Supplementary Table S1. The roles of involved genes in breast cancer.

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| Gene | Involved pathway/roles | References |
| *TP53* | p53 signaling , Hereditary signaling, DNA damage response | [1-3] |
| *HER2/ERBB2* | HER-2 Signaling | [4] |
| *CCND1* | Estrogen signaling, p53 signaling | [5,6] |
| *FGFR1* | PTEN signaling, Epithelial-Mesenchymal Transition | [7,8] |
| *BRCA1* | Hereditary signaling, DNA damage response, p53 signaling | [9-11] |
| *BRCA2* | Hereditary signaling, DNA damage response | [10,11] |
| *BRCA3* | Hereditary signaling | [9,12] |
| *PTEN* | Hereditary signaling, p53 signaling, PTEN signaling | [3] |
| *ATM* | DNA damage response, Epithelial-Mesenchymal Transition | [13] |
| *MSH2* | DNA damage repair | [14,15] |
| *MLH1* | DNA damage response | [16] |
| *PMS1* | DNA mismatch repair | [15] |
| *MSH3* | DNA mismatch repair | [15] |
| *CDH1* | Epithelial-Mesenchymal Transition | [3] |
| *HRAS* | mTOR Signaling, Epithelial-Mesenchymal Transition | [17,18] |
| *NRAS* | Epithelial-Mesenchymal Transition | [17,18] |
| *KRAS* | mTOR Signaling, Epithelial-Mesenchymal Transition | [17,18] |
| *BIRC5* | p53 signaling | [19] |
| *EGFR* | Estrogen signaling, HER-2 Signaling, Epithelial-Mesenchymal Transition, | [20,21] |
| *EMSY* | BRCA2 impairment | [22] |
| *ESR1* | Estrogen signaling | [23] |
| *HIF1A* | mTOR Signaling, Epithelial-Mesenchymal Transition | [24,25] |
| *IGF1R* | Estrogen signaling | [26] |
| *MYC* | Estrogen-mediated S-phase Entry | [27] |
| *NOTCH1* | Epithelial-Mesenchymal Transition | [17] |
| *PIK3CA* | Estrogen signaling, HER-2 Signaling, p53 signaling, mTOR Signaling | [28,29] |
| *RARB* | Epithelial-Mesenchymal Transition, Wnt/β-catenin signaling | [17,30] |
| *RASSF1* | Tumorigenesis signaling | [31] |
| *SRC* | Estrogen signaling | [32] |
| *TOP2A* | Cell Cycle G2/M DNA Damage Checkpoint Regulation | [33] |
| *TWIST1* | Epithelial-Mesenchymal Transition | [17] |
| *BARD1* | DNA damage response | [34] |
| *BRIP1* | DNA damage response | [35] |
| *CHEK2* | DNA damage response, p53 signaling | [36,37] |
| *NBN* | DNA damage response | [38] |
| *NF1* | DNA damage response | [39] |
| *PALB2* | DNA damage response | [40] |
| *RAD51C* | DNA homologous recombination, DNA damage repair | [41] |
| *RAD51D* | DNA homologous recombination, DNA damage repair | [41] |
| *STK11* | mTOR Signaling | [3,42] |

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