | known |
| | rs13280055 | 8 | 11522353 | A | G | 0.0293 | 0.005968 | 0.109 | 6.07E-10 | 0.020702 | 1.05187E-10 | NEIL2 | 8p23.1 | known |
| | rs4738684 | 8 | 59393273 | G | A | -0.0311 | 0.00001593 | -0.105 | 1.89E-17 | -0.016247 | 1.82923E-12 | CYP7A1 | 8q12.1 | known |
| | rs11239535 | 10 | 45978387 | T | C | 0.0217 | 0.003196 | 0.11 | 3.14E-18 | 0.0209 | 5.5853E-19 | WASHC2C | 10q11.22 | known |
| Non-alcoholic fatty liver disease | rs112635299 | 14 | 94838142 | T | G | 0.0647 | 0.008503 | 0.248 | 1.95E-09 | 0.047405 | 3.9159E-10 | SERPIN A2 | 14q32.13 | known |
| | rs10107182 | 8 | 59392737 | T | C | -0.074737 | 8.148E-06 | -0.105 | 1.69E-17 | -0.020953 | 5.51099E-20 | CYP7A1 | 8q12.1 | known |
| | rs7924036 | 10 | 65191645 | T | G | 0.04869 | 0.002768 | 0.0659 | 1.74E-08 | 0.013178 | 1.09255E-09 | REEP3 | 10q21.3 | known |
| Peptic ulcer | rs28929474 | 14 | 94849497 | T | C | 0.2283 | 0.0001189 | 0.249 | 3.16E-09 | 0.050513 | 4.43119E-11 | SERPIN A2 | 14q32.13 | known |
| | rs174566 | 11 | 61592362 | G | A | -0.034175 | 0.0032 | 0.0685 | 2.19E-08 | 0.013701 | 2.41989E-09 | FADS1 | 11q12.2 | known |
| | rs34514836 | 19 | 46385438 | C | A | -0.050709 | 0.0026 | 0.113 | 3.55E-10 | 0.022325 | 3.80325E-11 | IRF2BP1 | 19q13.32 | known |
| | rs62129964 | 19 | 48374950 | A | C | -0.04173 | 0.0049 | -0.139 | 2.52E-18 | -0.022894 | 9.93441E-15 | TPRX2 | 19q13.33 | known |
| | rs516246 | 19 | 49206172 | T | C | -0.087713 | 4.1E-15 | 0.0929 | 2.28E-15 | 0.020189 | 3.23078E-20 | FUT2 | 19q13.33 | known |
| | rs5757140 | 22 | 38957013 | C | T | -0.032063 | 0.0087 | 0.0672 | 0.000000204 | 0.013366 | 3.52948E-08 | DDX17 | 22q13.1 | known |

Supplementary Table 22. Multi-trait meta-analysis between psychiatric disorders and non-alcoholic fatty liver disease in Europeans

| Type of psychiatric disorders | SNP | CHR | BP | A1 | A2 | Psychiatric disorders (all) Beta | Non-alcoholic fatty liver disease P-value | Beta | P-value | MTAG Beta-mtag | P-mtag | Genes | Cytogenetic band | Annotation |
|--|------------|-----|-----------|----|----|----------------------------------|---|------------|------------|----------------|-------------|------------|------------------|------------|
| Neuroticism | rs3115672 | 6 | 31760120 | T | C | -0.01807 | 3.7975E-12 | -0.0916367 | 0.004892 | -0.007807 | 5.20403E-09 | MHC region | known | |
| | rs2979204 | 8 | 8441347 | T | C | 0.0173638 | 1.0539E-17 | 0.0593777 | 0.001446 | 0.005132 | 1.40919E-12 | PRAG1 | 8p23.1 | |
| | rs10891570 | 11 | 113542843 | A | G | -0.0110001 | 1.9726E-12 | -0.04397 | 0.009882 | -0.004136 | 6.56875E-09 | ANKK1 | 11q23.2 | |
| | rs11152363 | 18 | 55389957 | A | G | 0.0127336 | 3.8457E-11 | 0.0653313 | 0.001751 | 0.005032 | 8.81154E-09 | TCF4 | 18q21.2 | |
| Attention-deficit hyperactivity disorder | rs7613360 | 3 | 49879277 | T | C | 0.0534008 | 3.175E-08 | 0.0451071 | 0.007454 | 0.004046 | 3.14163E-08 | CAMKV | 3p21.31 | |
| | rs10419672 | 19 | 19360432 | T | C | -0.0494004 | 0.0000217 | -0.1076665 | 5.998E-07 | -0.005509 | 2.41715E-08 | GATA2A | 19p13.11 | |
| Major depressive disorder | rs12619197 | 2 | 22343676 | A | G | 0.0233 | 6.834E-08 | 0.0610887 | 0.0001834 | 0.003764 | 3.1313E-08 | KLHL29 | 2p24.1 | |
| | rs7509 | 6 | 27451068 | T | G | -0.0274 | 2.226E-10 | -0.0438781 | 0.008958 | -0.003976 | 2.46776E-09 | MHC region | known | |
| | rs7240481 | 18 | 55431501 | A | G | -0.0317 | 2.483E-11 | -0.053711 | 0.003984 | -0.004545 | 4.11311E-10 | TCF4 | 18q21.2 | |
| Depression | rs12619197 | 2 | 22343676 | A | G | 0.0203966 | 2.043E-10 | 0.0610887 | 0.0001834 | 0.003088 | 2.482E-09 | KLHL29 | 2p24.1 | |
| | rs34890793 | 3 | 49582060 | T | C | -0.0361005 | 1.444E-16 | -0.0603317 | 0.009958 | -0.005073 | 3.18728E-12 | BSN | 3p21.31 | |
| | rs2844795 | 6 | 30106070 | T | C | 0.0239034 | 8.241E-14 | 0.0467349 | 0.008197 | 0.003366 | 1.204E-10 | MHC region | known | |
| | rs1273044 | 11 | 113123126 | T | C | 0.0243999 | 1.749E-10 | 0.0716365 | 0.00007079 | 0.003616 | 1.12472E-09 | NCAM1 | 11q23.2 | |
| | rs10891570 | 11 | 113542843 | A | G | -0.0212032 | 1.192E-10 | -0.04397 | 0.009882 | -0.002951 | 1.75188E-08 | ANKK1 | 11q23.2 | |
| | rs7212293 | 17 | 67851209 | A | G | -0.0234017 | 1.912E-09 | -0.0838086 | 0.00002482 | -0.003657 | 5.46232E-09 | BPTF | 17q24.2 | |
| | rs7240481 | 18 | 55431501 | A | G | -0.0289955 | 1.827E-16 | -0.053711 | 0.003984 | -0.004052 | 1.0455E-12 | TCF4 | 18q21.2 | |

Supplementary Table 23. Multi-trait meta-analysis between digestive diseases and non-alcoholic fatty liver disease in Europeans

| Type of digestive diseases | SNP | CHR | BP | A1 | A2 | Digestive diseases (all) | | Non-alcoholic fatty liver disease | | MTAG | | Genes | Cytogenetic band | Annotation |
|----------------------------------|------------|-----|----------|----|----|--------------------------|-----------|-----------------------------------|-------------|--------------|-------------|------------|------------------|------------|
| | | | | | | Beta | P-value | Beta | P-value | Beta-mtag | P-mtag | | | |
| Cholelithiasis and cholecystitis | rs10107182 | 8 | 58480178 | T | C | -0.105 | 1.69E-17 | -0.0747368 | 0.000008148 | -0.006643704 | 4.42944E-20 | CYP7A1 | 8q12.1 | new |
| | rs7924036 | 10 | 63431885 | T | G | 0.0659 | 1.74E-08 | 0.0486896 | 0.002768 | 0.00426934 | 9.70512E-10 | REEP3 | 10q21.3 | known |
| | rs28929474 | 14 | 94378610 | T | C | 0.249 | 3.16E-09 | 0.22823 | 0.0001189 | 0.018148788 | 2.06989E-11 | SERPIN A2 | 14q32.13 | new |
| | rs429358 | 19 | 44908684 | T | C | 0.0628 | 0.0000992 | 0.1366152 | 1.135E-08 | 0.005477592 | 1.34917E-08 | APOE | 19q13.32 | known |
| Diverticular disease | rs17615220 | 6 | 32709636 | A | G | 0.0069987 | 2.6E-08 | 0.0848791 | 0.008288 | 0.010018426 | 4.21278E-08 | MHC region | | known |
| Gastritis-duodenitis | rs10419672 | 19 | 19360432 | T | C | -0.0354 | 0.00245 | -0.1076665 | 5.998E-07 | -0.008744823 | 4.81972E-08 | GATA D2A | 19p13.11 | known |
| Gastroesophageal reflux disease | rs7609078 | 2 | 99873901 | A | G | -0.039 | 1.626E-10 | -0.0522793 | 0.001701 | -0.002947981 | 1.60381E-10 | AFF3 | 2q11.2 | new |

Supplementary Table 24. Multi-trait meta-analysis between psychiatric disorders and crohn's disease in Europeans

| Type of psychiatric disorders | SNP | CHR | BP | A1 | A2 | Psychiatric disorders (all) | | Crohn's disease | | MTAG | | Genes | Cytogenetic band | Annotation |
|-------------------------------|------------|-----|-----------|----|----|-----------------------------|------------|-----------------|-----------|-----------|-------------|------------|------------------|------------|
| | | | | | | Beta | P-value | Beta | P-value | Beta-mtag | P-mtag | | | |
| Anxiety, panic disorder | rs3129883 | 6 | 32442360 | C | T | -0.000854828 | 0.0016 | -0.1802 | 1.122E-19 | -0.053751 | 4.13175E-19 | MHC region | | known |
| | rs10790020 | 11 | 114537576 | G | A | -0.000615515 | 0.0095 | -0.0934 | 3.418E-09 | -0.035452 | 3.81303E-09 | NXPE1 | 11q23.2 | known |
| Bipolar disorder | rs2836881 | 21 | 39094373 | G | T | 0.000745223 | 0.0053 | 0.2217 | 1.105E-32 | 0.069844 | 3.7471E-31 | PSMG1 | 21q22.2 | known |
| | rs4870 | 1 | 2556714 | G | A | -0.0347985 | 0.0002618 | -0.1095 | 6.432E-12 | -0.038691 | 1.61006E-10 | TNFRSF14 | 1p36.32 | known |
| | rs4655208 | 1 | 19802043 | C | T | -0.0346018 | 0.003275 | -0.1671 | 2.701E-14 | -0.04295 | 1.26124E-12 | TMC04 | 1p36.13 | known |
| | rs7554511 | 1 | 200908434 | C | A | 0.0324962 | 0.001833 | 0.1448 | 4.267E-16 | 0.047572 | 3.77031E-15 | KIF21B | 1q32.1 | known |
| | rs4560096 | 2 | 60977782 | G | T | 0.0247999 | 0.009792 | 0.1595 | 3.751E-23 | 0.056331 | 1.27699E-20 | REL | 2p16.1 | known |
| | rs62180182 | 2 | 198898963 | C | A | -0.026498 | 0.009599 | -0.121 | 1.526E-12 | -0.041343 | 8.31749E-12 | SATB2 | 2q33.1 | known |
| | rs4676408 | 2 | 240634984 | G | A | -0.0305004 | 0.00148 | -0.1433 | 1.19E-17 | -0.05015 | 1.14704E-16 | GPR35 | 2q37.3 | known |
| | rs2960545 | 3 | 49692625 | G | A | -0.0281987 | 0.002497 | -0.0963 | 8.636E-10 | -0.036039 | 2.57969E-09 | APEH | 3p21.31 | known |
| Major depressive disorder | rs9268912 | 6 | 32464732 | C | A | 0.0335992 | 0.0005324 | 0.3225 | 2.966E-76 | 0.107471 | 1.38943E-70 | MHC region | | known |
| | rs4330804 | 9 | 136399795 | G | T | 0.0251023 | 0.009439 | 0.1203 | 6.618E-14 | 0.042595 | 1.92424E-12 | SNAPC4 | 9q34.3 | known |
| | rs12766391 | 10 | 62681444 | G | A | -0.0439977 | 4.736E-06 | -0.1029 | 1.396E-10 | -0.03588 | 3.1537E-09 | ADO | 10q21.3 | known |
| | rs12936409 | 17 | 39887396 | C | T | -0.0374018 | 0.0006516 | -0.1365 | 5.62E-19 | -0.048691 | 8.46354E-16 | ZPB2 | 17q21.1 | known |
| | rs6062475 | 20 | 63647034 | G | A | -0.0251998 | 0.009495 | -0.1008 | 5.48E-10 | -0.035136 | 6.36034E-09 | STMN3 | 20q13.33 | known |
| Neuroticism | rs6702590 | 1 | 201050977 | G | A | 0.0125 | 0.00605 | 0.1261 | 5.431E-14 | 0.044433 | 1.19159E-13 | KIF21B | 1q32.1 | known |
| | rs1809028 | 2 | 61186588 | G | A | 0.0171 | 0.0008038 | 0.1023 | 5.519E-08 | 0.033218 | 2.93172E-08 | C2orf74 | 2p15 | known |
| | rs12474120 | 2 | 198828721 | G | A | 0.0125 | 0.008314 | 0.1201 | 5.044E-12 | 0.040938 | 8.23767E-12 | SATB2 | 2q33.1 | known |
| | rs6871626 | 5 | 159399784 | C | A | -0.0122 | 0.008489 | -0.1713 | 5.895E-24 | -0.054856 | 5.29753E-20 | IL12B | 5q33.3 | known |
| | rs9271546 | 6 | 32622377 | C | T | -0.0118 | 0.006995 | -0.212 | 4.075E-37 | -0.069604 | 3.26605E-31 | MHC region | | known |
| Neuroticism | rs13234982 | 7 | 107837916 | G | A | 0.0117 | 0.007204 | 0.141 | 1.035E-17 | 0.050255 | 4.87713E-17 | SLC26A3 | 7q22.3-q31.1 | known |
| | rs12766391 | 10 | 62681444 | G | A | -0.016 | 0.0002678 | -0.1029 | 1.396E-10 | -0.033551 | 2.12952E-08 | ADO | 10q21.3 | known |
| | rs12122809 | 1 | 201045838 | C | T | 0.00425142 | 0.00957688 | 0.1301 | 1.725E-13 | 0.043352 | 5.5766E-13 | KIF21B | 1q32.1 | known |
| | rs7608697 | 2 | 60977506 | C | A | 0.00453079 | 0.00542154 | 0.1597 | 3.031E-23 | 0.057667 | 8.68978E-22 | REL | 2p16.1 | known |
| | rs62180181 | 2 | 198987286 | C | T | -0.00618788 | 0.00013962 | -0.1226 | 8.084E-13 | -0.04299 | 8.66008E-13 | SATB2 | 2q33.1 | known |
| Schizophrenia | rs131095 | 3 | 49676792 | C | T | 0.00563987 | 0.0011431 | 0.1593 | 2.177E-21 | 0.050825 | 2.82669E-17 | APEH | 3p21.31 | known |
| | rs9274655 | 6 | 32668512 | C | T | -0.00585351 | 0.00271693 | -0.331 | 2.542E-46 | -0.077853 | 2.38316E-38 | MHC region | | known |
| | rs798498 | 7 | 2756248 | G | T | -0.00419345 | 0.00907111 | -0.1094 | 2.933E-10 | -0.037168 | 6.32944E-10 | AMZ1 | 7p22.3 | known |
| | rs12942547 | 17 | 42375526 | G | A | -0.00426818 | 0.00542825 | -0.1047 | 1.203E-10 | -0.03401 | 1.54324E-08 | STAT3 | 17q21.2 | known |
| | rs2823290 | 21 | 15468984 | C | A | -0.00441703 | 0.0032347 | -0.1255 | 2.905E-13 | -0.038789 | 1.10709E-10 | USP25 | 21q21.1 | known |
| | rs7522794 | 1 | 161505035 | C | T | -0.02820402 | 0.00211 | -0.1685 | 1.19E-22 | -0.050777 | 9.15079E-18 | FCGR2A | 1q23.3 | known |
| | rs72749142 | 1 | 200982179 | G | A | 0.064401012 | 8.118E-08 | 0.1824 | 2.127E-15 | 0.048423 | 2.69537E-16 | KIF21B | 1q32.1 | known |
| | rs62180181 | 2 | 198987286 | C | T | -0.032202995 | 0.0066443 | -0.1226 | 8.084E-13 | -0.042448 | 7.17531E-13 | SATB2 | 2q33.1 | known |
| Depression | rs131095 | 3 | 49676792 | C | T | 0.025605029 | 0.006281 | 0.1593 | 2.177E-21 | 0.051571 | 1.22571E-17 | APEH | 3p21.31 | known |
| | rs9271176 | 6 | 32610350 | G | A | -0.043002017 | 0.00001002 | -0.3495 | 4.2E-91 | -0.11474 | 8.08265E-84 | MHC region | | known |
| | rs34530632 | 6 | 111455132 | C | T | -0.052504554 | 0.005746 | -0.2114 | 9.111E-11 | -0.03808 | 1.21322E-10 | TRAF3IP2 | 6q21 | known |
| | rs822341 | 9 | 5453396 | C | T | -0.025696986 | 0.009173 | -0.1063 | 3.33E-09 | -0.034753 | 4.22268E-09 | CD274 | 9p24.1 | known |
| | rs3812555 | 9 | 136367481 | C | T | -0.026795823 | 0.005381 | -0.104 | 1.927E-09 | -0.035518 | 1.92141E-09 | SNAPC4 | 9q34.3 | known |
| | rs10761659 | 10 | 62685804 | G | A | 0.024702369 | 0.004272 | 0.1276 | 1.327E-15 | 0.040984 | 4.24801E-12 | ADO | 10q21.3 | known |
| | rs2012070 | 17 | 42505083 | G | T | 0.032895162 | 0.0007368 | 0.1037 | 6.271E-09 | 0.035026 | 3.19212E-09 | NAGLU | 17q21.2 | known |
| | rs5771069 | 22 | 49997051 | G | A | 0.023698607 | 0.006786 | 0.0998 | 2.472E-10 | 0.037093 | 3.58984E-10 | IL17REL | 22q13.33 | known |
| Depression | rs296547 | 1 | 200923009 | C | T | 0.00879859 | 0.007062 | 0.1088 | 4.014E-11 | 0.03891 | 1.10935E-10 | INAV | 1q32.1 | known |
| | rs4671401 | 2 | 61246013 | C | T | -0.0120965 | 0.0009042 | -0.1035 | 1.61E-08 | -0.033884 | 1.93137E-08 | C2orf74 | 2p15 | known |
| | rs58513831 | 2 | 198859590 | C | T | 0.00910129 | 0.008501 | 0.1199 | 3.527E-12 | 0.041031 | 1.02569E-11 | SATB2 | 2q33.1 | known |
| | rs131095 | 3 | 49676792 | C | T | -0.0188021 | 5.424E-08 | 0.1593 | 2.177E-21 | 0.051571 | 1.22571E-17 | APEH | 3p21.31 | known |
| | rs60689680 | 5 | 159407359 | G | T | 0.00909948 | 0.006367 | -0.134 | 1.722E-15 | -0.044219 | 2.27557E-13 | IL12B | 5q33.3 | known |
| | rs6905775 | 6 | 32658244 | G | A | -0.0122953 | 0.00442 | 0.385 | 3.816E-53 | 0.086203 | 2.45211E-46 | MHC region | | known |
| | rs798502 | 7 | 2750246 | C | A | -0.0108015 | 0.0018 | -0.1162 | 3.895E-11 | -0.0392 | 8.06269E-11 | AMZ1 | 7p22.3 | known |
| | rs13234982 | 7 | 107837916 | G | A | 0.00850374 | 0.007896 | 0.141 | 1.035E-17 | 0.05004 | 1.06271E-16 | SLC26A3 | 7q22.3-q31.1 | known |
| Depression | rs12302207 | 12 | 68121059 | G | A | -0.0129029 | 0.005826 | -0.1285 | 3.173E-09 | -0.03511 | 5.84256E-09 | IFNG | 12q15 | known |
| | rs7222154 | 17 | 39933720 | G | A | 0.00859685 | 0.009738 | -0.1148 | 7.365E-12 | -0.037768 | 3.80431E-10 | ZPB2 | 17q21.1 | known |
| | rs2738783 | 20 | 63677259 | G | T | 0.0128016 | 0.001799 | 0.1302 | 9.445E-10 | 0.03638 | 1.62197E-09 | TNFRSF6B | 20q13.33 | known |

Supplementary Table 25. Multi-trait meta-analysis between digestive diseases and crohn's disease in Europeans

| Type of digestive diseases | SNP | CHR | BP | A1 | A2 | Digestive diseases (all) Beta | P-value | Crohn's disease Beta | P-value | MTAG Beta-mtag | P-mtag | Genes | Cytogenetic band | Annotation |
|---------------------------------|-------------|-----|-----------|----|----|----------------------------------|-----------|-------------------------|-------------|-------------------|-------------|------------|------------------|------------|
| Appendicitis | rs4654737 | 1 | 19884608 | G | A | 0.0005378 | 0.0046 | 0.1143 | 1.71E-12 | 0.038225 | 0.20317E-10 | OTUD3 | 1p36.13 | known |
| | rs2088242 | 1 | 67298097 | C | T | 0.00054159 | 0.0087 | -0.1837 | 7.64E-25 | -0.060645 | 6.5254E-24 | IL12RB2 | 1p31.3 | known |
| | rs6735694 | 2 | 240647279 | C | T | 0.00054715 | 0.01 | -0.1273 | 3.912E-12 | -0.041435 | 5.5975E-12 | AQP12B | 2q37.3 | known |
| | rs34659678 | 6 | 111567337 | C | T | 0.00134161 | 0.00084 | -0.2165 | 1.661E-11 | -0.040649 | 1.39148E-11 | TRAF3IP12 | 6q21 | known |
| | rs7911680 | 10 | 99533711 | C | A | 0.00051859 | 0.005 | -0.1525 | 6.707E-22 | -0.056619 | 4.7664E-21 | NKX2-3 | 10q24.2 | known |
| | rs2508755 | 11 | 76534518 | G | A | -0.0004833 | 0.0091 | 0.0901 | 1.374E-08 | 0.034116 | 1.40697E-08 | LRRK32 | 11q13.5 | known |
| Gastroesophageal reflux disease | rs16940202 | 16 | 85980635 | C | T | -0.0009191 | 0.00025 | 0.135 | 3.073E-10 | 0.03851 | 1.52104E-10 | IRF8 | 16q24.1 | known |
| | rs62066988 | 17 | 39836028 | C | T | 0.00063924 | 0.0012 | -0.1229 | 2.838E-13 | -0.043947 | 2.72667E-13 | ZPB2 | ZPB2 | known |
| | rs7551717 | 1 | 19827168 | C | T | -0.0218 | 0.008531 | -0.1539 | 1.892E-10 | -0.0375 | 4.96859E-10 | OTUD3 | 1p36.13 | known |
| | rs1583398 | 1 | 206795610 | C | A | -0.0235 | 0.005636 | -0.1889 | 2.355E-17 | -0.049723 | 1.77253E-16 | IL10 | 1q32.1 | known |
| | rs62180181 | 2 | 198987286 | C | T | -0.0202 | 0.001549 | -0.1226 | 8.084E-13 | -0.042411 | 2.13522E-12 | SATB2 | 2q33.1 | known |
| | rs1131095 | 3 | 49676792 | C | T | -0.0211 | 0.001215 | 0.1593 | 2.177E-21 | 0.053123 | 1.37089E-19 | APEH | 3p21.31 | known |
| Irritable bowel syndrome | rs11130509 | 5 | 159344329 | G | A | -0.0162 | 0.009696 | -0.1038 | 4.99E-16 | -0.036702 | 1.20477E-14 | IL12B | 5q33.3 | known |
| | rs9271511 | 6 | 32621706 | G | A | 0.0228 | 0.0002242 | 0.3569 | 1.777E-87 | 0.112337 | 2.81956E-77 | MHC region | known | known |
| | rs4246905 | 9 | 114790969 | C | T | -0.0245 | 0.0001622 | 0.141 | 5.86E-15 | 0.046217 | 1.92027E-14 | TNFSF15 | 9q32 | known |
| | rs6062296 | 20 | 63660784 | C | T | -0.0158 | 0.007254 | -0.1058 | 3.342E-11 | -0.039022 | 1.01948E-10 | TNFRSF6B | 20q13.33 | known |
| | rs2836881 | 21 | 39094373 | G | T | -0.0234 | 0.0004472 | 0.2217 | 1.105E-32 | 0.069806 | 6.31896E-31 | PSMG1 | 21q22.2 | known |
| | rs2641117 | 1 | 7969450 | G | A | 0.0287 | 0.008372 | 0.1454 | 9.192E-10 | 0.038354 | 1.95986E-08 | ERRFI1 | 1p36.23 | known |
| Ulcerative colitis | rs7543680 | 1 | 22404776 | G | A | 0.0217 | 0.008946 | 0.1333 | 1.041E-11 | 0.040232 | 2.49731E-11 | ZBTB40 | 1p36.12 | known |
| | rs72883844 | 2 | 60840158 | C | T | 0.024 | 0.004494 | 0.1215 | 1.068E-11 | 0.040274 | 2.38055E-11 | REL | 2p16.1 | known |
| | rs62180106 | 2 | 198764830 | G | A | 0.0191 | 0.009587 | 0.0951 | 2.975E-08 | 0.03293 | 4.69901E-08 | SATB2 | 2q33.1 | known |
| | rs9271511 | 6 | 32621706 | G | A | -0.0264 | 0.0004119 | 0.3569 | 1.777E-87 | 0.112349 | 7.69162E-77 | MHC region | known | known |
| | rs6973357 | 7 | 107864223 | C | T | 0.018 | 0.009198 | -0.1347 | 7.497E-17 | 0.049196 | 3.33963E-16 | SLC26A3 | 7q22.3-q31.1 | known |
| | rs10899231 | 11 | 76565411 | C | A | 0.0201 | 0.009912 | -0.1111 | 9.469E-12 | -0.040299 | 2.31449E-11 | LRRK32 | 11q13.5 | known |
| Celiac disease | rs9512464 | 13 | 26956578 | C | T | 0.0241 | 0.002555 | 0.1141 | 6.652E-10 | 0.036798 | 1.03485E-09 | GPR12 | 13q12.13 | known |
| | rs72634258 | 1 | 8090578 | C | T | -0.1167 | 9.818E-08 | -0.1417 | 5.257E-11 | -0.039308 | 1.93335E-12 | ERRFI1 | 1p36.23 | known |
| | rs12041676 | 1 | 8213332 | G | A | 0.0949 | 3.437E-06 | 0.1052 | 2.289E-07 | 0.031881 | 1.13534E-08 | SLC45A1 | 1p36.23 | known |
| | rs34920465 | 1 | 22373858 | G | A | -0.0799 | 0.0001531 | -0.1708 | 9.013E-16 | -0.042662 | 2.17685E-14 | ZBTB40 | 1p36.12 | known |
| | rs11209026 | 1 | 67240275 | G | A | 0.7935 | 6.85E-93 | 0.483 | 1.995E-41 | 0.09951 | 3.28358E-71 | IL12RB2 | 1p31.3 | known |
| | rs15090963 | 1 | 67440746 | C | A | -0.1148 | 2.86E-12 | -0.0845 | 1.83E-07 | -0.036712 | 4.88789E-11 | SERBP1 | 1p31.3 | known |
| Osteoarthritis | rs1336900 | 1 | 150706557 | G | A | 0.0776 | 2.265E-06 | 0.0887 | 4.951E-28 | 0.033222 | 2.69385E-09 | GOLPH3L | 1q21.3 | known |
| | rs4845604 | 1 | 151829204 | G | A | 0.1178 | 6.063E-07 | 0.1608 | 1.572E-11 | 0.039379 | 1.76638E-12 | RORC | 1q21.3 | known |
| | rs12411216 | 1 | 155194689 | C | A | 0.0825 | 3.556E-07 | 0.0835 | 1.788E-07 | 0.032956 | 3.59742E-09 | MUC1 | 1q22 | new |
| | rs7522794 | 1 | 161505035 | C | T | -0.0732 | 3.098E-05 | -0.1685 | 1.19E-22 | -0.051179 | 4.81088E-20 | FCGR2A | 1q23.3 | known |
| | rs7554511 | 1 | 200908434 | C | A | 0.1158 | 1.491E-10 | 0.1448 | 4.267E-16 | 0.048339 | 4.94958E-18 | KIF21B | 1q32.1 | known |
| | rs3024495 | 1 | 206769068 | C | T | -0.1624 | 3.312E-14 | -0.2093 | 9.345E-24 | -0.059139 | 1.26301E-26 | IL10 | 1q32.1 | known |
| Cardiovascular diseases | rs11677002 | 2 | 28391534 | C | T | -0.1124 | 4.567E-12 | -0.0672 | 0.00002905 | -0.031934 | 1.07388E-08 | FOSL2 | 2p23.2 | known |
| | rs7605725 | 2 | 43414488 | G | A | -0.0732 | 1.554E-05 | -0.0868 | 2.61E-07 | -0.031224 | 2.52086E-08 | THADA | 2p21 | known |
| | rs55946629 | 2 | 43624107 | C | A | -0.1755 | 2.85E-14 | -0.0962 | 0.00003178 | -0.033279 | 2.53094E-09 | PLEKHH2 | 2p21 | known |
| | rs7608697 | 2 | 60977506 | C | A | 0.1229 | 4.033E-14 | 0.1597 | 3.031E-23 | 0.058414 | 1.31141E-25 | REL | 2p16.1 | known |
| | rs2071008 | 2 | 101998817 | G | T | -0.0757 | 2.074E-06 | -0.0804 | 3.172E-07 | -0.031814 | 1.21854E-08 | IL1R2 | 2q11.2 | known |
| | rs1558619 | 2 | 102315090 | G | T | 0.11 | 4.74E-12 | 0.0633 | 0.00005716 | 0.031355 | 1.96582E-08 | IL18R1 | 2q12.1 | known |
| Type 2 diabetes | rs6740847 | 2 | 181443625 | G | A | -0.104 | 9.72E-11 | -0.0767 | 0.00001431 | -0.03924 | 1.23943E-09 | ITGA4 | 2q31.3 | known |
| | rs12617311 | 2 | 198767841 | G | A | 0.0568 | 0.001183 | 0.0977 | 1.843E-07 | 0.031046 | 2.7052E-08 | SATB2 | 2q33.1 | known |
| | rs4676408 | 2 | 240634984 | G | A | -0.0565 | 0.0006554 | -0.1433 | 7.948E-08 | 0.045674 | 2.86046E-16 | SLC22A5 | 5q31.1 | known |
| | rs74597888 | 3 | 47263535 | C | T | 0.1634 | 3.643E-05 | 0.1976 | 3.355E-07 | 0.030553 | 4.46853E-08 | KLHL18 | 3p21.31 | known |
| | rs9834996 | 3 | 48717444 | G | T | -0.1248 | 1.411E-07 | -0.1611 | 5.807E-13 | -0.040607 | 3.54623E-13 | IP6K2 | 3p21.31 | known |
| | rs1131095 | 3 | 49676792 | C | T | 0.1719 | 4.593E-24 | 0.1593 | 2.177E-21 | 0.061576 | 2.83587E-28 | APEH | 3p21.31 | known |
| Parkinson's disease | rs1398553 | 4 | 122626913 | G | A | -0.0939 | 4.267E-08 | -0.0883 | 1.476E-07 | -0.033907 | 1.26362E-09 | IL21 | 4q27 | known |
| | rs395157 | 5 | 38867630 | C | T | -0.084 | 1.555E-07 | -0.0728 | 0.00004355 | -0.030586 | 4.32065E-08 | OSMR | 5p13.1 | known |
| | rs11742570 | 5 | 40410482 | C | T | 0.2601 | 1.105E-55 | 0.0831 | 2.761E-07 | 0.036446 | 5.71273E-22 | PTGER4 | 5p13.1 | known |
| | rs2517950 | 5 | 132395634 | G | A | 0.1957 | 5.624E-34 | 0.079 | 7.948E-07 | 0.045674 | 2.86046E-16 | SLC6A7 | 5q32 | known |
| | rs1765349 | 6 | 150226431 | C | T | -0.0476 | 0.0013136 | -0.09 | 1.54E-08 | -0.030675 | 3.94952E-08 | ZNF300 | 5q33.1 | known |
| | rs17800987 | 9 | 150943866 | G | A | 0.2545 | 5.806E-19 | 0.1401 | 6.551E-10 | 0.039375 | 1.77516E-12 | PRDM1 | 6q21 | known |
| Schizophrenia | rs2546779 | 5 | 159143746 | G | A | 0.126 | 6.072E-09 | 0.0932 | 0.000009953 | 0.030849 | 3.30694E-08 | EBF1 | 5q33.3 | known |
| | rs8477719 | 5 | 159292539 | C | A | 0.1215 | 1.097E-05 | 0.1478 | 6.05E-08 | 0.032449 | 2.61633E-09 | UBLCP1 | 5q33.3 | known |
| | rs755374 | 5 | 15940286 | C | T | -0.1969 | 1.38E-29 | -0.1714 | 9.73E-24 | -0.06633 | 5.33779E-32 | IL12B | 5q33.3 | known |
| | rs2654812 | 5 | 177367190 | G | A | -0.0731 | 2.258E-05 | -0.0933 | 4.819E-08 | -0.032285 | 7.40445E-09 | RGS14 | 5q35.3 | known |
| | rs9370777 | 6 | 14725005 | G | A | -0.1132 | 9.676E-08 | -0.1066 | 4.292E-07 | -0.032713 | 4.67946E-09 | JARID2 | 6p22.3 | known |
| | rs1012636 | 6 | 20674580 | G | T | -0.1291 | 7.013E-11 | -0.0825 | 0.00002027 | -0.031537 | 1.62697E-08 | CDKAL1 | 6p22.3 | known |
| Alzheimer's disease | rs9466056 | 6 | 21384382 | G | A | -0.0905 | 2.574E-08 | -0.0715 | 0.000008426 | -0.030574 | 4.37476E-08 | SOX4 | 6p22.3 | known |
| | rs145568234 | 6 | 32279268 | G | T | 0.1860 | 4.308E-02 | 0.1972 | 1.94E-67 | 0.103013 | 5.50067E-76 | MHC region | known | known |
| | rs11125949 | 10 | 160601210 | G | A | 0.1399 | 2.595E-16 | 0.0656 | 0.001075 | 0.033191 | 9.21267E-14 | SPATA31C2 | 9q22.1 | known |
| | rs34659678 | 6 | 111567337 | C | T | -0.1045 | 0.001528 | -0.2165 | 1.661E-11 | -0.035754 | 1.52566E-10 | TRAF3IP2 | 6q21 | known |
| | rs35171809 | 11 | 167019278 | G | A | 0.1566 | 9.068E-23 | 0.0707 | 0.000006644 | 0.039212 | 2.18663E-12 | CEP43 | 6q27 | known |
| | rs25296269 | 7 | 74869879 | C | T | 0.1004 | 1.325E-09 | 0.0992 | 0.00001542 | 0.030663 | 3.99812E-08 | GTF2IRD2 | 7q12.13 | known |
| Huntington's disease | rs6969140 | 7 | 99156277 | G | A | 0 | | | | | | | | |

Supplementary Table 26. Multi-trait meta-analysis between psychiatric disorders and ulcerative colitis in Europeans

| Type of psychiatric disorders | SNP | CHR | BP | A1 | A2 | Psychiatric disorders (all) | | Ulcerative colitis | | MTAG | | Genes | Cytogenetic band | Annotation |
|-------------------------------|-------------|-----|-----------|------|---------|-----------------------------|-------------|--------------------|-----------|-----------|--------------|------------|------------------|------------|
| | | | | Beta | P-value | Beta | P-value | Beta | P-value | Beta-mtag | P-mtag | | | |
| Bipolar disorder | rs1260326 | 2 | 27508073 | C | T | -0.0339955 | 0.0003715 | -0.1053 | 6.316E-11 | -0.047514 | 1.08099E-10 | GCKR | 2p23.3 | known |
| | rs7602701 | 2 | 43613980 | G | A | -0.0361969 | 0.009877 | 0.1542 | 1.5E-11 | 0.045637 | 5.63713E-10 | THADA | 2p21 | known |
| | rs4560096 | 2 | 60977782 | G | T | -0.0247999 | 0.009792 | 0.1224 | 5.433E-14 | 0.051052 | 4.03771E-12 | PEX13 | 2p15 | known |
| | rs6740847 | 2 | 181443625 | G | A | -0.0307038 | 0.001152 | -0.104 | 9.72E-11 | -0.046805 | 2.03136E-10 | ITGA4 | 2q31.3 | known |
| | rs6782577 | 3 | 49583337 | G | A | 0.0244975 | 0.008956 | -0.1513 | 4.209E-21 | -0.067373 | 5.52306E-20 | APEH | 3p21.31 | known |
| | rs17388568 | 4 | 122408207 | G | A | -0.0579046 | 2.131E-08 | -0.099 | 2.38E-08 | -0.041998 | 1.15777E-08 | ADAD1 | 4q27 | known |
| | rs12519421 | 5 | 40291864 | G | A | 0.0630030 | 0.004665 | 0.229 | 4.091E-09 | 0.043309 | 4.0667E-09 | PTGER4 | 5p13.1 | known |
| | rs4151651 | 6 | 31947837 | G | A | 0.0739008 | 0.004425 | -0.3682 | 2.246E-19 | -0.061338 | 7.86208E-17 | MHC region | | known |
| | rs1321859 | 6 | 90301954 | C | T | -0.0308007 | 0.002372 | 0.1049 | 1.176E-09 | 0.044179 | 1.9571E-09 | BACH2 | 6q15 | known |
| | rs3812575 | 9 | 136398807 | C | T | -0.0251998 | 0.009045 | 0.1645 | 1.546E-24 | 0.069932 | 2.08024E-21 | SNAPC4 | 9q34.3 | known |
| Major depressive disorder | rs2002695 | 10 | 30516551 | G | A | 0.0296966 | 0.008392 | -0.1293 | 8.311E-12 | -0.046366 | 2.99005E-10 | MAP3K8 | 10p11.23 | known |
| | rs10822050 | 10 | 62679011 | C | T | -0.0440339 | 0.00004005 | 0.1827 | 2.348E-29 | 0.076286 | 3.61005E-25 | ADO | 10q21.3 | known |
| | rs36038753 | 17 | 39879117 | G | T | 0.0371031 | 0.00073791 | -0.142 | 5.128E-19 | -0.060256 | 2.69217E-16 | ZPBP2 | 17q21.1 | known |
| | rs34118004 | 19 | 1141715 | G | A | 0.0338058 | 0.009023 | -0.1457 | 5.164E-20 | -0.049565 | 1.65239E-11 | SBNO2 | 19p13.3 | known |
| | rs73135821 | 20 | 63644492 | C | T | 0.0251998 | 0.005944 | -0.1185 | 2.122E-12 | -0.047573 | 1.02525E-10 | STMN3 | 20q13.33 | known |
| | rs1775448 | 1 | 197646000 | G | A | 0.0194 | 0.00002593 | -0.122 | 6.777E-13 | -0.044969 | 5.80075E-10 | DENND1B | 1q31.3 | known |
| | rs11584383 | 1 | 200966738 | C | T | -0.0128 | 0.00597 | -0.1112 | 3.23E-10 | -0.045786 | 2.82121E-10 | KIF21B | 1q32.1 | known |
| | rs6736400 | 2 | 43273665 | G | A | 0.0156 | 0.006668 | 0.1288 | 1.047E-09 | 0.04453 | 8.49749E-10 | ZFP36L2 | 2p21 | known |
| | rs80033912 | 3 | 49431256 | C | A | -0.0148 | 0.002204 | -0.1638 | 9.178E-18 | -0.061865 | 1.54511E-17 | NICN1 | 3p21.31 | known |
| | rs13107325 | 4 | 102267552 | C | T | -0.0242 | 0.003878 | -0.2006 | 1.665E-12 | -0.051296 | 5.78076E-12 | SLC39A8 | 4q24 | known |
| Neuroticism | rs12519790 | 5 | 132395634 | G | A | 0.0117 | 0.007649 | 0.1957 | 4.624E-34 | 0.085974 | 2.05245E-32 | SLC22A5 | 5q31.1 | known |
| | rs755374 | 5 | 159402286 | C | T | 0.0143 | 0.002053 | -0.1969 | 1.38E-29 | -0.074452 | 1.09109E-24 | IL12B | 5q33.3 | known |
| | rs148571474 | 6 | 31704935 | C | T | -0.0371 | 0.009947 | -0.4834 | 2.263E-17 | -0.060706 | 6.06699E-17 | MHC region | | known |
| | rs10822050 | 10 | 62679011 | C | T | -0.0162 | 0.0002344 | 0.1827 | 2.348E-29 | 0.073616 | 3.57172E-24 | ADO | 10q21.3 | known |
| | rs79726587 | 16 | 50133876 | G | A | 0.0239 | 0.00901 | 0.1814 | 4.077E-08 | 0.040191 | 3.06943E-08 | TENT4B | 16q12.1 | known |
| | rs7500958 | 16 | 5037685 | C | T | -0.0134 | 0.006585 | -0.1152 | 4.077E-20 | -0.045649 | 3.18619E-10 | BRD7 | 16q12.1 | known |
| | rs62030049 | 16 | 50538798 | G | A | 0.0148 | 0.003842 | -0.1562 | 3.454E-14 | -0.049068 | 1.37482E-11 | NKD1 | 16q12.1 | known |
| | rs2066844 | 16 | 50712015 | C | T | -0.0278 | 0.006594 | -0.6752 | 6.266E-99 | -0.147349 | 1.24646E-91 | NOD2 | 16q12.1 | known |
| | rs6074022 | 20 | 46111557 | C | T | 0.0247 | 8.228E-07 | 0.0953 | 1.461E-07 | 0.041031 | 1.57521E-08 | CD40 | 20q13.12 | known |
| | rs1775448 | 1 | 197646000 | G | A | 0.0081035 | 1.23141E-05 | -0.122 | 6.777E-13 | -0.045985 | 2.88637E-10 | DENND1B | 1q31.3 | known |
| Schizophrenia | rs11583328 | 1 | 201033045 | G | A | 0.004928 | 0.008841279 | 0.1027 | 4.977E-09 | 0.041601 | 1.17283E-09 | KIF21B | 1q32.1 | known |
| | rs78572881 | 2 | 43535820 | C | T | 0.0085211 | 0.005158446 | 0.1826 | 1.409E-09 | 0.043871 | 1.80057E-09 | THADA | 2p21 | known |
| | rs7608697 | 2 | 60977506 | C | A | 0.0045308 | 0.00421537 | 0.1229 | 4.033E-14 | 0.054148 | 1.13724E-13 | PEX13 | 2p15 | known |
| | rs62192912 | 4 | 232326296 | C | T | -0.047628 | 0.003990224 | -0.2113 | 1.424E-29 | -0.080129 | 4.46683E-28 | ATG16L1 | 2q37.1 | known |
| | rs9836291 | 3 | 49660026 | G | A | 0.0054926 | 0.001532069 | -0.1722 | 3.773E-24 | -0.076282 | 2.84541E-20 | APEH | 3p21.31 | known |
| | rs4833071 | 4 | 38581238 | C | T | 0.0086269 | 0.000331717 | 0.0935 | 7.002E-08 | 0.039861 | 4.62599E-08 | KLF3 | 4p14 | known |
| | rs13107325 | 4 | 102267552 | C | T | -0.0105439 | 0.000134985 | -0.2006 | 1.665E-12 | -0.051685 | 1.37849E-12 | SLC39A8 | 4q24 | known |
| | rs25890 | 5 | 132101869 | C | T | -0.0487859 | 0.01463521 | -0.1382 | 7.105E-21 | -0.059877 | 2.22474E-16 | SLC22A5 | 5q31.1 | known |
| | rs41315816 | 6 | 31977074 | C | T | 0.0136591 | 9.78676E-06 | 0.2537 | 1.202E-15 | 0.058638 | 9.02066E-16 | MHC region | | known |
| | rs35171809 | 6 | 167019278 | G | A | 0.0052554 | 0.000424103 | 0.1566 | 9.068E-23 | 0.070646 | 3.46319E-22 | CEP43 | 6q27 | known |
| Depression | rs12782948 | 10 | 35161679 | G | A | -0.0041503 | 0.00832411 | -0.1292 | 6.18E-15 | -0.055712 | 2.20196E-14 | CUL2 | 10p11.21 | known |
| | rs80028601 | 10 | 62542114 | G | A | 0.009181 | 0.002018603 | -0.2023 | 5.124E-10 | -0.040312 | 3.2591E-08 | ZNF365 | 10q21.2 | known |
| | rs10822056 | 10 | 62754351 | C | T | -0.0054003 | 0.000705758 | 0.1029 | 1.021E-10 | 0.041909 | 9.14306E-09 | ADO | 10q21.3 | known |
| | rs3850378 | 14 | 87951173 | C | T | 0.0046868 | 0.008754993 | 0.199 | 8.313E-14 | 0.053425 | 2.39414E-13 | GALC | 14q31.3 | known |
| | rs6500315 | 15 | 50474190 | G | A | 0.0046655 | 0.007989198 | 0.1431 | 4.37E-13 | 0.047696 | 6.18272E-11 | NKD1 | 16q12.1 | known |
| | rs80067282 | 16 | 50878764 | G | A | 0.0101002 | 0.008962342 | 0.5453 | 3.241E-49 | 0.103547 | 9.60683E-46 | NOD2 | 16q12.1 | known |
| | rs17885629 | 17 | 42373080 | G | A | 0.0041758 | 0.006180041 | -0.1143 | 2.045E-12 | -0.046445 | 1.91792E-10 | STAT3 | 17q21.2 | known |
| | rs4807644 | 19 | 1175842 | G | A | -0.0059601 | 0.00999012 | -0.1732 | 3.788E-11 | -0.05313 | 3.10423E-13 | SBNO2 | 19p13.3 | known |
| | rs601338 | 19 | 48703417 | G | A | -0.0044037 | 0.003004862 | -0.1085 | 2.33E-11 | -0.048492 | 9.26528E-11 | FUT2 | 19q13.33 | known |
| | rs6074022 | 20 | 46111557 | C | T | 0.00100278 | 1.12564E-08 | 0.0953 | 1.461E-07 | 0.040794 | 2.21998E-08 | CD40 | 20q13.12 | known |
| Depression | rs78528804 | 1 | 67128136 | G | A | -0.0135007 | 0.0004529 | 1.6E-08 | 9.794E-11 | 0.040903 | 1.62772E-08 | IL12RB2 | 1p31.3 | known |
| | rs1775448 | 1 | 197646000 | G | A | 0.0185001 | 2.728E-07 | 1.7E-09 | 6.777E-13 | -0.043788 | 1.69503E-09 | DENND1B | 1q31.3 | known |
| | rs4343432 | 2 | 24938637 | G | A | 0.0090004 | 0.004581 | 5.3E-12 | 3.503E-12 | 0.049984 | 5.31634E-12 | PTRHD1 | 2p23.3 | known |
| | rs1260326 | 2 | 27508073 | C | T | -0.0091976 | 0.004439 | 6.2E-11 | 6.316E-11 | 0.047388 | 6.20586E-11 | GCKR | 2p23 | known |
| | rs6727824 | 2 | 43301238 | G | A | 0.011597 | 0.007349 | 2.3E-09 | 2.623E-09 | 0.043309 | 2.28886E-09 | ZFP36L2 | 2p21 | known |
| | rs11720964 | 3 | 49298799 | C | T | -0.0105955 | 0.000003037 | 2.7E-08 | 1.871E-07 | -0.040273 | 2.740403E-08 | GPX1 | 3p21.31 | known |
| | rs9836291 | 3 | 49660026 | G | A | 0.018704 | 6.37E-08 | 2.7E-18 | 3.773E-24 | -0.063231 | 2.66767E-18 | APEH | 3p21.31 | known |
| | rs13107325 | 4 | 102267552 | C | T | -0.0208049 | 0.001041 | 1.3E-12 | 1.665E-12 | -0.051383 | 1.3416E-12 | SLC39A8 | 4q24 | known |
| | rs54487 | 5 | 132226322 | C | T | -0.011597 | 0.003816 | 6.7E-10 | 8.455E-10 | -0.044737 | 6.70388E-10 | SLC22A5 | 5q31.1 | known |
| | rs12655757 | 5 | 15940973 | C | T | 0.0093957 | 0.005335 | 1.1E-17 | 9.831E-22 | -0.062034 | 1.13291E-17 | IL12B | 5q33.3 | known |
| Depression | rs401775 | 6 | 31963360 | C | T | 0.0160989 | 0.0001644 | 5.5E-23 | 2.174E-23 | 0.071554 | 5.48008E-23 | MHC region | | known |
| | rs224123 | 10 | 62691473 | C | T | -0.013298 | 0.00004346 | 1.3E-14 | 1.201E-18 | 0.055843 | 1.3047E-14 | ADO | 10q21.3 | known |
| | rs102275 | 11 | 61790331 | C | T | 0.0183982 | 2.92E-08 | 1.8E-08 | 2.706E-07 | 0.040795 | 1.81316E-08 | TMEM258 | 11q12.2 | known |
| | rs13380620 | 16 | 50207275 | G | A | -0.0116982 | 0.007095 | 4.4E-11 | 3.171E-11 | -0.047751 | 4.4339E-11 | ADCY7 | 16q12.1 | known |
| | rs80067282 | 16 | 50878764 | G | A | 0.0267034 | 0.003788 | 7.4E-46 | 3.241E-49 | | | | | |

Supplementary Table 27. Multi-trait meta-analysis between digestive diseases and ulcerative colitis in Europeans

| Type of digestive diseases | SNP | CHR | BP | A1 | A2 | Digestive diseases (all) Beta | P-value | Ulcerative colitis Beta | P-value | MTAG Beta-mtag | P-mtag | Genes | Cytogenetic band | Annotation |
|----------------------------|-------------|-----|-----------|----|----|----------------------------------|-----------|----------------------------|-----------|-------------------|----------|------------|------------------|------------|
| Crohn's disease | rs72634258 | 1 | 8090578 | C | T | -0.1417 | 5.26E-11 | -0.1167 | 9.82E-08 | -0.043211 | 2.06E-09 | ERRFI1 | 1p36.23 | known |
| | rs72676005 | 1 | 67072029 | C | T | 0.2848 | 3.75E-13 | 0.5287 | 1.74E-36 | 0.090478 | 4.03E-36 | SLC35D1 | 19q13.11 | known |
| | rs10789226 | 1 | 67158045 | G | A | -0.0492 | 0.004148 | -0.2634 | 9.58E-50 | -0.098002 | 4.43E-42 | IL23R | 1p31.3 | known |
| | rs11209026 | 1 | 67240275 | G | A | 0.483 | 1.99E-01 | 0.7935 | 6.85E-93 | 0.149102 | 5.26E-95 | Clorf141 | 1p31.3 | known |
| | rs11576006 | 1 | 67306330 | C | T | -0.0652 | 0.0008176 | -0.1173 | 4.83E-09 | -0.042007 | 5.67E-09 | IL12RB2 | 1p31.3 | known |
| | rs12138718 | 1 | 67446396 | G | A | 0.0825 | 3.48E-07 | 0.1159 | 1.74E-12 | 0.05214 | 4.77E-13 | SERBP1 | 1p31.3 | known |
| | rs4845604 | 1 | 151829204 | G | A | 0.1608 | 1.57E-11 | 0.1178 | 6.06E-07 | 0.041311 | 1.01E-08 | RORC | 1q21.3 | known |
| | rs12131079 | 1 | 155349877 | C | T | 0.0551 | 0.001372 | 0.1088 | 3.99E-10 | 0.044268 | 8.26E-10 | RUSC1 | 1q22 | known |
| | rs114802258 | 1 | 160862065 | C | T | 0.1208 | 0.0006955 | 0.2245 | 5.11E-09 | 0.04196 | 5.9E-09 | CD244 | 1q23.3 | known |
| | rs10800309 | 1 | 161502368 | G | A | -0.1595 | 2.19E-21 | -0.0778 | 0.0000065 | -0.042135 | 5.1E-09 | FCGR2A | 1q23.3 | known |
| Irritable bowel syndrome | rs1775448 | 1 | 197646000 | G | A | -0.0542 | 0.001205 | -0.122 | 6.78E-13 | -0.050162 | 3.47E-12 | DENND1B | 1q31.3 | known |
| | rs7554511 | 1 | 200908434 | C | A | 0.1448 | 4.27E-16 | 0.1158 | 1.49E-10 | 0.05225 | 4.27E-13 | INAVA | 1q32.1 | known |
| | rs3122605 | 1 | 206781696 | G | A | 0.2197 | 2.33E-23 | 0.1748 | 1.24E-14 | 0.063103 | 2.09E-18 | IL10 | 1q32.1 | known |
| | rs4343432 | 2 | 24938367 | G | A | 0.0516 | 0.001133 | 0.1123 | 3.51E-2 | 0.048638 | 1.52E-11 | ADCY3 | 2p23.3 | known |
| | rs13428812 | 2 | 25269598 | G | A | 0.0656 | 0.0001013 | 0.0926 | 7.91E-08 | 0.039724 | 3.6E-08 | DNMT3A | 2p23.3 | known |
| | rs11677002 | 2 | 28391534 | C | T | -0.0672 | 0.0000291 | -0.1124 | 4.57E-12 | -0.049737 | 5.26E-12 | FOSL2 | 2p23.2 | known |
| | rs55946629 | 2 | 43624107 | C | A | -0.0962 | 0.0000318 | -0.1755 | 2.85E-14 | -0.054177 | 5.73E-14 | PLEKH2 | 2p21 | known |
| | rs7608697 | 2 | 60977506 | C | A | 0.1597 | 3.03E-23 | 0.1229 | 4.03E-14 | 0.062053 | 7.53E-18 | PEX13 | 2p15 | known |
| | rs2110735 | 2 | 102434465 | G | A | -0.0572 | 0.001796 | -0.1372 | 1.21E-13 | -0.051539 | 8.79E-13 | IL18RAP | 2q12.1 | known |
| | rs72852162 | 2 | 144728756 | C | A | -0.0848 | 0.0008616 | -0.1438 | 4.65E-08 | -0.039479 | 4.36E-08 | ZEB2 | 2q22.3 | known |
| Inflammatory bowel disease | rs8179584 | 2 | 172558338 | G | T | -0.1566 | 0.0002113 | -0.2463 | 7.91E-09 | -0.041906 | 6.17E-09 | PDK1 | 2q31.1 | known |
| | rs6740847 | 2 | 181443625 | G | A | -0.0767 | 1.43E-06 | -0.104 | 9.72E-11 | -0.047901 | 3.06E-11 | ITGA4 | 19p13.2 | known |
| | rs838717 | 2 | 233387798 | G | A | 0.0433 | 0.0064 | 0.0951 | 4.2E-09 | 0.041153 | 1.14E-08 | SAG | 2q37.1 | known |
| | rs34236350 | 2 | 240628909 | C | T | -0.1524 | 2.73E-13 | -0.1071 | 4.89E-07 | -0.042351 | 4.26E-09 | GPR35 | 2q37.3 | known |
| | rs13090388 | 3 | 49353649 | C | T | -0.1415 | 3.21E-17 | -0.1688 | 2.67E-23 | -0.075073 | 2.18E-25 | GPX1 | 3p21.31 | known |
| | rs9836291 | 3 | 49660026 | G | A | -0.1584 | 3.73E-21 | -0.1722 | 3.77E-22 | -0.077783 | 3.91E-27 | APEH | 3p21.31 | known |
| | rs7428430 | 3 | 50136751 | C | T | -0.0815 | 2.98E-07 | -0.0848 | 1.26E-07 | -0.040974 | 1.32E-08 | SEMA3F | 3p21.31 | known |
| | rs56116661 | 3 | 188683372 | C | T | 0.0811 | 0.0000921 | 0.1312 | 5.67E-10 | 0.044884 | 4.81E-10 | TPRG1 | 3q28 | known |
| | rs62324212 | 4 | 122639784 | C | A | -0.0654 | 0.0000471 | -0.106 | 8.02E-11 | -0.047085 | 6.55E-11 | IL21 | 4q27 | known |
| | rs1239346 | 5 | 38861412 | G | A | 0.0692 | 0.000021 | 0.0877 | 9.3E-08 | 0.040015 | 2.86E-08 | OSMR | 5p13.1 | known |
| Gastric diseases | rs1024099 | 5 | 39998743 | C | A | -0.0414 | 0.008977 | -0.1027 | 1.72E-10 | -0.044232 | 8.52E-10 | DAB2 | 5p13.1 | known |
| | rs11742570 | 5 | 40410482 | C | T | 0.0831 | 2.76E-07 | 0.2601 | 1.11E-55 | 0.107381 | 3.64E-50 | PTGER4 | 5p13.1 | known |
| | rs149619730 | 5 | 40825466 | C | A | -0.2813 | 0.0001039 | -0.4237 | 7.63E-09 | -0.042238 | 4.68E-09 | RPL37 | 5p13.1 | known |
| | rs6873866 | 5 | 96912106 | C | T | -0.0511 | 0.001635 | -0.1314 | 1.35E-09 | -0.055362 | 1.61E-14 | LNPEP | 5q15 | known |
| | rs2188962 | 5 | 132435113 | C | T | -0.0757 | 1.88E-06 | -0.2004 | 5.59E-36 | -0.086301 | 5.13E-33 | SLC22A5 | 5q31.1 | known |
| | rs181826 | 5 | 142146492 | C | A | -0.0597 | 0.0002589 | -0.1162 | 3.25E-12 | -0.049401 | 7.3E-12 | NDFIP1 | 5q31.3 | known |
| | rs9637870 | 5 | 150848053 | G | A | -0.1259 | 6.99E-06 | -0.2558 | 1.33E-20 | -0.065468 | 1.08E-19 | IRGM | 5q33.1 | known |
| | rs755374 | 5 | 159402286 | C | T | -0.1714 | 9.73E-24 | -0.1969 | 1.38E-29 | -0.086166 | 6.43E-33 | IL12B | 5q33.3 | known |
| | rs145568234 | 6 | 32279268 | G | T | 1.0972 | 1.94E-67 | 0.8602 | 4.31E-42 | 0.11099 | 1.42E-53 | MHC region | | known |
| | rs17585295 | 6 | 90235112 | C | T | 0.0615 | 0.0001853 | 0.1015 | 1.21E-09 | 0.04394 | 1.1E-09 | BACH2 | 6q15 | known |
| Pancreatic diseases | rs73516754 | 6 | 106011863 | C | A | 0.0615 | 0.0002462 | 0.1423 | 4.04E-17 | 0.058676 | 4.01E-16 | PRDM1 | 6q21 | known |
| | rs35171809 | 6 | 167019278 | G | A | 0.0707 | 6.64E-06 | 0.1566 | 9.07E-23 | 0.068951 | 1.14E-21 | CCR6 | 6q27 | known |
| | rs9656588 | 7 | 50267184 | C | T | 0.0529 | 0.001804 | 0.1183 | 8.73E-12 | 0.047851 | 3.21E-11 | IKZF1 | 7p12.2 | known |
| | rs4380956 | 8 | 125516832 | G | A | -0.0506 | 0.001788 | -0.132 | 1.15E-11 | -0.055241 | 1.84E-14 | TRIB1 | 8q24.13 | known |
| | rs7269574 | 9 | 5020089 | G | A | -0.1542 | 1.51E-18 | -0.1514 | 3.1E-17 | -0.066293 | 3.76E-20 | JAK2 | 9p24.1 | known |
| | rs11142085 | 9 | 88081422 | G | A | -0.1072 | 4.8E-08 | -0.9657 | 2.17E-07 | -0.040712 | 1.64E-08 | SPATA31C2 | 9q22.1 | known |
| | rs10114470 | 9 | 114785492 | C | T | 0.1309 | 5.91E-14 | 0.1687 | 1.76E-21 | 0.071257 | 4.93E-23 | TNFSF15 | 9q32 | known |
| | rs3829110 | 9 | 136374746 | G | A | 0.1308 | 1.87E-16 | 0.1848 | 4.62E-30 | 0.084172 | 1.73E-31 | CARD9 | 9q34.3 | known |
| | rs7870145 | 9 | 136507113 | G | A | -0.1595 | 8.97E-10 | -0.1656 | 1E-09 | -0.047563 | 4.2E-11 | SEC16A | 9q34.3 | known |
| | rs2002695 | 10 | 30516551 | G | A | -0.0573 | 0.001893 | -0.1293 | 8.31E-12 | -0.047853 | 3.21E-11 | MAP3K8 | 10p11.23 | known |
| Cardiovascular diseases | rs2384352 | 10 | 35203904 | G | A | 0.0655 | 0.0000857 | 0.1337 | 3.24E-15 | 0.055821 | 9.77E-15 | CCNY | 10p11.21 | known |
| | rs80028601 | 10 | 62542114 | G | A | -0.1132 | 0.0005941 | -0.2023 | 5.12E-10 | -0.044292 | 8.09E-10 | ZNF365 | 10q21.2 | known |
| | rs10761659 | 10 | 62685804 | G | A | 0.1276 | 1.33E-15 | 0.1819 | 7.65E-29 | 0.082238 | 3.9E-30 | ADO | 10q21.3 | known |
| | rs1250573 | 10 | 79282718 | G | A | 0.0466 | 0.007571 | 0.1522 | 1.92E-17 | 0.057794 | 1.09E-15 | PPIF | 10q22.3 | known |
| | rs1870148 | 10 | 80511585 | G | A | -0.0722 | 0.0003167 | -0.1351 | 5.44E-11 | -0.046788 | 8.62E-11 | SH2D4B | 10q23.1 | known |
| | rs6584282 | 10 | 99526738 | G | A | -0.1489 | 4.2E-21 | -0.1658 | 3.44E-25 | -0.079256 | 4.15E-28 | NKX2-3 | 10q24.2 | known |
| | rs10884966 | 10 | 110425383 | G | A | -0.0518 | 0.002181 | -0.1131 | 4.13E-18 | -0.046362 | 1.27E-10 | DUSP5 | 10q25.2 | known |
| | rs11236797 | 10 | 117688605 | C | A | -0.1242 | 5.27E-15 | -0.176 | 8.51E-28 | -0.080558 | 5.52E-29 | LRRC32 | 11q13.5 | known |
| | rs34635748 | 12 | 40430861 | C | T | -0.1735 | 0.002361 | -0.4794 | 1.95E-21 | -0.064721 | 2.79E-19 | MUC19 | 12q12 | known |
| | rs12818923 | 12 | 68111453 | C | A | -0.1891 | 1.76E-31 | -0.0773 | 0.0000275 | -0.046446 | 1.18E-10 | IFNG | 12q24.13 | known |
| Neurodegenerative diseases | rs4807570 | 13 | 1123653 | G | A | -0.075 | 0.0001549 | -0.1811 | 6.03E-21 | -0.046971 | 2.04E-19 | GPX4 | 19p13.3 | known |
| | rs75407602 | 19 | 10286554 | C | T | 0.1836 | 0.0000361 | 0.2825 | 2.89E-10 | 0.045938 | 1.87E-10 | ICAM4 | 19p13.2 | known |
| | rs144309607 | 19 | 10381598 | C | T | 0.1345 | 0.003573 | 0.3712 | 2.69E-11 | 0.054298 | 5.04E-14 | TYK2 | 19p13.2 | known |
| | rs62126620 | 19 | 33262294 | G | A | -0.1307 | 2.1E-10 | -0.144 | 8.61E-13 | -0.054555 | 3.85E-14 | SLC7A10 | 19q13.11 | known |
| | rs6062496 | 21 | 63697746 | G | A | -0.1359 | 8.97E-17 | -0.1223 | 2.62E-13 | -0.058413 | 5.42E-16 | TNFRSF6B | 20q13.33 | known |
| | rs1297264 | 21 | 15443698 | G | A | -0.1203 | 6.12E-14 | -0.1769 | 1.79E-27 | -0.076939 | 2.3E-28 | USP25 | 21q21.1 | known |
| | rs4620647 | 21 | 35380028 | C | A | -0.0662 | 0.004459 | -0.1525 | 2.46E-10 | -0.044225 | 8.58E-10 | IFNGR2 | 21q22.11 | known |
| | rs2836881 | 21 | 39094373 | G | T | 0.2217 | 1.11E-12 | 0.0956 | 2.97E-07 | 0.049512 | 6.55E-12 | PSMG1 | 16p13.13 | known |
| | rs2838517 | 21 | 44193942 | C | T | -0.1177 | 1.7 | | | | | | | |

| | | | | | | | | | | | | | | |
|---------------------------------|-------------|----|-----------|---|---|-----------|-----------|---------|-----------|-----------|-----------|------------|----------|-------|
| Gastroesophageal reflux disease | rs10067892 | 5 | 40291889 | G | A | -0.0159 | 0.009915 | 0.1034 | 5.372E-10 | 0.040497 | 2.978E-08 | PTGER4 | 5p13.1 | known |
| | rs6873866 | 5 | 96912106 | C | T | -0.017 | 0.004873 | -0.1314 | 1.346E-15 | -0.057735 | 2.744E-15 | LNPEP | 5q15 | known |
| | rs2188962 | 5 | 132435113 | C | T | 0.0175 | 0.003277 | -0.2004 | 5.588E-36 | -0.083889 | 1.63E-30 | SLC22A5 | 5q31.1 | known |
| | rs17772583 | 5 | 132617818 | G | A | 0.0192 | 0.004869 | 0.1169 | 6.778E-10 | 0.040228 | 3.672E-08 | IL13 | 5q31.1 | known |
| | rs181826 | 5 | 142146492 | C | A | 0.0158 | 0.009218 | -0.1162 | 3.245E-12 | -0.050251 | 6.079E-12 | NDFIP1 | 5q31.3 | known |
| | rs11135059 | 5 | 159344329 | G | A | 0.0162 | 0.009696 | -0.1488 | 8.821E-19 | 0.063337 | 4.364E-18 | IL12B | 5q33.3 | known |
| | rs41291790 | 6 | 31604887 | G | A | -0.083 | 0.007161 | -0.7443 | 3.978E-18 | -0.062179 | 1.735E-17 | MHC region | | known |
| | rs10114470 | 9 | 114785492 | C | T | 0.0202 | 0.001419 | 0.1687 | 1.755E-21 | 0.068537 | 6.562E-21 | TNFSF15 | 9q32 | known |
| | rs1388585 | 12 | 40137889 | G | A | -0.065 | 0.009823 | 0.4265 | 1.241E-15 | 0.052974 | 4.154E-13 | SLC2A13 | 12q12 | known |
| | rs11066188 | 12 | 112172910 | G | A | -0.0294 | 1.023E-06 | -0.0979 | 4.593E-09 | -0.044692 | 9.542E-10 | TRAFD1 | 12q24.13 | known |
| | rs56135636 | 16 | 50305757 | G | A | -0.0199 | 0.007344 | -0.1218 | 1.483E-09 | -0.044138 | 1.53E-09 | ADCY7 | 16q12.1 | known |
| | rs2357623 | 16 | 50660100 | G | A | -0.02 | 0.002702 | -0.2184 | 4.37E-33 | -0.08538 | 1.507E-31 | NOD2 | 16q12.1 | known |
| | rs10492862 | 16 | 82833851 | C | A | -0.0312 | 1.833E-06 | -0.1067 | 1.261E-09 | -0.045987 | 3.092E-10 | CDH13 | 16q23.3 | new |
| | rs12450323 | 17 | 39816455 | G | T | -0.0194 | 0.009131 | 0.1377 | 3.679E-11 | 0.043404 | 2.838E-09 | ZPB2 | 17q21.1 | known |
| | rs4809330 | 20 | 63718234 | G | A | 0.0232 | 0.0001956 | 0.1263 | 2.665E-13 | 0.053612 | 2.172E-13 | TNFRSF6B | 20q13.33 | known |
| | rs4820371 | 22 | 39263083 | C | T | 0.0201 | 0.003818 | -0.1365 | 1.23E-11 | -0.044331 | 1.299E-09 | PDGFB | 22q13.1 | known |
| Gastritis-duodenitis | rs6736400 | 2 | 43273665 | G | A | 0.0427 | 0.000336 | 0.1288 | 1.047E-09 | 0.044369 | 1.692E-09 | ZFP36L2 | 2p21 | known |
| | rs13362202 | 5 | 40473350 | G | A | 0.0359 | 0.00762 | 0.2368 | 6.386E-22 | 0.068699 | 1.074E-20 | PTGER4 | 5p13.1 | known |
| | rs4244437 | 5 | 159346109 | G | A | -0.0247 | 0.00948 | -0.1621 | 2.404E-20 | -0.066119 | 2.75E-19 | IL12B | 5q33.3 | known |
| | rs9268026 | 6 | 32258704 | G | A | 0.0512 | 0.000954 | -0.207 | 6.58E-14 | -0.050995 | 4.372E-12 | MHC region | | known |
| | rs2285147 | 6 | 167092060 | G | A | 0.0263 | 0.00327 | -0.1339 | 8.48E-17 | -0.057141 | 8.556E-15 | CCR6 | 6q27 | known |
| | rs1026422 | 7 | 50280211 | G | A | -0.0257 | 0.00429 | -0.1097 | 2.09E-11 | -0.048166 | 6.137E-11 | IKZF1 | 7p12.2 | known |
| | rs28374519 | 16 | 28478021 | G | A | 0.0255 | 0.00559 | 0.1272 | 4.937E-13 | 0.051906 | 1.812E-12 | NPIP7 | 16p12.1 | known |
| | rs78947484 | 16 | 51016373 | G | A | -0.0451 | 0.00902 | -0.2365 | 1.077E-14 | -0.055358 | 5.605E-14 | SALL1 | 16q12.1 | known |
| Appendicitis | rs601338 | 19 | 48703417 | G | A | -0.0311 | 0.000491 | -0.1085 | 2.33E-11 | -0.048493 | 4.556E-11 | FUT2 | 19q13.33 | known |
| | rs1909129 | 1 | 67269616 | G | A | -0.000556 | 0.005 | 0.2687 | 2.265E-57 | 0.113708 | 3.165E-54 | IL12RB2 | 1p31.3 | known |
| | rs12136659 | 1 | 172875110 | C | T | 0.0006259 | 0.0031 | 0.1718 | 2.939E-21 | 0.063296 | 6.057E-18 | TNFSF18 | 1q25.1 | known |
| | rs72745992 | 5 | 40567094 | C | T | -0.000513 | 0.01 | -0.1438 | 3.584E-16 | -0.054783 | 7.989E-14 | PTGER4 | 5p13.1 | known |
| | rs10515794 | 5 | 159481219 | G | A | -0.000635 | 0.0053 | -0.1239 | 5.891E-10 | -0.040842 | 2.555E-08 | IL12B | 5q33.3 | known |
| | rs12213415 | 6 | 31783811 | G | A | 0.000993 | 0.0043 | -0.1647 | 6.208E-08 | -0.040088 | 4.588E-08 | MHC region | | known |
| | rs7850715 | 10 | 62601721 | C | T | 0.0010503 | 0.0086 | 0.2121 | 2.487E-10 | 0.041923 | 1.085E-08 | ADO | 10q21.3 | known |
| | rs192007 | 10 | 62826635 | G | A | 0.0005871 | 0.0026 | -0.114 | 5.008E-12 | -0.050607 | 5.162E-12 | EGR2 | 10q21.3 | known |
| | rs6584282 | 10 | 99526738 | G | A | 0.000495 | 0.0073 | -0.1658 | 3.437E-25 | -0.074388 | 3.536E-24 | NKX2-3 | 10q24.2 | known |
| | rs2508755 | 11 | 76534518 | G | A | -0.000483 | 0.0091 | 0.1081 | 1.997E-11 | 0.048917 | 2.548E-11 | LRRC32 | 11q13.5 | known |
| | rs149399409 | 16 | 50076931 | G | A | -0.001596 | 0.0017 | -0.2584 | 8.387E-11 | -0.04262 | 6.176E-09 | HEATR3 | 16q12.1 | known |
| | rs2066844 | 16 | 50712015 | C | T | -0.001171 | 0.0084 | -0.6752 | 6.26E-99 | -0.144775 | 9.324E-87 | NOD2 | 16q12.1 | known |
| | rs12150079 | 17 | 39869164 | G | A | 0.0006548 | 0.00099 | -0.1058 | 4.21E-10 | -0.046321 | 2.674E-10 | ZPB2 | 17q21.1 | known |
| | rs2838515 | 21 | 44188654 | G | A | 0.000565 | 0.0036 | -0.112 | 4.83E-11 | -0.048289 | 4.549E-11 | ICOSLG | 21q22.3 | known |

Supplementary Table 28. Multi-trait meta-analysis between psychiatric disorders and inflammatory bowel disease in Europeans

| Type of psychiatric disorders | SNP | CHR | BP | A1 | A2 | Psychiatric disorders (all) | | Inflammatory bowel disease | | MTAG | | Genes | Cytogenetic band | Annotation |
|-------------------------------|-------------|-----|-----------|----|----|-----------------------------|-------------|----------------------------|-----------|-----------|-------------|------------|------------------|------------|
| | | | | | | Beta | P-value | Beta | P-value | Beta-mtag | P-mtag | | | |
| Anxiety, panic disorder | rs77335401 | 5 | 132424133 | C | T | 0.00102223 | 0.0053 | -0.1291 | 8.329E-11 | -0.035682 | 5.22157E-09 | SLC22A5 | 5q31.1 | known |
| | rs56169886 | 5 | 159107905 | C | T | -0.00842747 | 0.0083 | -0.0971 | 1.286E-08 | -0.03395 | 2.75428E-08 | EBF1 | 5q33.3 | known |
| | rs3129883 | 6 | 32442360 | C | T | -0.000854828 | 0.0016 | -0.1339 | 2.058E-17 | -0.050256 | 1.94946E-16 | MHC region | | known |
| | rs4817986 | 21 | 39093586 | G | T | 0.000739642 | 0.0057 | 0.1635 | 1.98E-29 | 0.066105 | 2.79764E-27 | PSMG1 | 21q22.2 | known |
| Bipolar disorder | rs4655208 | 1 | 19802043 | C | T | 0.0346018 | 0.003275 | -0.1037 | 1.247E-09 | -0.033744 | 3.61322E-08 | TMCO4 | 1p36.13 | known |
| | rs7535491 | 1 | 67336362 | C | A | -0.0255024 | 0.007818 | -0.0766 | 1.867E-09 | -0.035519 | 6.68238E-09 | IL12RB2 | 1p31.3 | known |
| | rs7366775 | 1 | 155199139 | G | A | -0.0253999 | 0.008176 | -0.0727 | 1.076E-08 | -0.033755 | 3.57557E-08 | MUC1 | 1q22 | known |
| | rs7554511 | 1 | 200908434 | C | A | 0.0324962 | 0.001833 | 0.1343 | 9.999E-22 | 0.056106 | 5.21243E-20 | KIF21B | 1q32.1 | known |
| | rs6546044 | 2 | 25264787 | C | T | -0.0328952 | 0.007533 | -0.0976 | 1.953E-09 | -0.032575 | 8.47289E-09 | DNMT3A | 2p23.3 | known |
| | rs76450091 | 2 | 43540050 | C | T | -0.0402971 | 0.004472 | 0.1093 | 1.483E-09 | 0.03363 | 4.01509E-08 | THADA | 2p21 | known |
| | rs4560096 | 2 | 60977782 | G | T | -0.0247999 | 0.009792 | 0.1392 | 2.494E-28 | 0.062441 | 2.11289E-24 | PEX13 | 2p15 | known |
| | rs6740847 | 2 | 181443625 | G | A | -0.0307038 | 0.001152 | -0.0924 | 1.181E-13 | -0.043535 | 1.83171E-12 | ITGA4 | 2q31.3 | known |
| | rs4676408 | 2 | 240634984 | G | A | -0.0305004 | 0.00148 | -0.1011 | 7.629E-15 | -0.045711 | 8.48712E-14 | GPR35 | 2q37.3 | known |
| | rs2005557 | 3 | 49663865 | G | A | 0.0278972 | 0.002728 | 0.1231 | 1.138E-21 | 0.058443 | 1.41402E-21 | APEH | 3p21.31 | known |
| | rs72669172 | 4 | 122551661 | C | T | -0.057502 | 0.0393E-08 | -0.0923 | 1.655E-11 | -0.040576 | 3.49152E-11 | IL21 | 4q27 | known |
| | rs12519421 | 5 | 40291864 | G | A | 0.063003 | 0.004665 | 0.1705 | 2.948E-09 | 0.035059 | 1.04373E-08 | PTGER4 | 5p13.1 | known |
| | rs9370776 | 6 | 14725005 | G | A | 0.040395 | 0.008904 | -0.109 | 4.335E-11 | -0.036717 | 2.04506E-09 | JARID2 | 6p22.3 | known |
| Major depressive disorder | rs4151651 | 6 | 31947837 | G | A | 0.0379008 | 0.004425 | -0.0788 | 6.964E-56 | -0.089315 | 3.7081E-48 | MHC region | | known |
| | rs62408218 | 6 | 9022139 | C | T | 0.0304031 | 0.001976 | 0.0818 | 2.402E-10 | 0.037451 | 9.70926E-10 | BACH2 | 6q15 | known |
| | rs4330804 | 9 | 136399795 | G | T | -0.0251023 | 0.009439 | 0.143 | 7.482E-30 | 0.064169 | 1.11471E-25 | SNAPC4 | 9q34.3 | known |
| | rs1127152 | 9 | 136441147 | G | A | -0.0259016 | 0.006793 | 0.1022 | 1.418E-16 | 0.046313 | 4.00716E-14 | INPP5E | 9q34.3 | known |
| | rs2002695 | 10 | 30516551 | G | A | -0.0296966 | 0.008392 | -0.0887 | 1.203E-09 | -0.033914 | 3.08484E-08 | MAP3K8 | 10p11.23 | known |
| | rs12766391 | 10 | 62681444 | G | A | 0.0439977 | 0.000004736 | -0.1418 | 1.715E-29 | -0.062922 | 9.39646E-25 | ADO | 10q21.3 | known |
| | rs12936409 | 17 | 39887396 | C | T | 0.0374018 | 0.0006516 | -0.1406 | 7.726E-30 | -0.06362 | 2.86368E-25 | ZPB2P2 | 17q21.1 | known |
| | rs34118004 | 19 | 1141715 | G | A | -0.033805 | 0.009023 | -0.1037 | 4.505E-10 | -0.036735 | 2.00717E-09 | SNB2O | 19p13.3 | known |
| | rs6062293 | 20 | 63645516 | C | T | 0.0252973 | 0.009278 | -0.1082 | 2.9E-17 | -0.047555 | 8.25354E-15 | STMN3 | 20q13.33 | known |
| Major depressive disorder | rs1775448 | 1 | 197646000 | G | A | 0.0194 | 0.00002593 | -0.0849 | 9.824E-11 | -0.033257 | 3.86992E-08 | DENN1B | 1q31.3 | known |
| | rs11584383 | 1 | 200966738 | C | T | -0.0128 | 0.00597 | -0.1211 | 7.363E-19 | -0.025307 | 4.37008E-18 | KIF21B | 1q32.1 | known |
| | rs6753197 | 2 | 43300823 | G | T | -0.0162 | 0.004807 | -0.0966 | 3.207E-09 | -0.035574 | 4.10995E-09 | ZFP36L2 | 2p21 | known |
| | rs2698194 | 2 | 61136061 | C | T | -0.0117 | 0.007548 | -0.0736 | 3.559E-09 | -0.035254 | 5.65163E-09 | C2orf74 | 2p15 | known |
| | rs80033912 | 3 | 49431256 | C | A | -0.0148 | 0.002204 | -0.1223 | 1.259E-16 | -0.048973 | 5.75843E-16 | NICN1 | 3p21.31 | known |
| | rs12517950 | 5 | 132395634 | G | A | 0.0117 | 0.007649 | 0.136 | 1.857E-27 | 0.063393 | 1.09587E-25 | SLC22A5 | 5q31.1 | known |
| | rs755374 | 5 | 159402286 | C | T | 0.0143 | 0.002053 | -0.1767 | 1.586E-39 | -0.071916 | 1.39509E-32 | IL12B | 5q33.3 | known |
| | rs148571474 | 6 | 31704935 | C | T | -0.0371 | 0.009947 | -0.5963 | 7.547E-44 | -0.08035 | 3.01283E-40 | MHC region | | known |
| | rs1768365 | 7 | 6505557 | G | A | -0.0144 | 0.005696 | -0.0837 | 3.879E-08 | -0.033189 | 4.12209E-08 | KDELR2 | 7p22.1 | known |
| | rs2529269 | 7 | 74869879 | C | T | -0.0141 | 0.004766 | 0.1042 | 1.697E-10 | 0.038444 | 2.22194E-08 | GTF2IR2D | 7q11.23 | new |
| | rs13234982 | 7 | 107837916 | G | A | 0.0117 | 0.007204 | 0.099 | 1.866E-14 | 0.045372 | 6.43096E-14 | DLD | 7q31.1 | known |
| | rs6476933 | 9 | 4984154 | C | T | -0.013 | 0.005707 | 0.0868 | 2.841E-10 | 0.033037 | 3.69276E-08 | JAK2 | 9p24.1 | known |
| | rs12766391 | 10 | 62681444 | G | A | 0.016 | 0.0002678 | -0.1418 | 1.715E-29 | -0.060613 | 1.26976E-23 | ADO | 10q21.3 | known |
| | rs7500958 | 16 | 50357685 | C | T | -0.0134 | 0.006658 | -0.086 | 1.619E-09 | -0.036023 | 6.21936E-09 | BRD7 | 16q12.1 | known |
| | rs2066844 | 16 | 50712015 | C | T | -0.0278 | 0.006594 | -0.3497 | 1.416E-38 | -0.075394 | 1.21654E-35 | NOD2 | 16q12.1 | known |
| | rs3859191 | 17 | 39972461 | G | A | -0.0128 | 0.002872 | 0.0926 | 1.132E-13 | 0.039446 | 7.0492E-11 | ZPB2P2 | 17q21.1 | known |
| Schizophrenia | rs10800309 | 1 | 161502368 | G | A | 0.02850236 | 0.001872 | -0.123 | 1.942E-20 | -0.048801 | 5.93029E-16 | FCGR2A | 1q23.3 | known |
| | rs12134279 | 1 | 197812068 | C | T | -0.02839947 | 0.00759 | -0.0955 | 2.134E-10 | -0.037543 | 4.83765E-10 | DENN1B | 1q31.3 | known |
| | rs7554511 | 1 | 200908434 | C | A | 0.036302999 | 0.0001836 | 0.1343 | 9.999E-22 | 0.056326 | 9.78892E-21 | KIF21B | 1q32.1 | known |
| | rs1039823 | 2 | 28400292 | G | A | -0.023504069 | 0.006514 | 0.0846 | 1.062E-11 | 0.035635 | 3.46504E-09 | FOSL2 | 2p23.2 | known |
| | rs10931830 | 2 | 198756909 | C | T | -0.024604804 | 0.006576 | -0.0782 | 2.34E-09 | -0.035358 | 4.57204E-09 | PLCL1 | 2q33.1 | known |
| | rs1456536 | 2 | 198961498 | C | T | -0.033401677 | 0.0004058 | -0.0734 | 4.753E-08 | -0.033235 | 3.29744E-08 | SATB2 | 2q33.1 | known |
| | rs34514189 | 3 | 49335612 | G | A | 0.035399224 | 0.001642 | 0.1318 | 8.428E-17 | 0.04888 | 5.32473E-16 | USP4 | 3p21.31 | known |
| | rs1310953 | 3 | 49676792 | C | T | 0.025605029 | 0.006281 | 0.1635 | 1.219E-32 | 0.071524 | 1.95694E-32 | APEH | 3p21.31 | known |
| | rs13107325 | 4 | 102267552 | C | T | -0.158702691 | 2.9E-21 | -0.113 | 6.436E-07 | -0.035384 | 4.46389E-09 | SLC39A8 | 4q24 | known |
| | rs11729811 | 4 | 122550510 | G | A | 0.031903549 | 0.0009495 | 0.0922 | 1.667E-11 | 0.040088 | 3.00716E-09 | LYRM7 | 5q23.3-q31.1 | known |
| | rs2548532 | 5 | 96902874 | C | T | -0.023698607 | 0.006727 | 0.0838 | 2.242E-11 | 0.034984 | 6.62020E-09 | ERAP2 | 5q15 | known |
| | rs4705885 | 5 | 131087866 | G | A | 0.033695864 | 0.0007723 | -0.1057 | 5.743E-15 | -0.040704 | 1.49662E-11 | LYRM7 | 5q23.3-q31.1 | known |
| | rs9271176 | 6 | 32610350 | G | A | -0.043002017 | 0.0001002 | -0.2069 | 1.205E-51 | -0.087479 | 1.15858E-47 | MHC region | | known |
| | rs17585295 | 6 | 90235112 | C | T | -0.039748076 | 0.0003646 | 0.0817 | 2.538E-10 | 0.038541 | 6.16629E-10 | BACH2 | 6q15 | known |
| Depression | rs35931461 | 6 | 111525822 | G | A | -0.047395637 | 0.006438 | -0.1529 | 2.48E-10 | -0.037311 | 6.18161E-10 | REV3L | 6q21 | known |
| | rs62482552 | 7 | 109924735 | G | A | 0.02709947 | 0.002715 | 0.0737 | 1.971E-08 | 0.033703 | 2.30169E-08 | MUC3A | 7q22.1 | known |
| | rs3812555 | 9 | 136367481 | C | T | -0.026795823 | 0.005381 | -0.1241 | 9.621E-20 | -0.025952 | 1.65664E-18 | SNAPC4 | 9q34.3 | known |
| | rs10826797 | 10 | 30401447 | G | T | -0.02499991 | 0.009319 | 0.099 | 3.986E-13 | 0.038277 | 2.21141E-10 | MTPAP | 10p11.23 | known |
| | rs2384352 | 10 | 35203904 | G | A | 0.031996471 | 0.0004519 | 0.0951 | 3.118E-13 | 0.043187 | 8.07374E-13 | CNNY | 10p11.21 | known |
| | rs10761659 | 13 | 62685804 | G | A | -0.024702369 | 0.004472 | 0.1585 | 2.298E-32 | 0.067481 | 4.69092E-29 | ADO | 10q21.3 | known |
| | rs1932990 | 13 | 43886106 | C | T | -0.03900737 | 0.0001494 | -0.0816 | 2.51E-08 | -0.034134 | 1.52184E-08 | CCDC122 | 13q14.11 | known |
| | rs62036658 | 16 | 28839050 | G | T | 0.0249991 | 0.0044705 | 0.0976 | 1.566E-14 | 0.044995 | 8.67125E-14 | TUFM | 16p11.2 | known |
| | rs2066848 | 16 | 50681274 | G | A | 0.036302999 | 0.0004336 | 0.1193 | 1.515E-20 | 0.055089 | 6.65067E-20 | NOD2 | 16q12.1 | known |

Supplementary Table 29. Multi-trait meta-analysis between digestive diseases and inflammatory bowel disease in Europeans

| Type of digestive diseases | SNP | CHR | BP | A1 | A2 | Digestive diseases (all) | | Inflammatory bowel disease | | MTAG | | Genes | Cytogenetic band | Annotation |
|---------------------------------|-------------|-----|-----------|----|----|--------------------------|------------|----------------------------|-----------|-------------|-------------|------------|------------------|------------|
| | | | | | | Beta | P-value | Beta | P-value | Beta-mtag | P-mtag | | | |
| Appendicitis | rs2088242 | 1 | 67298097 | C | T | 0.0005416 | 0.0087 | -0.2309 | 3.02E-61 | -0.09591036 | 9.47891E-56 | IL12RB2 | 1p31.3 | known |
| | rs6735694 | 2 | 240647279 | C | T | 0.0005472 | 0.01 | -0.0814 | 1.189E-08 | -0.03421031 | 2.01622E-08 | AQP12B | 2q37.3 | known |
| | rs150064688 | 5 | 40526093 | G | A | -0.002272 | 0.0037 | 0.333 | 2.02E-11 | 0.040187783 | 4.37086E-11 | PTGER4 | 5p13.1 | known |
| | rs11744957 | 5 | 159460964 | C | T | -0.000647 | 0.01 | -0.1442 | 1.328E-16 | -0.04560311 | 7.48567E-14 | IL12B | 5q33.3 | known |
| | rs67289879 | 6 | 42039665 | C | T | 0.0008863 | 0.00018 | -0.0898 | 3.041E-08 | -0.0341476 | 2.13958E-08 | CCND3 | 6p21.1 | known |
| | rs34659678 | 6 | 111567337 | C | T | 0.0013416 | 0.00084 | -0.1655 | 7.416E-11 | -0.03942667 | 1.00562E-10 | TRAF3IP2 | 6q21 | known |
| | rs192007 | 10 | 62826635 | G | A | 0.0005871 | 0.0026 | -0.0808 | 2.926E-10 | -0.03804898 | 4.37132E-10 | EGR2 | 10q21.3 | known |
| | rs6584282 | 10 | 99526738 | G | A | 0.000495 | 0.0073 | -0.152 | 1.194E-34 | -0.07177295 | 5.50683E-32 | NKX2-3 | 10q24.2 | known |
| | rs2508755 | 11 | 76534518 | G | A | -0.000483 | 0.0091 | 0.0968 | 8.157E-15 | 0.045952101 | 4.83512E-14 | EMSY | 11q13.5 | known |
| | rs2066844 | 16 | 50712015 | C | T | -0.001171 | 0.0084 | -0.3497 | 1.416E-11 | -0.07246111 | 1.43581E-11 | NOD2 | 16q12.1 | known |
| Gastritis-duodenitis | rs16940202 | 16 | 85980635 | C | T | -0.000919 | 0.00025 | 0.113 | 2.505E-11 | 0.040618322 | 2.70977E-11 | IRF8 | 16q24.1 | known |
| | rs62066988 | 17 | 39836028 | C | T | 0.0006392 | 0.0012 | -0.1105 | 4.778E-17 | -0.04994861 | 2.57471E-16 | IKZF3 | 17q12-q21.1 | known |
| | rs2838515 | 21 | 44188654 | G | A | 0.000565 | 0.0036 | -0.0858 | 5.176E-11 | -0.03933555 | 1.10994E-10 | ICSLG | 21q22.3 | known |
| | rs62266440 | 22 | 30194233 | G | A | 0.0006079 | 0.0034 | -0.076 | 2.178E-08 | -0.03385986 | 2.80604E-08 | LIF | 22q12.2 | known |
| | rs6753197 | 2 | 43300823 | G | T | 0.0427 | 0.000321 | -0.0966 | 3.207E-09 | -0.05332712 | 7.82168E-09 | ZFP36L2 | 2p21 | known |
| | rs13362202 | 5 | 40473350 | G | A | 0.0359 | 0.00762 | 0.1358 | 4.768E-13 | 0.04247535 | 3.91441E-12 | PTGER4 | 5p13.1 | known |
| | rs4244437 | 5 | 159346109 | G | A | -0.0247 | 0.00948 | -0.1587 | 1.493E-31 | -0.06803639 | 1.03968E-28 | IL12B | 5q33.3 | known |
| | rs9370777 | 6 | 14725005 | G | A | -0.0365 | 0.00109 | -0.109 | 4.335E-11 | -0.03912662 | 1.62585E-10 | JARID2 | 6p22.3 | known |
| | rs9271176 | 6 | 32610350 | G | A | 0.0336 | 0.000388 | -0.2069 | 1.205E-51 | -0.08570558 | 1.47716E-44 | MHC region | | known |
| | rs2285147 | 6 | 167092060 | G | A | 0.0263 | 0.00327 | -0.0955 | 1.672E-14 | -0.04332385 | 1.45327E-12 | CCR6 | 6q27 | known |
| Gastroesophageal reflux disease | rs4917129 | 7 | 50283578 | C | T | 0.0262 | 0.00368 | 0.0838 | 4.906E-11 | 0.038963257 | 1.93545E-10 | IKZF1 | 7p12.2 | known |
| | rs7137828 | 12 | 111494996 | C | T | 0.0248 | 0.00535 | 0.0783 | 4.682E-10 | 0.036711245 | 1.99253E-09 | SH2B3 | 12q24.12 | known |
| | rs28374519 | 16 | 28478021 | G | A | 0.0255 | 0.00595 | 0.1105 | 6.547E-16 | 0.047359959 | 1.00711E-14 | NPIP87 | 16p12.1 | known |
| | rs11576006 | 1 | 67306330 | C | T | -0.0189 | 0.005893 | -0.0872 | 1.488E-08 | -0.03386265 | 2.75163E-08 | IL12RB2 | 1p31.3 | known |
| | rs11583398 | 1 | 206795610 | C | A | -0.0235 | 0.005636 | -0.1689 | 7.538E-22 | -0.05628498 | 2.56159E-20 | IL10 | 1q32.1 | known |
| | rs2891409 | 2 | 24794488 | G | T | -0.021 | 0.00196 | 0.0914 | 1.041E-10 | 0.035101261 | 8.4205E-09 | PTRHD1 | 2p23.3 | known |
| | rs6736400 | 2 | 43273665 | G | A | 0.0205 | 0.009358 | 0.0965 | 4.246E-09 | 0.035040915 | 8.92882E-09 | ZFP36L2 | 2p21 | known |
| | rs72928115 | 2 | 198744122 | G | A | -0.017 | 0.007163 | -0.0747 | 2.437E-08 | -0.03333897 | 4.4841E-08 | SATB2 | 2q33.1 | known |
| | rs1131095 | 3 | 49676792 | C | T | -0.0211 | 0.001125 | 0.1635 | 1.219E-35 | 0.069173328 | 7.35268E-30 | APEH | 3p21.31 | known |
| | rs6873866 | 5 | 96912106 | C | T | -0.017 | 0.004873 | -0.0919 | 6.148E-13 | -0.04255999 | 2.87441E-12 | LNPEP | 5q15 | known |
| Irritable bowel syndrome | rs2188962 | 5 | 132435113 | C | T | -0.0175 | 0.003277 | -0.1345 | 3.672E-27 | -0.05956598 | 1.45201E-22 | SLC22A5 | 5q31.1 | known |
| | rs10041497 | 5 | 142135017 | C | T | 0.016 | 0.008169 | 0.0819 | 1.946E-10 | 0.037704037 | 6.13547E-10 | NDFIP1 | 5q31.3 | known |
| | rs11135059 | 5 | 159344329 | G | A | -0.0162 | 0.009696 | -0.1239 | 2.379E-21 | -0.05538196 | 1.01515E-19 | IL12B | 5q33.3 | known |
| | rs9370777 | 6 | 14725005 | G | A | -0.0217 | 0.003519 | -0.109 | 4.335E-11 | -0.03935125 | 1.06655E-10 | JARID2 | 6p22.3 | known |
| | rs148571474 | 6 | 31704935 | C | T | 0.0567 | 0.002733 | 0.5963 | 7.547E-44 | -0.08093234 | 3.01158E-40 | MHC region | | known |
| | rs2529269 | 7 | 74869879 | C | T | -0.0204 | 0.002468 | 0.1042 | 1.697E-10 | 0.034616365 | 1.34498E-08 | GTF2IRD2 | 7q11.23 | new |
| | rs4246905 | 9 | 114790969 | C | T | 0.0245 | 0.0001622 | 0.1535 | 4.62E-27 | 0.063356237 | 2.57975E-25 | TNFSF15 | 9q32 | known |
| | rs11221335 | 11 | 128516011 | C | T | 0.0188 | 0.00884 | 0.0827 | 2.44E-08 | 0.0336281 | 4.38619E-08 | ETS1 | 11q24.3 | known |
| | rs1388585 | 12 | 40137889 | G | A | -0.065 | 0.009823 | 0.3311 | 3.933E-14 | 0.04153542 | 9.38659E-12 | SLC2A13 | 12q12 | known |
| | rs11066188 | 12 | 112172910 | G | A | 0.0294 | 0.1023E-06 | -0.0874 | 1.759E-11 | -0.04117623 | 1.41201E-11 | TRAFF1 | 12q24.13 | known |
| Irritable bowel syndrome | rs11639295 | 15 | 67168419 | C | T | 0.0168 | 0.009461 | 0.0819 | 1.827E-09 | 0.035820301 | 4.15747E-09 | IQCH | 15q23 | known |
| | rs2357623 | 16 | 50661010 | G | A | -0.02 | 0.002702 | -0.1048 | 1.769E-13 | -0.04379179 | 6.67857E-13 | NOD2 | 16q12.1 | known |
| | rs12450323 | 17 | 39816455 | G | T | 0.0194 | 0.009131 | 0.1241 | 1.221E-14 | 0.042357517 | 3.63975E-12 | IKZF3 | 17q12-q21.1 | known |
| | rs4812068 | 20 | 59268848 | C | T | -0.0211 | 0.008356 | -0.0833 | 7.591E-10 | -0.03711518 | 1.1271E-09 | EDN3 | 20q13.32 | known |
| | rs3787089 | 20 | 63685277 | C | T | -0.0221 | 0.0004597 | -0.124 | 1.299E-19 | -0.05361571 | 1.39424E-18 | TNFRSF6B | 20q13.33 | known |
| | rs4817986 | 21 | 39093586 | G | T | 0.023 | 0.0005678 | 0.1635 | 1.98E-29 | 0.06624841 | 1.60403E-27 | PSMG1 | 21q22.2 | known |
| | rs4820371 | 22 | 39263083 | C | T | 0.0201 | 0.003818 | -0.1056 | 1.072E-11 | -0.03708751 | 1.15951E-09 | PDGFB | 22q13.1 | known |
| | rs2641117 | 1 | 7969450 | G | A | -0.0287 | 0.008372 | 0.1374 | 1.548E-08 | 0.040261988 | 3.74388E-11 | PARK7 | 1p36.23 | known |
| | rs7543680 | 1 | 22404776 | G | A | 0.0217 | 0.008946 | 0.1001 | 5.508E-11 | 0.038967829 | 1.54078E-10 | ZBTB40 | 1p36.12 | known |
| | rs10889668 | 1 | 67195561 | C | T | -0.028 | 0.007916 | -0.11 | 2.552E-09 | -0.03560923 | 4.92867E-09 | C1orf141 | 1p31.3 | known |
| Irritable bowel syndrome | rs2477077 | 1 | 197701985 | C | T | 0.0228 | 0.005751 | -0.0973 | 3.969E-11 | -0.03581648 | 4.01419E-10 | DENND1B | 1q31.3 | known |
| | rs2883844 | 2 | 60840158 | C | T | 0.024 | 0.004494 | 0.0885 | 3.021E-10 | 0.037872684 | 4.92796E-10 | REL | 2p16.1 | known |
| | rs4851586 | 2 | 102447804 | C | T | -0.0234 | 0.003878 | -0.096 | 2.101E-11 | 0.040212313 | 3.46385E-11 | SLC9A4 | 2q12.1 | known |
| | rs62180106 | 2 | 198764830 | G | A | 0.0191 | 0.009587 | 0.0812 | 1.614E-09 | 0.035943701 | 3.53705E-09 | SATB2 | 2q33.1 | known |
| | rs7559194 | 2 | 233298153 | G | A | -0.0198 | 0.004364 | -0.133 | 2.722E-26 | -0.06244837 | 1.0843E-24 | SAG | 2q37.1 | known |
| | rs17388568 | 4 | 122408207 | G | A | 0.0196 | 0.009773 | -0.0921 | 1.749E-11 | -0.03651815 | 1.98694E-09 | ADAD1 | 4q27 | known |
| | rs6451494 | 5 | 40411189 | C | T | 0.0187 | 0.007237 | 0.1689 | 3.633E-40 | 0.077469299 | 4.42256E-37 | PTGER4 | 5p13.1 | known |
| | rs156025 | 5 | 132205191 | C | T | 0.0219 | 0.009153 | 0.0858 | 2.051E-08 | 0.033645976 | 3.25649E-08 | PDLM4 | 5q31.1 | known |
| | rs1433043 | 5 | 159337296 | C | T | -0.0303 | 0.002245 | -0.1204 | 8.627E-11 | -0.03887176 | 1.70841E-10 | IL12B | 5q33.3 | known |
| | rs9271511 | 6 | 32621706 | G | A | -0.0264 | 0.0004119 | 0.1813 | 5.101E-39 | 0.071844862 | 3.81037E-32 | MHC region | | known |
| Irritable bowel syndrome | rs12669950 | 7 | 107867555 | C | T | -0.0178 | 0.009965 | -0.0821 | 7.656E-11 | -0.0387932 | 1.85855E-10 | DLD | 7q31.1 | known |
| | rs11145917 | 9 | 136407748 | C | T | -0.0206 | 0.006506 | -0.0784 | 1.144E-08 | -0.04346816 | 1.6452E-08 | ENTR1 | 9q34.3 | known |
| | rs10899231 | 11 | 76565411 | C | A | -0.0201 | 0.009912 | -0.1166 | 6.618E-20 | -0.05354523 | 1.41874E-18 | LRRC32 | 11q13.5 | known |
| | rs137980689 | 12 | 40419036 | G | A | 0.0672 | 0.009355 | 0.3234 | 8.968E-17 | 0.049030152 | 7.99811E-16 | MUC19 | 12q12 | known |
| | rs34838 | 16 | 284830 | | | | | | | | | | | |

Supplementary Table 30. Multi-trait meta-analysis between psychiatric disorders and appendicitis in Europeans

| Type of psychiatric disorders | SNP | CHR | BP | A1 | A2 | Psychiatric disorders (all) | | Appendicitis | | MTAG | | Genes | Cytogenetic band | Annotation |
|-------------------------------|----------|-----|----------|----|----|-----------------------------|-----------|--------------|---------|-----------|-------------|------------|------------------|------------|
| | | | | | | Beta | P-value | Beta | P-value | Beta-mtag | P-mtag | | | |
| Major depressive disorder | rs203876 | 6 | 28078895 | T | C | 0.0323 | 1.289E-11 | 0.00056 | 0.0061 | 0.026688 | 1.69072E-09 | MHC region | | known |

Supplementary Table 31. Multi-trait meta-analysis between digestive diseases and appendicitis in Europeans

| Type of digestive diseases | SNP | CHR | BP | A1 | A2 | Digestive diseases (all) | | Appendicitis | | MTAG | | Genes | Cytogenetic band | Annotation |
|----------------------------|-------------|-----|-----------|----|----|--------------------------|----------|--------------|---------|-----------|-------------|------------|------------------|------------|
| | | | | | | Beta | P-value | Beta | P-value | Beta-mtag | P-mtag | | | |
| Crohn's disease | rs2088242 | 1 | 67298097 | C | T | -0.1837 | 7.65E-25 | 0.00054 | 0.0087 | 0.035425 | 2.81965E-19 | IL12RB2 | 1p31.3 | new |
| | rs6735694 | 2 | 240647279 | C | T | -0.1273 | 3.91E-12 | 0.00055 | 0.01 | 0.027503 | 7.21337E-11 | AQP12B | 2q37.3 | new |
| | rs34659678 | 6 | 111567337 | C | T | -0.2165 | 1.66E-11 | 0.00134 | 0.00084 | 0.054067 | 1.04866E-11 | TRAF3IP2 | 6q21 | known |
| | rs7911680 | 10 | 99533711 | A | C | 0.1525 | 6.71E-22 | -0.00052 | 0.005 | -0.031518 | 1.15757E-17 | NKX2-3 | 10q24.2 | known |
| | rs2508755 | 11 | 76534518 | G | A | 0.0901 | 1.37E-08 | -0.00048 | 0.0091 | -0.020749 | 2.01028E-08 | EMSY | 11q13.5 | new |
| | rs16940202 | 16 | 85980635 | T | C | -0.135 | 3.07E-10 | 0.00092 | 0.00025 | 0.033349 | 2.22088E-11 | IRF8 | 16q24.1 | known |
| Inflammatory bowel disease | rs62066988 | 17 | 39836028 | C | T | -0.1229 | 2.84E-13 | 0.00064 | 0.0012 | 0.028087 | 7.82077E-13 | ZPBP2 | 17q21.1 | known |
| | rs2088242 | 1 | 67298097 | C | T | -0.2309 | 3.02E-61 | 0.00054 | 0.0087 | 0.043777 | 2.08898E-42 | IL12RB2 | 1p31.3 | new |
| | rs6735694 | 2 | 240647279 | C | T | -0.0814 | 1.19E-08 | 0.00055 | 0.01 | 0.018877 | 3.73103E-08 | AQP12B | 2q37.3 | new |
| | rs67289879 | 6 | 42039665 | C | T | -0.0898 | 3.04E-08 | 0.00089 | 0.00018 | 0.022407 | 2.59623E-09 | CCND3 | 6p21.1 | known |
| | rs34659678 | 6 | 111567337 | C | T | -0.1655 | 7.42E-11 | 0.00134 | 0.00084 | 0.041944 | 8.54689E-11 | TRAF3IP2 | 6q21 | known |
| | rs192007 | 10 | 62826635 | G | A | -0.0808 | 2.93E-10 | 0.00059 | 0.0026 | 0.019425 | 6.3134E-10 | EGR2 | 10q21.3 | known |
| | rs11190140 | 10 | 99531836 | T | C | 0.1503 | 3.37E-34 | -0.00052 | 0.0048 | 0.031519 | 6.2956E-26 | NKX2-3 | 10q24.2 | known |
| | rs2508755 | 11 | 76534518 | G | A | 0.0968 | 8.16E-15 | -0.00048 | 0.0091 | 0.021234 | 1.60146E-12 | EMSY | 11q13.5 | new |
| | rs2066844 | 16 | 50712015 | C | T | -0.3497 | 1.42E-38 | -0.00117 | 0.0084 | -0.061307 | 1.70217E-17 | NOD2 | 16q12.1 | new |
| | rs16940202 | 16 | 85980635 | T | C | -0.113 | 2.51E-11 | 0.00092 | 0.00025 | -0.027442 | 1.24859E-11 | IRF8 | 16q24.1 | known |
| Ulcerative colitis | rs62066988 | 17 | 39836028 | C | T | -0.1105 | 4.78E-17 | 0.00064 | 0.0012 | 0.024962 | 4.71657E-15 | ZPBP2 | 17q21.1 | known |
| | rs2838515 | 21 | 44188654 | A | G | 0.0858 | 5.18E-11 | -0.00056 | 0.0036 | 0.019428 | 2.74446E-10 | ICOSLG | 21q22.3 | known |
| | rs62226440 | 22 | 30194233 | G | A | -0.076 | 2.18E-08 | 0.00061 | 0.0034 | -0.018777 | 2.15238E-08 | LIF | 22q12.2 | known |
| | rs7546245 | 1 | 67284791 | T | C | -0.2691 | 2.25E-57 | 0.00061 | 0.0022 | -0.044153 | 4.91963E-42 | IL12RB2 | 1p31.3 | new |
| | rs6425143 | 1 | 172875212 | T | G | -0.1706 | 4.07E-21 | -0.00062 | 0.0037 | -0.019886 | 9.59018E-09 | TNFSF18 | 1q25.1 | known |
| | rs150064688 | 5 | 40526093 | A | G | -0.421 | 7.17E-11 | 0.00227 | 0.0037 | -0.0814 | 1.9397E-10 | PTGER4 | 5p13.1 | known |
| Ulcerative colitis | rs12213415 | 6 | 31783811 | G | A | -0.1647 | 6.21E-08 | 0.00099 | 0.0043 | 0.031595 | 3.64093E-08 | MHC region | known | known |
| | rs67289879 | 6 | 42039665 | C | T | -0.1102 | 2.03E-07 | 0.00089 | 0.00018 | 0.022141 | 7.51968E-09 | CCND3 | 6p21.1 | known |
| | rs192007 | 10 | 62826635 | G | A | -0.114 | 5.01E-12 | 0.00059 | 0.0026 | 0.021494 | 1.83775E-11 | EGR2 | 10q21.3 | known |
| | rs6584281 | 10 | 99526723 | A | G | 0.1648 | 6.66E-25 | -0.00052 | 0.0048 | 0.028037 | 3.62672E-20 | NKX2-3 | 10q24.2 | known |
| | rs2508755 | 11 | 76534518 | G | A | 0.1081 | 2E-11 | -0.00048 | 0.0091 | -0.019503 | 1.85341E-10 | EMSY | 11q13.5 | new |
| | rs2066844 | 16 | 50712015 | C | T | -0.6752 | 6.3E-99 | -0.00117 | 0.0084 | -0.108033 | 4.05888E-49 | NOD2 | 16q12.1 | new |
| Ulcerative colitis | rs12150079 | 17 | 39869164 | G | A | -0.1058 | 4.21E-10 | 0.00065 | 0.00099 | 0.020748 | 1.97392E-10 | ZPBP2 | 17q21.1 | known |
| | rs2838515 | 21 | 44188654 | A | G | 0.112 | 4.83E-11 | -0.00056 | 0.0036 | 0.020137 | 1.31365E-10 | ICOSLG | 21q22.3 | known |

Supplementary Table 32. Number of genes ($P < 0.01$) identified by MAGMA

| Catgerory | Disease | Genes |
|-----------------------|---------|-------|
| Psychiatric disorders | AN | 682 |
| | ADHD | 1049 |
| | ANX | 267 |
| | ASD | 545 |
| | BIP | 1989 |
| | DEP | 2255 |
| | MDD | 1340 |
| | NE | 2003 |
| | PTSD | 290 |
| | SCZ | 2738 |
| Digestive diseases | AP | 371 |
| | APP | 199 |
| | CC | 624 |
| | DD | 1166 |
| | CD | 1263 |
| | CRC | 1512 |
| | GD | 430 |
| | GERD | 1292 |
| | IBD | 1732 |
| | IBS | 636 |
| | NAFLD | 231 |
| | PU | 343 |
| | SF | 716 |
| | UC | 1550 |

Supplementary Table 33. Details of gene co-expression networks constructed using GTEx RNAseq data

| Tissue Name | Samples Count | Gene Count | Modules Count |
|---------------------------------------|---------------|------------|---------------|
| Brain - Cortex | 255 | 18726 | 14 |
| Brain - Caudate (basal ganglia) | 246 | 17768 | 12 |
| Brain - Hypothalamus | 202 | 17942 | 18 |
| Brain - Amygdala | 152 | 17627 | 19 |
| Brain - Hippocampus | 197 | 17470 | 13 |
| Brain - Cerebellar Hemisphere | 215 | 18789 | 15 |
| Brain - Spinal cord (cervical c-1) | 159 | 17539 | 15 |
| Esophagus - Mucosa | 555 | 16483 | 17 |
| Esophagus - Muscularis | 515 | 16802 | 17 |
| Esophagus - Gastroesophageal Junction | 375 | 16892 | 16 |
| Stomach | 359 | 16429 | 4 |
| Small Intestine - Terminal Ileum | 187 | 18229 | 5 |
| Colon - Transverse | 406 | 17057 | 3 |
| Colon - Sigmoid | 373 | 17073 | 17 |

Supplementary Table 34. Co-expression modules associated neurological pathways in six highly correlated diseases.

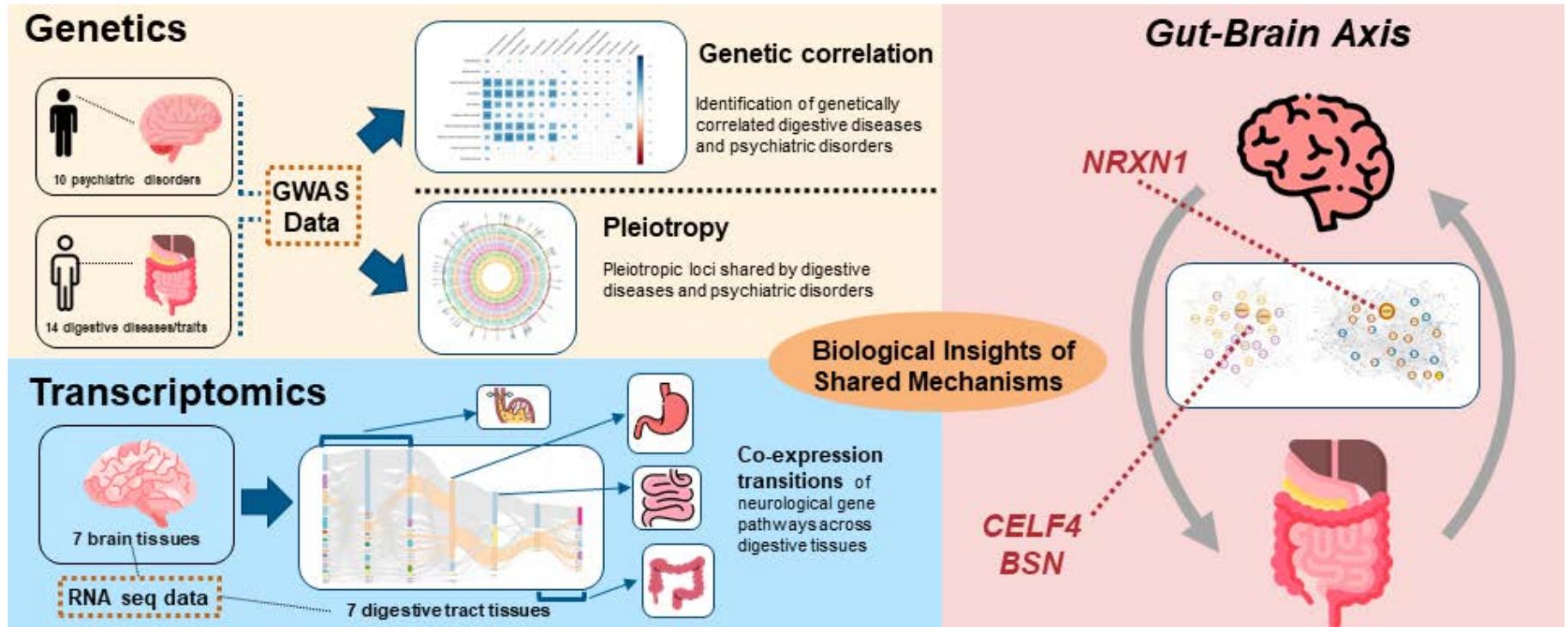
| Disease | Tissue | Module |
|---------|---------------------------------------|--------|
| IBS | Brain - Hypothalamus | 9 |
| | Esophagus - Mucosa | 3 |
| GERD | Brain - Amygdala | 2 |
| | Brain - Spinal cord (cervical c-1) | 2 |
| | Esophagus - Muscularis | 2 |
| DEP | Brain - Hypothalamus | 1 |
| | Brain - Amygdala | 1 |
| | Brain - Hippocampus | 1 |
| | Brain - Cerebellar Hemisphere | 4 |
| | Brain - Spinal cord (cervical c-1) | 2 |
| | Esophagus - Muscularis | 2 |
| | Esophagus - Gastroesophageal Junction | 14 |
| | Small Intestine - Terminal Ileum | 3 |
| | Colon - Transverse | 2 |
| | Colon - Sigmoid | 13 |
| MDD | Brain - Amygdala | 1 |
| | Brain - Hippocampus | 1 |
| | Brain - Spinal cord (cervical c-1) | 2 |
| | Esophagus - Gastroesophageal Junction | 14 |
| | Colon - Transverse | 2 |
| | Colon - Sigmoid | 13 |
| NE | Brain - Caudate (basal ganglia) | 1 |
| | Brain - Hypothalamus | 1 |
| | Brain - Amygdala | 1 |
| | Brain - Hippocampus | 1 |
| | Brain - Cerebellar Hemisphere | 4 |
| | Brain - Spinal cord (cervical c-1) | 2 |
| | Esophagus - Mucosa | 3 |
| | Esophagus - Muscularis | 2 |
| | Esophagus - Gastroesophageal Junction | 14 |
| | Small Intestine - Terminal Ileum | 3 |
| | Colon - Transverse | 2 |
| | Colon - Sigmoid | 8 |
| | Colon - Sigmoid | 13 |

Supplementary Table35. Percentile rank of selected hub genes from each tissue (Selected gene must rank within top 10% in the modules from at least two different tissues, top 5% is colored in red, top 10% is colored in yellow).

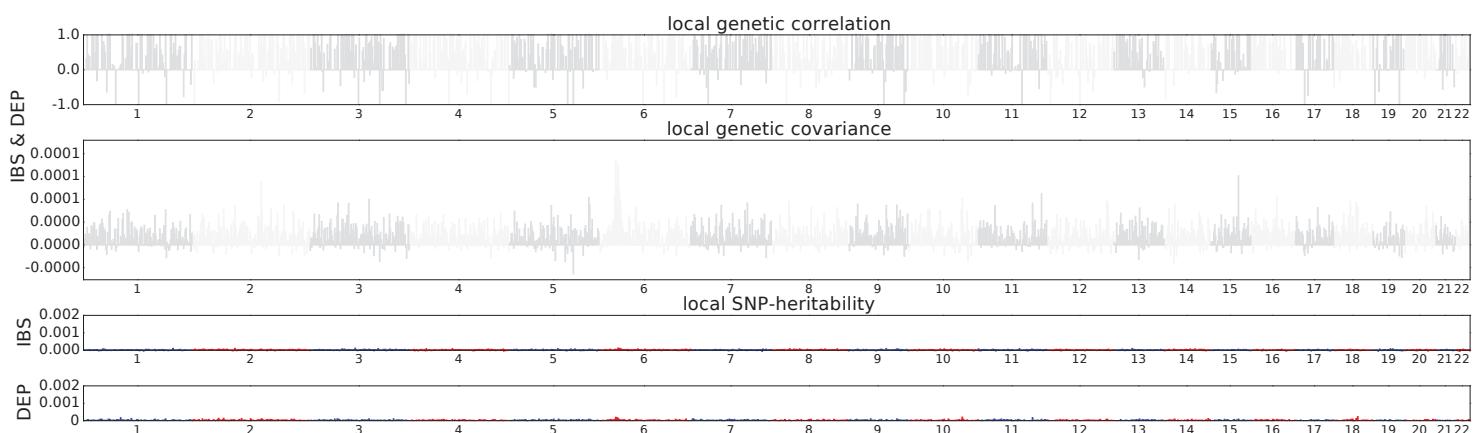
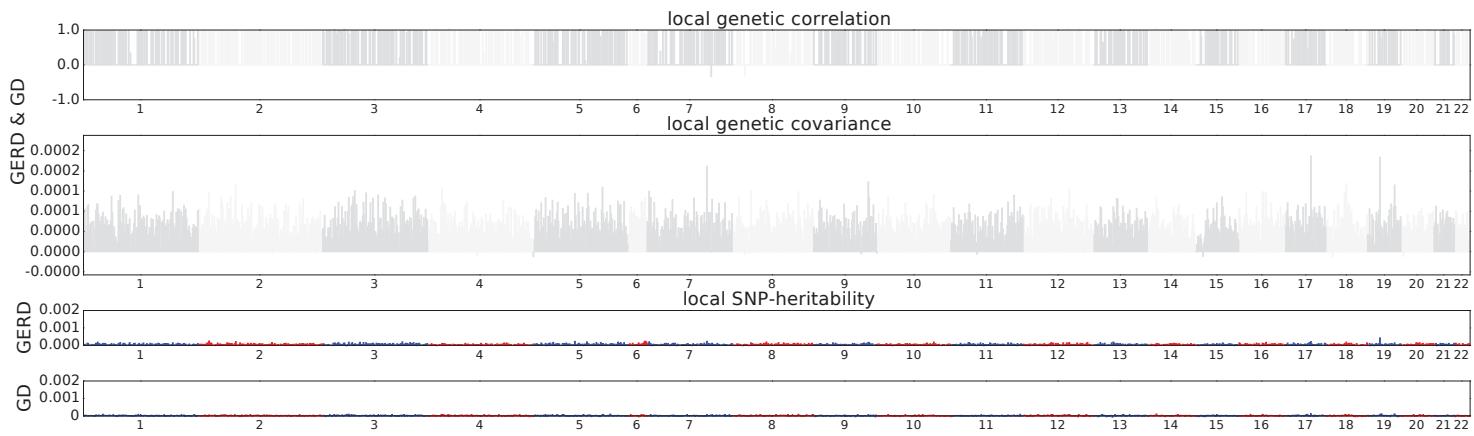
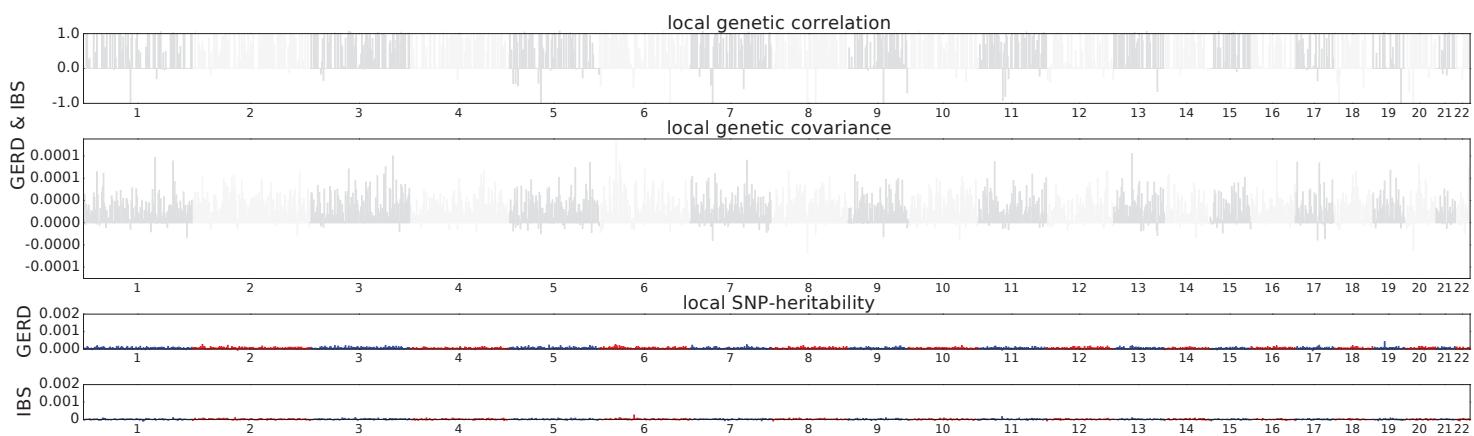
| GENE | Brain - Cortex | Brain - Caudate (basal ganglia) | Brain - Amygdala | Brain - Cerebellar Hemisphere | Brain - Hypothalamus | Brain - Spinal cord (cervical c-1) | Brain - Hippocampus | Small Intestine - Terminal Ileum | Colon - Transverse | Esophagus - Mucosa | Esophagus - Muscularis | Esophagus - Gastroesophageal Junction | Stomach | Colon - Sigmoid |
|----------|-----------------|------------------------------------|------------------|----------------------------------|----------------------|--|---------------------|-------------------------------------|--------------------|-----------------------|---------------------------|---|-----------------|--------------------|
| | Percentile rank | Percentile rank | Percentile rank | Percentile rank | Percentile rank | Percentile rank | Percentile rank | Percentile rank | Percentile rank | Percentile rank | Percentile rank | Percentile rank | Percentile rank | Percentile rank |
| SPINT2 | 14.27 | 14.13 | 10.73 | NA | 10.04 | 26.33 | 5.40 | 5.21 | 0.89 | NA | 74.80 | 80.95 | 0.46 | 8.43 |
| NRXN1 | 17.35 | 49.40 | 22.49 | 3.76 | 11.02 | 29.39 | 7.96 | 29.74 | 66.57 | 35.97 | 24.57 | 1.44 | 15.27 | 0.30 |
| KLHL29 | 5.12 | 5.61 | 18.55 | NA | 8.95 | 18.30 | 1.66 | 23.36 | 15.92 | 72.83 | 57.08 | 52.61 | 1.45 | 47.34 |
| NEGR1 | 1.28 | 9.85 | 7.75 | 86.08 | 22.68 | 60.48 | 12.79 | 11.58 | 11.26 | 4.94 | 60.60 | NA | 4.17 | 30.06 |
| ATP1B1 | 3.78 | 10.00 | 7.67 | 58.13 | 10.36 | 37.58 | 17.73 | 15.10 | 43.06 | NA | 36.03 | 20.09 | 5.16 | 71.94 |
| IRF8 | 10.90 | 24.15 | 14.81 | NA | 20.46 | 8.50 | 26.27 | 8.99 | 52.20 | 11.86 | 32.52 | 26.09 | 25.37 | 14.49 |
| ERBB3 | 0.36 | 1.35 | 2.11 | NA | 1.89 | 5.49 | 0.40 | 14.71 | 29.24 | NA | 30.22 | 6.47 | 6.37 | 20.28 |
| ANTXR2 | 39.23 | 26.14 | 75.52 | 41.78 | 65.71 | 31.02 | 49.20 | 21.92 | 58.97 | 13.45 | 5.29 | 2.24 | 0.40 | 6.05 |
| PCLO | 9.75 | 8.12 | 1.67 | 32.83 | 7.38 | 77.19 | 3.11 | 10.75 | 58.31 | 91.78 | 84.16 | NA | 21.73 | 52.55 |
| SLC45A1 | 6.49 | 15.94 | 16.90 | NA | 7.35 | 44.99 | 6.01 | 25.26 | 17.80 | 29.69 | 43.89 | 31.03 | 14.48 | NA |
| TMEM59L | 5.64 | 8.63 | 2.60 | NA | 3.22 | 0.39 | 0.34 | 64.23 | 51.56 | 89.96 | NA | NA | 27.25 | 12.42 |
| CELF4 | 10.80 | 2.67 | 3.73 | NA | 2.42 | 2.20 | 5.65 | 66.09 | 58.01 | NA | 16.83 | NA | NA | 6.69 |
| PPP1R14A | 12.80 | 18.72 | 33.89 | NA | 3.81 | 18.21 | 26.93 | 8.37 | 14.96 | 20.45 | 53.93 | 41.13 | 5.07 | NA |
| BSN | 1.01 | 3.56 | 1.72 | 85.71 | 5.58 | 9.13 | 0.56 | 75.36 | NA | NA | 71.29 | NA | NA | 28.34 |
| DISP2 | 9.48 | 15.06 | 12.37 | NA | 1.30 | 12.12 | 1.33 | 31.54 | 71.56 | NA | 83.17 | NA | 80.42 | 38.99 |
| PBX3 | 36.93 | 23.43 | 75.64 | 22.30 | 90.80 | 18.91 | 43.92 | 4.62 | 0.34 | 63.52 | 53.04 | NA | 4.11 | 10.50 |
| CACNB2 | 18.87 | 1.72 | 9.60 | NA | 5.67 | 65.67 | 3.15 | 30.17 | NA | 21.01 | NA | 6.43 | 3.63 | NA |
| LRRTM1 | 10.21 | 1.68 | 9.84 | 63.98 | 14.62 | 92.11 | 3.91 | 34.98 | 88.99 | NA | 20.94 | 31.65 | NA | 16.13 |
| SLC12A5 | 0.71 | 0.96 | 1.12 | 86.48 | 1.57 | 0.53 | 0.54 | NA | NA | NA | NA | NA | NA | 75.48 |
| SLC25A13 | 14.06 | 43.00 | 48.95 | 21.67 | 21.67 | 1.26 | 7.49 | 6.77 | 22.55 | 16.54 | 62.08 | 49.77 | 16.66 | 24.21 |
| LHFPL4 | 0.76 | 2.61 | 2.81 | NA | 1.59 | 75.02 | 2.01 | 61.69 | NA | NA | NA | NA | NA | 30.57 |
| LRFN5 | 3.00 | 19.42 | 14.22 | 93.66 | 7.32 | 4.02 | 1.94 | 19.06 | 49.93 | NA | NA | NA | NA | 76.75 |
| MDFIC | 26.89 | 32.44 | 51.61 | 5.35 | 45.10 | 7.35 | 65.51 | 38.68 | 56.82 | NA | 88.91 | 24.97 | 77.19 | NA |
| ARHGAP15 | 45.73 | 31.50 | 37.12 | NA | 16.91 | 30.26 | 60.38 | 11.43 | NA | NA | 6.62 | 1.71 | NA | 19.63 |
| ADGRB2 | 9.50 | 11.47 | 2.01 | NA | 62.43 | 29.03 | 5.74 | 47.70 | 92.11 | 64.18 | 49.60 | 61.47 | 43.75 | NA |
| TENM2 | 4.99 | 9.55 | 19.57 | NA | 8.62 | 21.00 | 3.61 | NA | NA | 53.08 | 90.08 | 63.70 | NA | NA |
| TRPS1 | NA | NA | 19.55 | 0.22 | NA | 83.27 | 51.35 | 13.68 | 9.19 | NA | 66.94 | 55.60 | 1.79 | 20.85 |
| ABD2 | 47.45 | 14.60 | 30.98 | 79.57 | 70.45 | 72.80 | 37.63 | 25.33 | 1.88 | 54.89 | 62.64 | 78.18 | 3.70 | 12.17 |
| CAMKV | 6.62 | 1.64 | 0.80 | NA | 9.63 | 12.83 | 1.05 | NA | NA | NA | NA | NA | NA | NA |
| GPR158 | 1.44 | 1.95 | 13.10 | 19.92 | 49.56 | 82.13 | 17.84 | NA | NA | NA | NA | NA | NA | 62.10 |
| MIF2C | 4.76 | 61.05 | 7.70 | NA | NA | 21.12 | 68.84 | 22.50 | 82.01 | 0.86 | 55.47 | 45.03 | 17.36 | 67.28 |
| WDR12 | 6.89 | 8.93 | 53.00 | NA | 2.19 | 89.52 | 6.64 | 82.84 | 87.83 | 3.01 | NA | 40.77 | 74.50 | NA |
| STAG1 | 45.61 | 45.59 | 38.87 | 5.88 | NA | NA | 21.82 | NA | NA | 53.08 | 5.69 | 2.64 | 30.57 | 10.14 |
| DYNLT5 | 65.23 | 5.86 | 4.18 | 13.26 | 12.23 | 14.98 | 9.08 | NA | NA | 47.26 | 19.42 | 80.16 | 36.74 | NA |
| ADCY2 | NA | 43.44 | 3.96 | 2.43 | NA | 0.14 | 30.00 | 12.20 | 12.51 | 23.56 | NA | 33.20 | 65.55 | NA |
| HHIP | 10.04 | 5.06 | 1.66 | NA | 6.13 | 74.01 | 30.44 | NA | 95.57 | NA | 46.48 | 34.95 | 21.18 | NA |
| FOXP2 | 81.58 | 23.91 | 98.57 | 76.10 | NA | 99.56 | NA | 42.01 | 24.39 | 62.91 | 34.82 | 26.70 | 5.01 | 12.96 |
| GYGI | 56.23 | NA | 85.07 | 73.90 | NA | 70.75 | NA | 6.20 | 16.07 | 28.04 | 8.57 | 1.51 | 5.23 | 3.33 |
| EEMPI1 | NA | NA | 22.62 | 6.29 | NA | 17.01 | 68.81 | 77.77 | NA | 18.92 | NA | 4.56 | 67.31 | NA |
| CNTNAP2 | 2.38 | 17.76 | 4.36 | NA | NA | 15.19 | 12.54 | NA | NA | 87.99 | NA | NA | NA | NA |
| CDH8 | 2.36 | 1.35 | 16.68 | NA | 53.66 | 50.52 | 10.93 | NA | NA | NA | NA | NA | NA | NA |
| PDP1 | 8.30 | 5.45 | 10.10 | NA | 43.44 | 35.15 | 16.61 | NA | NA | NA | 77.85 | NA | NA | NA |
| COL6A1 | NA | 46.22 | 46.22 | 48.26 | 62.01 | 22.25 | 68.72 | 0.96 | 1.54 | 0.96 | NA | NA | 0.58 | NA |
| ELAVL2 | 6.31 | 34.37 | 3.65 | NA | 20.41 | 6.79 | 20.40 | NA | NA | NA | NA | NA | NA | NA |
| BMPR1B | NA | NA | 0.73 | 1.66 | NA | 0.41 | 5.84 | NA | NA | 97.68 | 66.92 | NA | 95.37 | 67.58 |
| CCKBR | 10.39 | 11.57 | 4.53 | NA | 68.10 | NA | 6.02 | NA | NA | NA | NA | 10.44 | NA | NA |
| PHETA1 | 71.65 | 33.98 | 47.49 | 60.65 | NA | 83.54 | NA | 1.06 | 10.80 | NA | 46.78 | 58.13 | 7.79 | 28.20 |
| TSHZ3 | 38.31 | 84.10 | 85.48 | NA | NA | 33.65 | NA | 1.65 | 0.58 | 2.47 | 63.90 | 82.35 | 0.29 | 9.96 |
| TCF4 | NA | 36.26 | NA | NA | 31.51 | 90.29 | 90.26 | 14.43 | 45.50 | 8.07 | NA | 2.95 | 24.20 | 44.95 |
| KNDCL1 | 16.92 | 79.25 | 9.27 | NA | NA | 8.49 | 9.36 | 82.59 | 95.14 | NA | 89.75 | NA | 73.90 | 68.79 |
| ZBTB4 | 53.78 | NA | NA | 98.46 | NA | 84.88 | 85.25 | 26.29 | 0.67 | 47.62 | 24.69 | 29.67 | 7.44 | 11.39 |
| ABO | 74.71 | 39.18 | 50.33 | NA | NA | 44.64 | 84.98 | 6.16 | 8.92 | NA | 74.90 | 46.05 | 24.49 | 2.53 |
| APOE | NA | NA | 7.51 | 21.91 | NA | 42.87 | 6.74 | 94.99 | NA | 87.03 | 92.49 | 65.05 | 96.08 | 68.11 |
| CLDN23 | 40.74 | 63.52 | 83.22 | NA | 85.97 | 60.51 | 85.29 | 4.39 | 16.62 | NA | NA | 2.76 | 6.50 | NA |
| EP300 | NA | 19.40 | NA | NA | NA | NA | NA | NA | NA | 11.57 | 4.40 | 0.79 | 87.55 | 2.62 |
| ESR1 | 82.12 | NA | NA | 2.71 | NA | 58.44 | NA | 46.57 | NA | 89.05 | 9.08 | 1.54 | 56.50 | NA |
| RAB5B | 77.20 | NA | NA | NA | 22.51 | 10.10 | NA | 14.69 | NA | NA | 0.91 | 0.90 | 64.81 | 13.98 |
| FUT2 | 96.69 | 36.56 | 71.45 | NA | 98.58 | 86.03 | 79.19 | 12.21 | 5.06 | NA | 67.04 | NA | 2.45 | 1.82 |
| GTDC1 | 44.38 | 76.93 | NA | 9.97 | 50.99 | NA | 22.18 | 9.55 | NA | 66.88 | 45.01 | NA | 29.20 | 46.88 |
| PAX6 | NA | NA | 9.05 | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| NFAT5 | NA | 48.32 | NA | 0.18 | NA | NA | NA | NA | NA | NA | 5.56 | NA | 17.99 | 82.78 |
| PIAS1 | NA | NA | NA | 11.66 | NA | NA | 33.03 | NA | NA | NA | NA | 11.64 | 7.19 | 93.12 |
| GALNT2 | NA | 86.52 | 52.53 | NA | 77.34 | 76.95 | NA | 43.98 | NA | NA | NA | 6.44 | 6.30 | 15.96 |
| C6orf118 | NA | 1.53 | 2.32 | NA | 0.91 | NA | 6.60 | NA | NA | NA | NA | NA | NA | NA |
| SLC9A3 | 98.57 | NA | NA | NA | NA | 96.11 | 98.60 | 7.75 | 41.62 | 99.34 | 95.03 | NA | 4.95 | 59.73 |

Supplementary Table 36. Details on the characteristics of GWAS datasets in this study.

| Phenotype | Abbreviation | Data source | Total sample size | Ncase | Ncontrol | GWAS Catalog accession ID / Download website |
|--|--------------|--|-------------------|---------|---|---|
| Irritable bowel syndrome | IBS | Eijbouts C.,et al. Genome-wide analysis of 53,400 people with irritable bowel syndrome highlights shared genetic pathways with mood and anxiety disorders. <i>Nat Genet</i> . 2021 Nov;53(11):1543-1552. doi: 10.1038/s41588-021-00950-8 | 486,601 | 53,400 | 433,201 | GCST90016564 |
| Gastroesophageal reflux disease | GERD | An J.,et al. Gastroesophageal reflux GWAS identifies risk loci that also associate with subsequent severe esophageal diseases. <i>Nat Commun</i> . 2019 Sep 16;10(1):4219. doi: 10.1038/s41467-019-11968-2 | 332,601 | 71,522 | 261,079 | 10.6084/m9.figshare.8986589 |
| Peptic ulcer | PU | Wu Y.,et al. GWAS of peptic ulcer disease implicates <i>Helicobacter pylori</i> infection, other gastrointestinal disorders and depression. <i>Nat Commun</i> . 2021 Feb 19;12(1):1146. doi: 10.1038/s41467-021-21280-7 | 456,327 | 16,666 | 439,661 | https://csgenomics.com/content/data |
| Acute pancreatitis | AP | Bourgault J.,et al. Proteome-wide Mendelian randomization identifies causal links between blood proteins and acute pancreatitis. <i>Gastroenterology</i> . 2023 May;164(6):953-965.e3. doi: 10.1053/j.gastro.2023.01.028 | 855,309 | 10,630 | 844,679 | GCST90255375 |
| Non-alcoholic fatty liver disease | NAFLD | Ghodsiyan N.,et al. Electronic health record-based genome-wide meta-analysis provides insights on the genetic architecture of non-alcoholic fatty liver disease. <i>Cell Rep Med</i> . 2021 Nov 3;2(1):100437. doi: 10.1016/j.xcrm.2021.100437 | 778,614 | 8,434 | 770,180 | GCST90091033 |
| Appendicitis | APP | Dönertaş HM.,et al. Common genetic associations between age-related diseases. <i>Nat Aging</i> . 2021 Apr;1(4):400-412. doi: 10.1038/s43587-021-00051-5 | 484,598 | 4,089 | 480,509 | GCST90038695 |
| Colorectal cancer | CRC | Fernandez-Rozadilla C.,et al. Deciphering colorectal cancer genetics through multi-omic analysis of 100,204 cases and 154,587 controls of European and east Asian ancestries. <i>Nat Genet</i> . 2023 Jan;55(1):89-99. doi: 10.1038/s41588-022-01227-2 | 185,616 | 78,473 | 107,143 | GCST90255675 |
| Inflammatory bowel disease | IBD | de Lange KM.,et al. Genome-wide association study implicates immune activation of multiple integrin genes in inflammatory bowel disease. <i>Nat Genet</i> . 2017 Feb;49(2):256-261. doi: 10.1038/ng.3760 | 59,957 | 25,042 | 34,915 | GCST004131 |
| Crohn's disease | CD | de Lange KM.,et al. Genome-wide association study implicates immune activation of multiple integrin genes in inflammatory bowel disease. <i>Nat Genet</i> . 2017 Feb;49(2):256-261. doi: 10.1038/ng.3761 | 40,266 | 12,194 | 28,072 | GCST004132 |
| Ulcerative colitis | UC | de Lange KM.,et al. Genome-wide association study implicates immune activation of multiple integrin genes in inflammatory bowel disease. <i>Nat Genet</i> . 2017 Feb;49(2):256-261. doi: 10.1038/ng.3762 | 45,975 | 12,366 | 33,609 | GCST004133 |
| Stool frequency | SF | Bonfiglio F.,et al. GWAS of stool frequency provides insights into gastrointestinal motility and irritable bowel syndrome. <i>Cell Genom</i> . 2021 Dec; 8:1(3):None. doi: | 167,875 | | | GCST90002250 |
| Diverticular disease | DD | Schafmayer C.,et al. Genome-wide association analysis of diverticular disease points towards neuromuscular, connective tissue and epithelial pathomechanisms. <i>Gut</i> . 2019 May;68(5):854-865. doi: 10.1136/gutnl-2018-317619. Epub | 451,099 | 31,964 | 419,135 | GCST008105 |
| Gastritis-duodenitis | GD | 407,065 | 28,941 | 378,124 | https://www.leelabsrg.org/resources | |
| Cholelithiasis and cholecystitis | CL&CC | 407,532 | 16,225 | 391,307 | https://www.leelabsrg.org/resources | |
| Anxiety, panic disorder | ANX | Dönertaş HM.,et al. Common genetic associations between age-related diseases. <i>Nat Aging</i> . 2021 Apr;1(4):400-412. doi: 10.1038/s43587-021-00051-5 | 484,598 | 6,514 | 478,084 | GCST90038651 |
| Neuroticism | NE | Baselmans BML.,et al. Multivariate genome-wide analyses of the well-being spectrum. <i>Nat Genet</i> . 2019 Mar;51(3):445-451. doi: 10.1038/s41588-018-0320-8 | 523,783 | | | GCST007339 |
| Major depressive disorder | MDD | McIntosh AM.,et al. Genome-wide meta-analysis of depression identifies 102 independent variants and highlights the importance of the prefrontal brain regions. <i>Nat Neurosci</i> . 2019 Mar;22(3):343-352. doi: 10.1038/s41593-018-0326-7 | 670,955 | 170,756 | 500,199 | https://pgc.unc.edu/for-researchers/download-results/ |
| Depression | DEP | Thomas D Als.,et al. Depression pathophysiology, risk prediction of recurrence and comorbid psychiatric disorders using genome-wide analyses. <i>Nat Med</i> . 2023 Jul;29(7):1832-1844. doi: 10.1038/s41591-023-07352-1 | 1,035,760 | 294,322 | 741,438 | https://ipsych.dk/en/research/downloads/ |
| Schizophrenia | SCZ | Trubetskoy V.,et al. Schizophrenia Working Group of the Psychiatric Genomics Consortium: Mapping genomic loci implicates genes and synapses biology in schizophrenia. <i>Nature</i> . 2022 Apr;604(7906):502-508. doi: 10.1038/s4156-022-01285-8 | 320,404 | 76,755 | 243,649 | https://pgc.unc.edu/for-researchers/download-results/ |
| Attention-deficit hyperactivity disorder | ADHD | Dementis D.,et al. Genome-wide analyses of ADHD identify 27 risk loci, refine the genetic architecture and implicate several cognitive domains. <i>Nat Genet</i> . 2023 Feb;55(2):198-208. doi: 10.1038/s41588-022-01285-8 | 225,534 | 38,691 | 186,843 | https://pgc.unc.edu/for-researchers/download-results/ |
| Autism spectrum disorder | ASD | Grove J.,et al. Identification of common genetic risk variants for autism spectrum disorder. <i>Nat Genet</i> . 2019 Mar;51(3):431-444. doi: 10.1038/s41588-019-0344-x | 46,350 | 18,381 | 27,969 | https://pgc.unc.edu/for-researchers/download-results/ |
| Bipolar disorder | BIP | Mullins N.,et al. Genome-wide association study of more than 40,000 bipolar disorder cases provides new insights into the underlying biology. <i>Nat Genet</i> . 2021 Jun;53(6):817-829. doi: 10.1038/s41588-021-040857-4 | 413,466 | 41,917 | 371,549 | https://pgc.unc.edu/for-researchers/download-results/ |
| Post traumatic stress disorder | PTSD | Nievergelt CM.,et al. International meta-analysis of PTSD genome-wide association studies identifies sex- and ancestry-specific genetic risk loci. <i>Nat Commun</i> . 2019 Oct 8;10(1):4558. doi: 10.1038/s41467-019-12576-w | 206,655 | 32,428 | 174,227 | https://pgc.unc.edu/for-researchers/download-results/ |
| Anorexia nervosa | AN | Watson HJ.,et al. Genome-wide association study identifies eight risk loci and implicates metabo-psychiatric origins for anorexia nervosa. <i>Nat Genet</i> . 2019 Aug;51(8):1207-1214. doi: 10.1038/s41588-019-0439-7 | 72,517 | 16,992 | 55,525 | https://pgc.unc.edu/for-researchers/download-results/ |



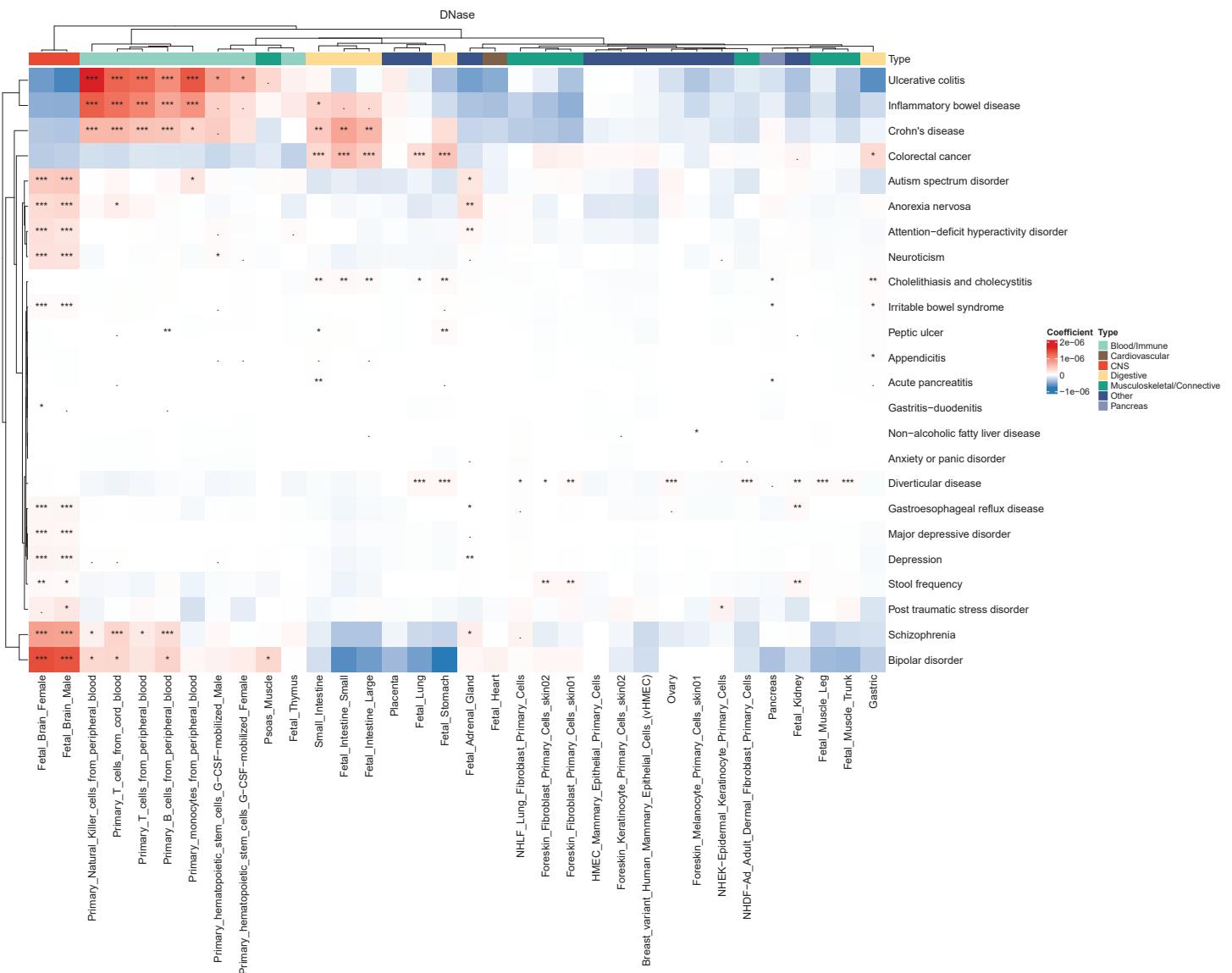
Supplementary Figure 1. The overview of the study.

A**B****C**

Supplementary Figure 2. Local genetic correlations among psychiatric disorders and digestive conditions.

(A) Manhattan plot showing the estimates of local genetic correlation, genetic covariance, and SNP heritability between IBS and DEP. (B) Manhattan plot showing the estimates of local genetic correlation, genetic covariance, and SNP heritability between GERD and GD in Europeans. (C) Manhattan plot showing the estimates of local genetic correlation, genetic covariance, and SNP heritability between IBS and GERD in Europeans. Red bars represent loci showing significant local genetic correlation after multiple testing adjustment. GERD, gastroesophageal reflux disease; IBS, irritable bowel syndrome; DEP, depression; GD, gastritis-duodenitis.

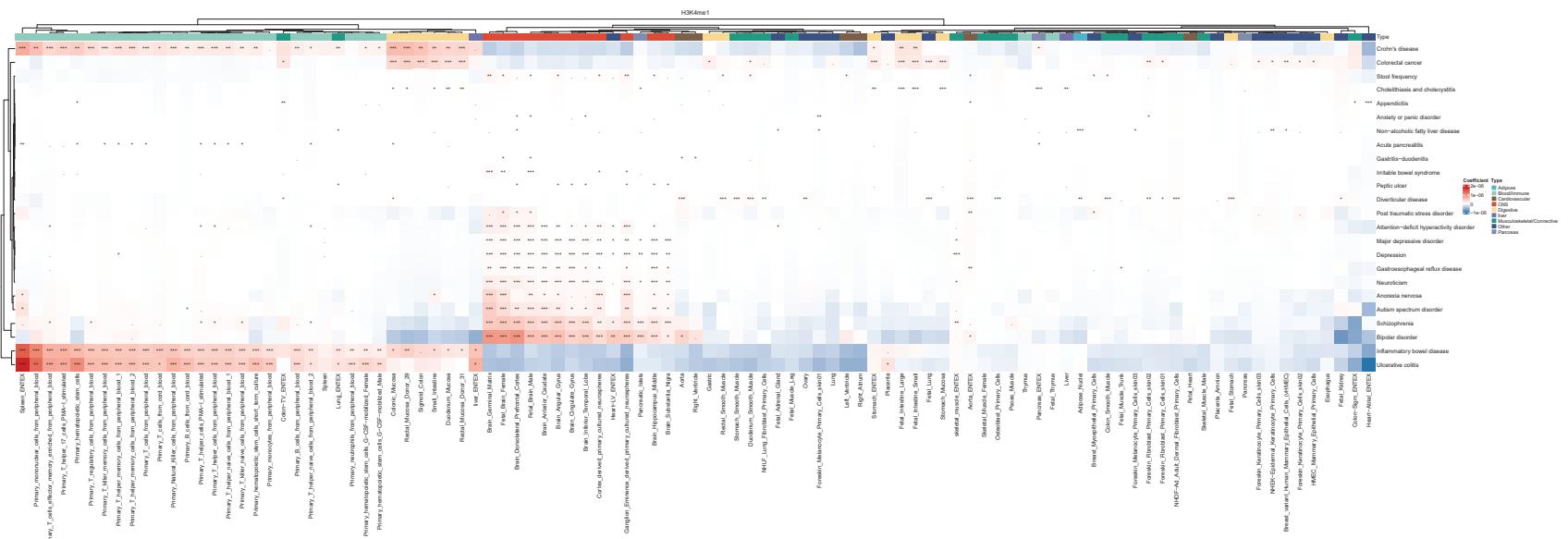
Supplementary Figure 3



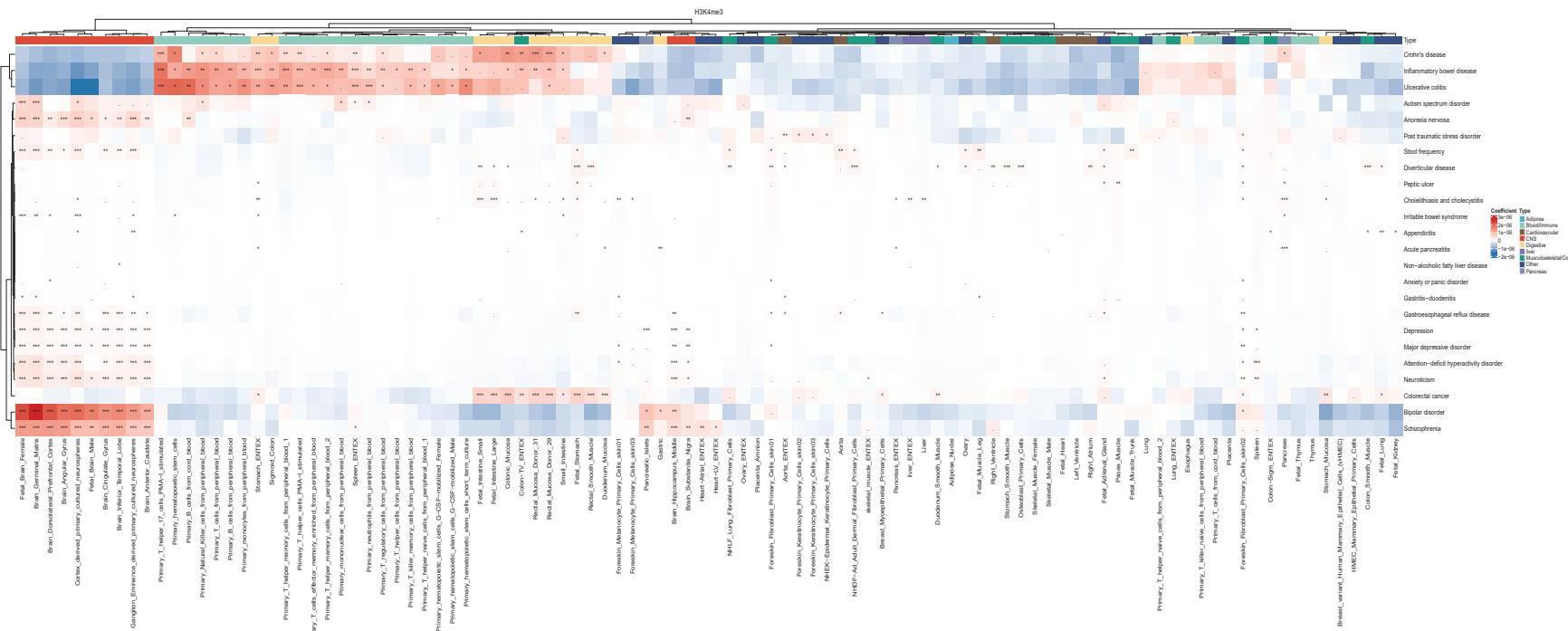
Supplementary Figure 3-8. Cell-type-specific enrichment of SNP heritability.

Heat maps showing patterns of cell-type-specific enrichments of SNP-heritability for genetically associated traits across 88 cell types- or tissues-specific annotations. Each checkered rectangle reflects the z-score, scaled by traits. Red indicates enrichment, blue indicates depletion. Deeper color represents stronger magnitude of effects. Asterisks represent statistical significance. The category of cell-types is color coded to the left. S3) DNase (DNase I hypersensitive sites), S4) H3K4me1, S5) H3K4me3, S6) H3K9ac, S7) H3K27ac, and S8) H3K36me3.

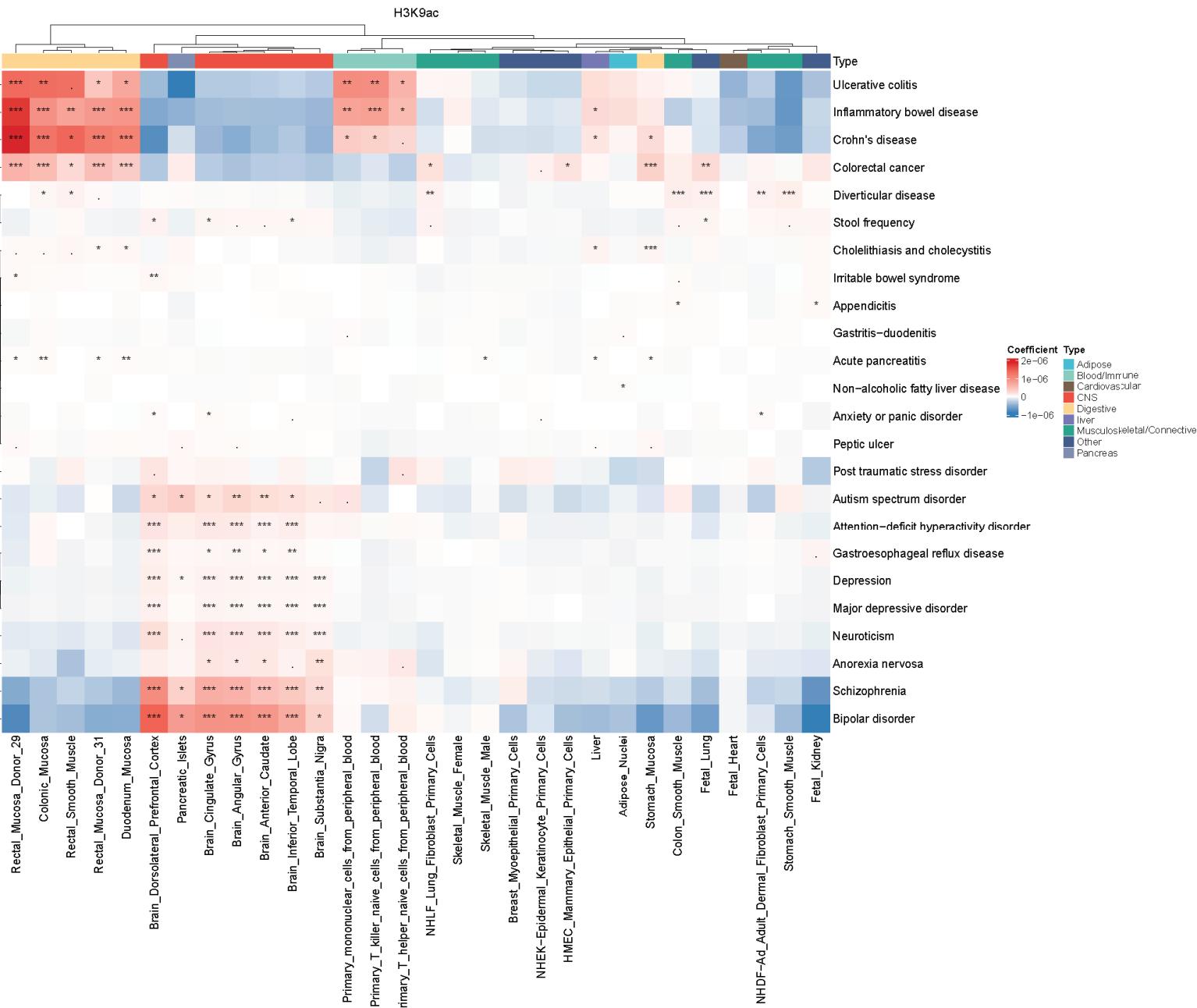
Supplementary Figure 4



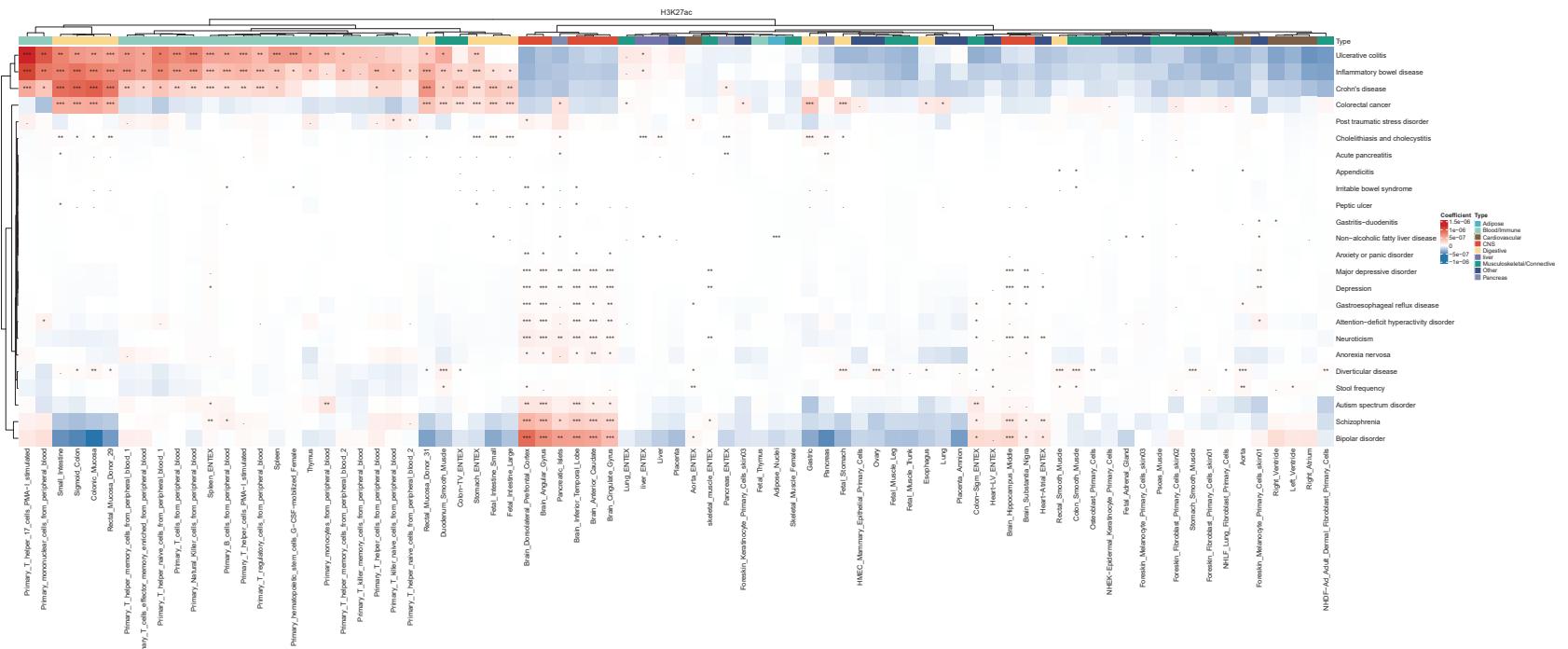
Supplementary Figure 5



Supplementary Figure 6

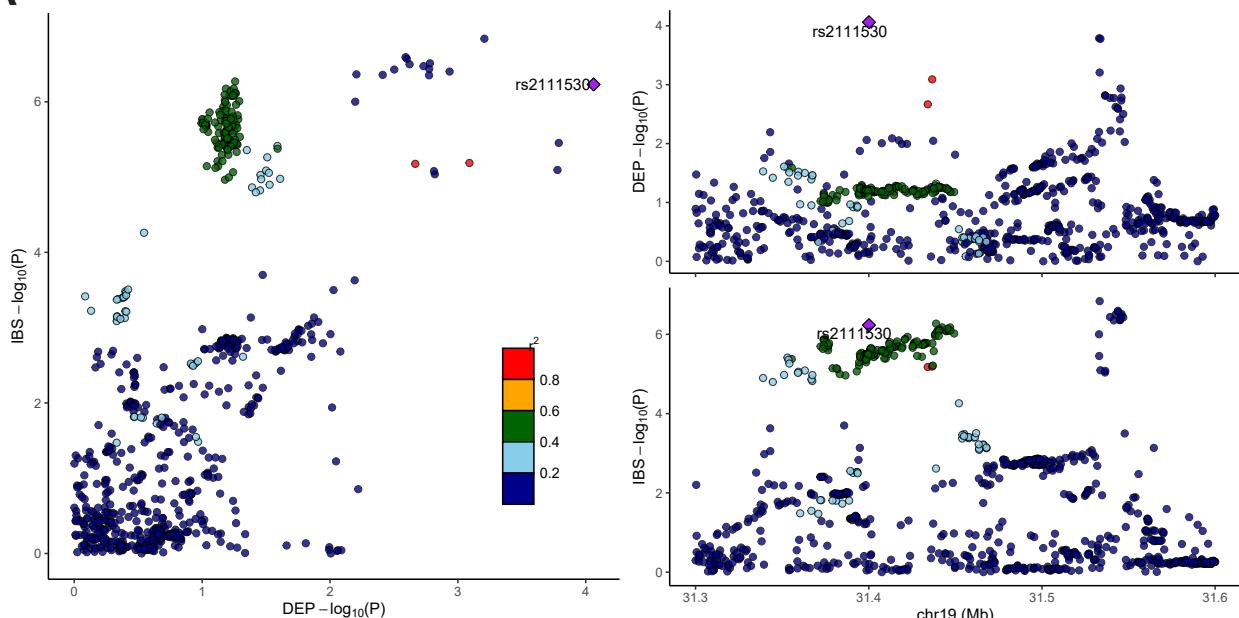
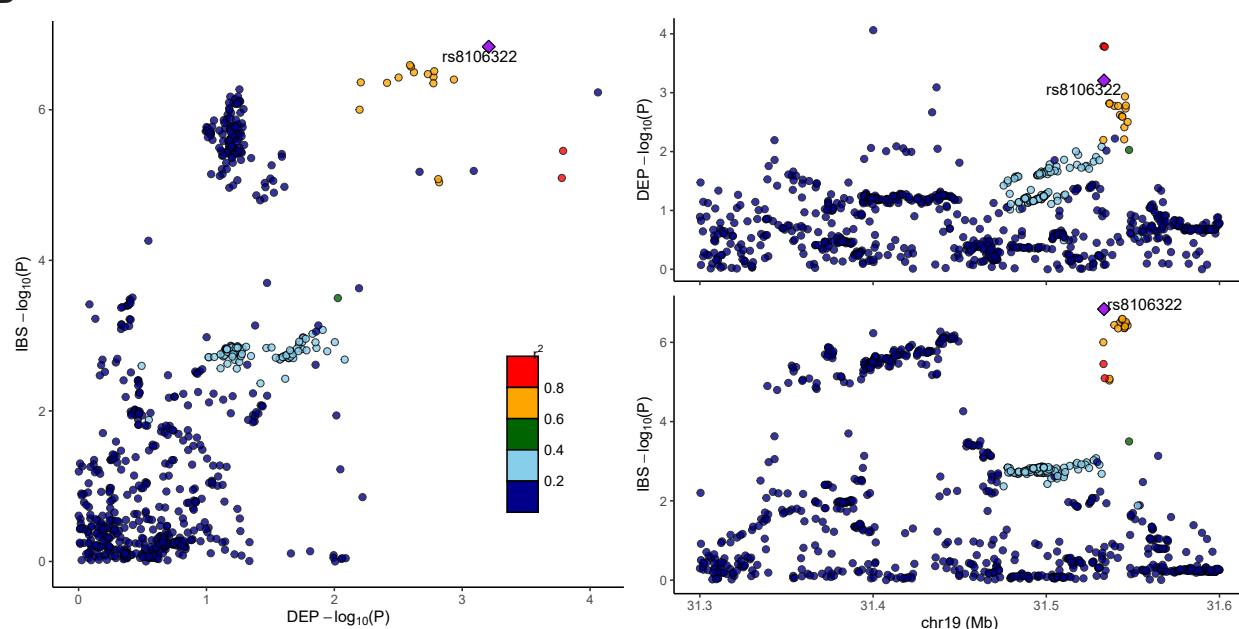


Supplementary Figure 7



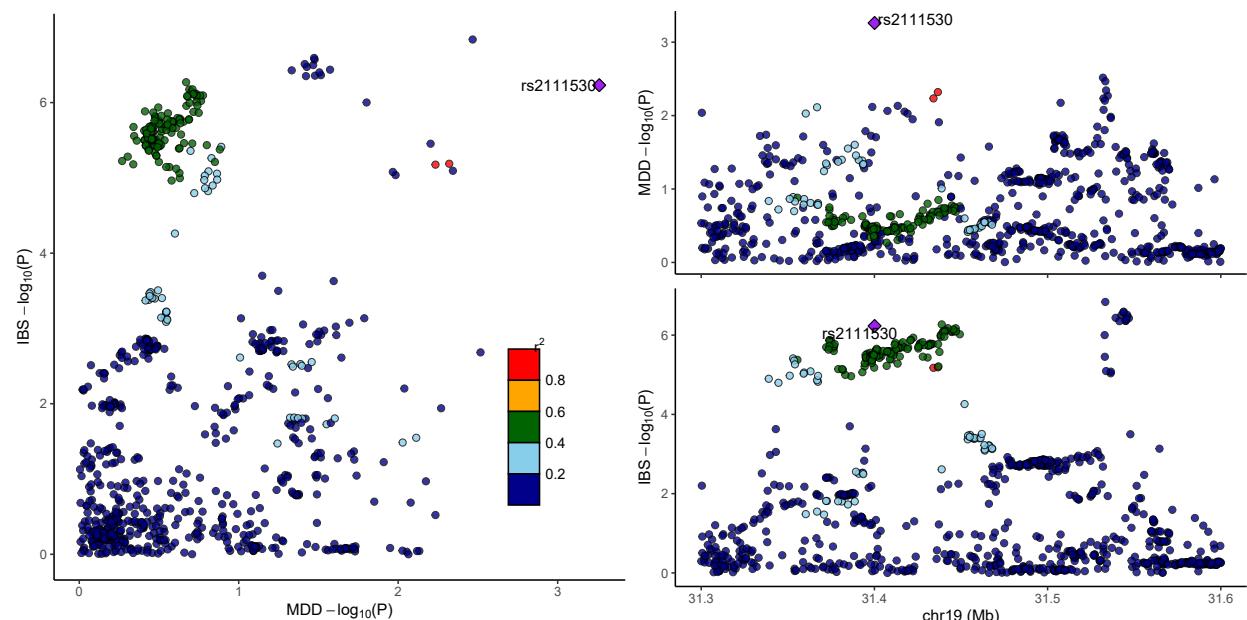
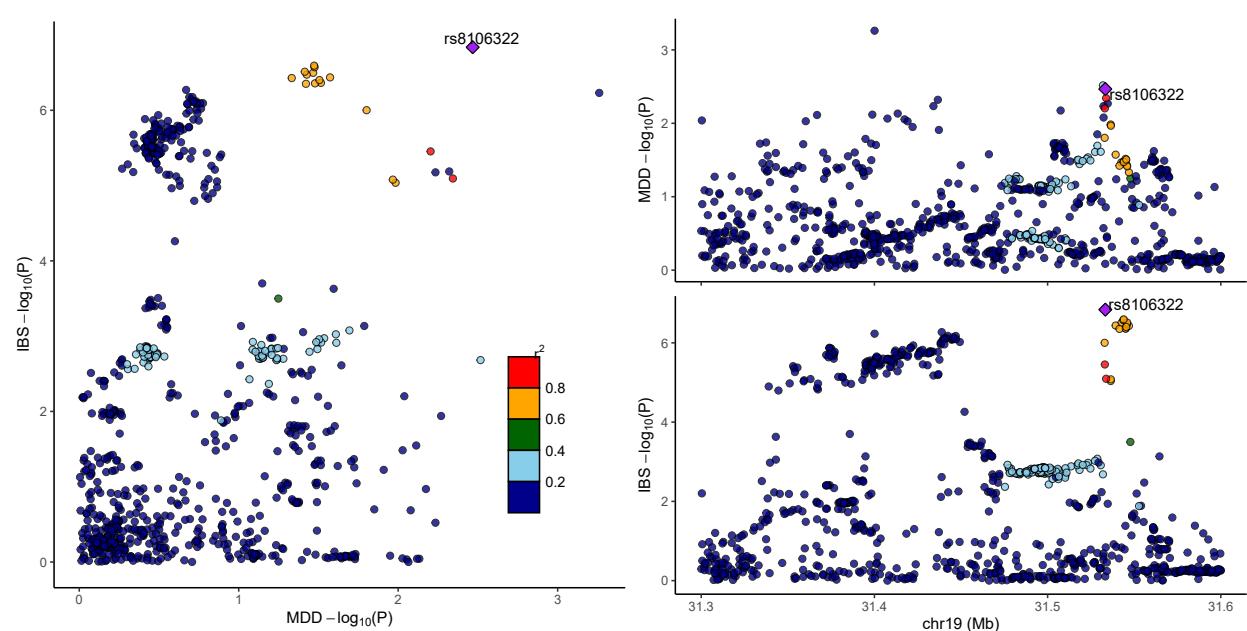
Supplementary Figure 8



A**B**

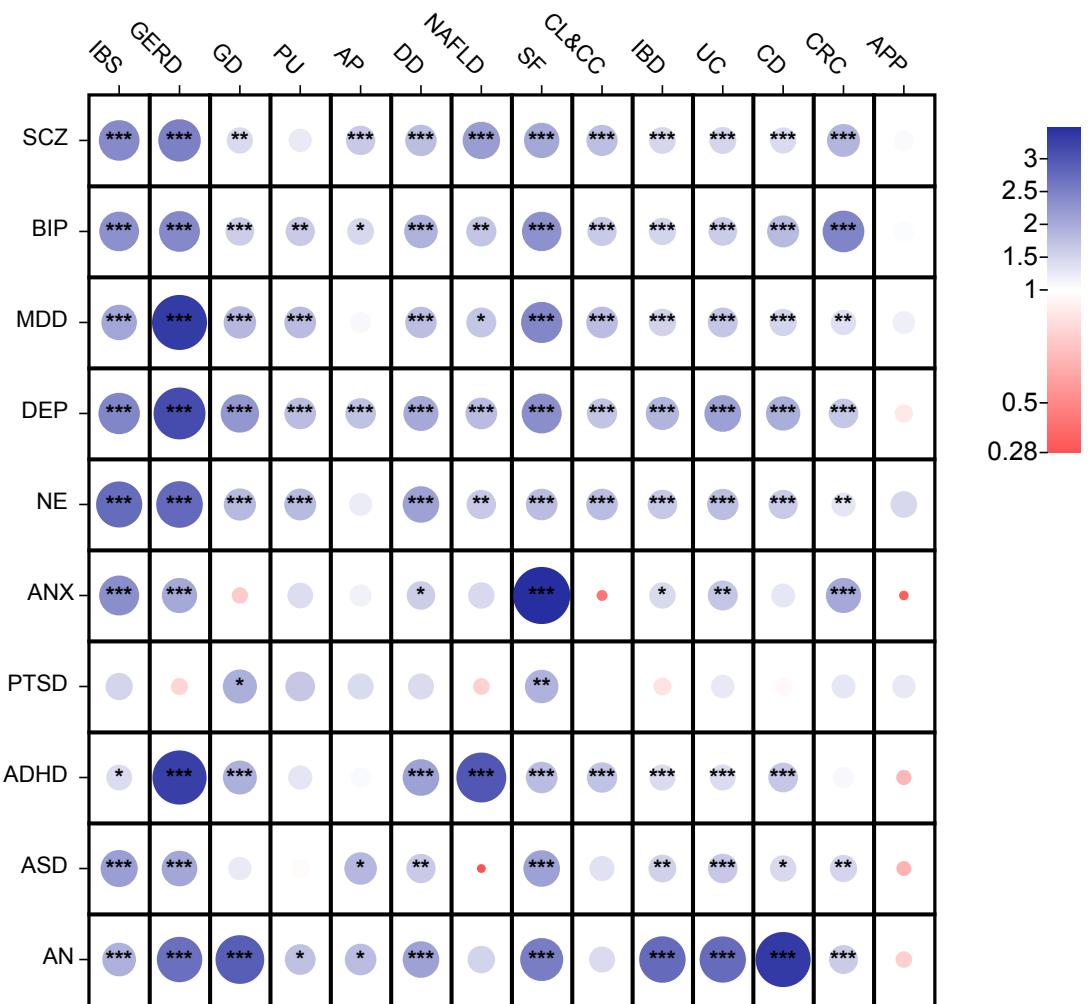
Supplementary Figure 9. The regional plots near rs2111530 (A) and rs8106322 (B) for IBS and DEP using LocusZoom.

(A) novel locus rs2111530 in IBS and DEP. (B) novel locus rs8106322 in IBS and DEP. Purple diamond indicates the lead SNP, and circles represent the other SNPs in the region, with coloring from the linkage disequilibrium (r^2 , based on the 1000 Genomes Project Europeans) between each SNP and the lead SNP. IBS, irritable bowel syndrome; DEP, depression.

A**B**

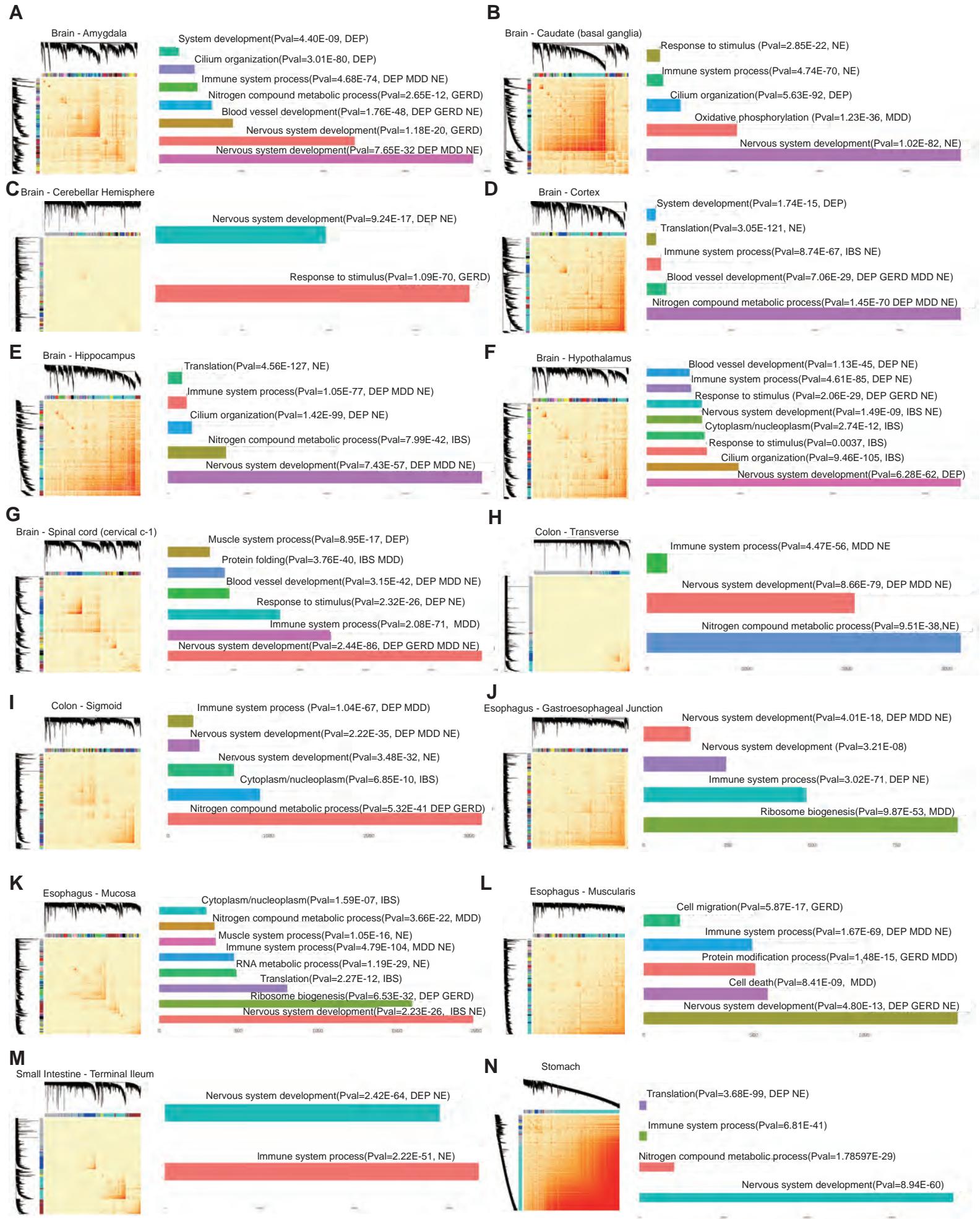
Supplementary Figure 10. The regional plots near rs2111530 (A) and rs8106322 (B) for IBS and MDD using LocusZoom.

(A) novel locus rs2111530 in IBS and DEP. (B) novel locus rs8106322 in IBS and MDD. Purple diamond indicates the lead SNP, and circles represent the other SNPs in the region, with coloring from the linkage disequilibrium (r^2 , based on the 1000 Genomes Project Europeans) between each SNP and the lead SNP. IBS, irritable bowel syndrome; MDD, major depressive disorder.



Supplementary Figure 11. Gene set enrichment analysis of the overlapping genes detected by MAGMA between ten psychiatric disorders and 14 Digestive Diseases.

Gene set enrichment of the overlapping genes between trait-pairs is evaluated by Fisher's Exact test, with significant enrichment marked by an asterisk (FDR < 0.05). The shading of each circle indicates enrichment (blue) or depletion (red), with the intensity of the shading varying according to the magnitude of OR value. *FDR < 0.05, **FDR < 0.01, ***FDR < 0.001 .



Supplementary Figure 12. Topological overlap matrix (TOM) plots for seven brain tissues and seven digestive tract tissues.

The color bars at the right side of each plot show module color and size with their enriched GO functions and enriched disorders/diseases. The most closely related three psychiatric disorders and three digestive disorders selected based on genetic correlation analysis. The scale at the bottom right of each plot represents the module size. GO terms' p-values are shown in parentheses.