

**Supplementary Table S1.** Characteristic information of 33 types of cancer included in this study.

| Abbreviation | Full name  | Number of samples |        |
|--------------|--|-------------------|--------|
|              |  | Tumor             | Normal |
| ACC          | Adrenocortical carcinoma   | 77                | 0      |
| BLCA         | Bladder urothelial carcinoma                                     | 407               | 19     |
| BRCA         | Breast invasive carcinoma  | 1098              | 113    |
| CESC         | Cervical squamous cell carcinoma and endocervical adenocarcinoma | 306               | 3      |
| CHOL         | Cholangiocarcinoma   | 36                | 9      |
| COAD         | Colon adenocarcinoma   | 288               | 41     |
| DLBC         | Lymphoid neoplasm diffuse large B-cell lymphoma                  | 47                | 0      |
| ESCA         | Esophageal carcinoma   | 182               | 13     |
| GBM          | Glioblastoma multiforme  | 165               | 0      |
| HNSC         | Head and neck squamous cell carcinoma                            | 520               | 44     |
| KICH         | Kidney chromophobe   | 66                | 25     |
| KIRC         | Kidney renal clear cell carcinoma                                | 531               | 72     |
| KIRP         | Kidney renal papillary cell carcinoma                            | 289               | 32     |
| LAML         | Acute myeloid leukemia   | 173               | 0      |
| LGG          | Brain lower-grade glioma   | 522               | 0      |
| LIHC         | Liver hepatocellular carcinoma                                   | 371               | 50     |
| LUAD         | Lung adenocarcinoma  | 515               | 59     |
| LUSC         | Lung squamous cell carcinoma                                     | 498               | 50     |
| MESO         | Mesothelioma   | 87                | 0      |
| OV           | Ovarian serous cystadenocarcinoma                                | 427               | 0      |
| PAAD         | Pancreatic adenocarcinoma  | 179               | 4      |
| PCPG         | Pheochromocytoma and paraganglioma                               | 182               | 3      |
| PRAD         | Prostate adenocarcinoma  | 496               | 52     |
| READ         | Rectum adenocarcinoma  | 92                | 10     |
| SARC         | Sarcoma  | 262               | 2      |
| SKCM         | Skin cutaneous melanoma  | 496               | 1      |
| STAD         | Stomach adenocarcinoma   | 414               | 36     |
| TGCT         | Testicular germ cell tumors                                      | 137               | 0      |
| THCA         | Thyroid carcinoma  | 512               | 59     |
| THYM         | Thymoma  | 119               | 2      |
| UCEC         | Uterine corpus endometrial carcinoma                             | 181               | 13     |
| UCS          | Uterine carcinosarcoma   | 57                | 0      |
| UVM          | Uveal melanoma   | 79                | 0      |
| Total        |  | 9784              | 712    |