| No. | Cancer type   | Treatment line | PARP inhibitors | PD-1 inhibitors | combined therapy        | cycles |
|-----|---------------|----------------|----------------|-----------------|-------------------------|--------|
| 1   | Pancreatic cancer | 2              | olaparib 400mg bid | pembrolizumab 200mg/3w | cisplatin120mg/3w | 5      |
| 2   | NSCLC         | 5              | olaparib 400mg bid | nivolumab 240mg/2w | cisplatin120mg/3w | 6      |
| 3   | NSCLC         | 4              | olaparib 400mg bid | nivolumab 240mg/2w | 2                        |        |
| 4   | SCLC          | 2              | olaparib 400mg bid | nivolumab 240mg/2w | 3                        |        |
| 5   | SCLC          | 1              | olaparib 300mg bid | pembrolizumab 200mg/3w | etoposide 200/200/100mg day1-3 + cisplatin120mg/3w* 6 cycles | 10     |
| 6   | Endometrial carcinoma | 4              | olaparib 300mg bid | pembrolizumab 200mg/3w | cisplatin120mg/3w | 4      |
| 7   | Cervical carcinoma | 2              | olaparib 300mg bid | nivolumab 140mg/2w | 4                        |        |
| 8   | Cholangiocarcinoma | 3              | olaparib 300mg bid | pembrolizumab 200mg/3w | 2                        |        |
| 9   | SCLC          | 5              | olaparib 300mg bid | pembrolizumab 200mg/3w | 2                        |        |
| 10  | NSCLC         | 3              | olaparib 400mg bid | nivolumab 240mg/2w | 4                        |        |
| 11  | SCLC          | 2              | olaparib 300mg bid | pembrolizumab 200mg/3w | 10                       |        |
| 12  | SCLC          | 2              | olaparib 300mg bid | pembrolizumab 200mg/3w | cisplatin 100mg/3w | 1      |
| 13  | Prostate cancer | 4              | olaparib 300mg bid | pembrolizumab 200mg/3w | albumin-binding paclitaxel 100mg/3w | 3      |
| 14  | SCLC          | 3              | olaparib 300mg bid | pembrolizumab200mg/3w | cisplatin120mg/3w | 6      |
| 15  | Sarcoma       | 1              | olaparib 300mg bid | pembrolizumab200mg/3w | 6                        |        |
| 16  | NSCLC         | 6              | olaparib 300mg bid | pembrolizumab 200mg/3w | 2                        |        |
| 17  | Cholangiocarcinoma | 1              | olaparib 300mg bid | pembrolizumab 100mg/3w | oxaliplatin150mg/3w*6 cycles | 10     |
| 18  | NSCLC         | 3              | olaparib 300mg bid | pembrolizumab 200mg/3w | cisplatin120mg/3w*6 cycles | 10     |
| 19  | Pancreatic cancer | 1              | olaparib 300mg bid | pembrolizumab 200mg/3w | cisplatin110mg/3w | 4      |
| 20  | NSCLC         | 5              | olaparib 300mg bid | pembrolizumab 200mg/3w | cisplatin 120mg/3w | 4      |
| 21  | Prostate cancer | 3              | olaparib 300mg bid | nivolumab 240mg/2w | 8                        |        |
| 22  | Cholangiocarcinoma | 3              | olaparib 300mg bid | pembrolizumab 200mg/3w | oxaliplatin150mg/3w | 6      |
| 23  | NSCLC         | 3              | niraparib 300mg qd | pembrolizumab 200mg/3w | cisplatin 100mg/3w | 5      |
| No. | Diagnosis             | Dose of Olaparib | Dose of Pembrolizumab | Dose of Cisplatin | No. of Cycles |
|-----|-----------------------|------------------|-----------------------|-------------------|--------------|
| 24  | SCLC                  | 300mg bid        | 200mg/3w              | 110mg/3w          | 4            |
| 25  | NSCLC                 | 300mg bid        | 200mg/3w              |                   | 16           |
| 26  | Fallopian tube cancer | 300mg qd         | 200mg/3w              | 100mg/3w          | 6            |
| 27  | Pancreatic cancer     | 300mg bid        | 200mg/3w              | oxaliplatin 250mg/3w | 4   |
| 28  | Sarcoma               | 300mg bid        | 200mg/3w              | albumin-binding paclitaxel 200mg/3w | 2   |
| 29  | NSCLC                 | 300mg bid        | 200mg/3w              |                   | 10           |
| 30  | NSCLC                 | 300mg bid        | 200mg/3w              | cisplatin 50mg/3w | 6            |
| 31  | Fallopian mesothelioma| 300mg qd         | 200mg/3w              |                   | 6            |
| 32  | NSCLC                 | 300mg bid        | 200mg/3w              | cisplatin 70mg/3w | 6            |
| 33  | Endometrial carcinoma | 300mg bid        | nivolumab 240mg/2w    |                   | 4            |
| 34  | Pancreatic cancer     | 300mg bid        | 200mg/3w              |                   | 18           |
| 35  | Breast cancer         | 300mg bid        | pembrolizumab 200mg/3w| bevacizumab 500mg/3w | 20   |
| 36  | NSCLC                 | 300mg bid        | nivolumab 200mg/3w    | cisplatin 100mg/3w*6 cycles | 14   |
| 37  | Ovarian cancer        | 300mg qd         | pembrolizumab 200mg/3w| cisplatin 60mg/3w*6 cycles | 14   |
| 38  | NSCLC                 | 300mg bid        | pembrolizumab 200mg/3w|                   | 20           |
| 39  | Ovarian cancer        | 300mg bid        | pembrolizumab 200mg/3w| bevacizumab 300mg/3w | 20   |
| 40  | SCLC                  | 300mg bid        | pembrolizumab 200mg/3w|                   | 18           |

**Supplementary Table 1** The detailed regimens of 40 patients receiving PARPi/anti-PD-1 therapy.

NSCLC, non-small cell lung cancer; SCLC, small cell lung cancer.
| Clinical factors         | P values for ORR Univariable | P values for ORR Multivariable | P values for DCR Univariable | P values for DCR Multivariable | P values for PFS Univariable | P values for PFS Multivariable | P values for OS Univariable | P values for OS Multivariable |
|-------------------------|-----------------------------|-------------------------------|-------------------------------|-------------------------------|-------------------------------|-------------------------------|-------------------------------|-------------------------------|
| gender                  | 0.396                       | 0.926                         | 0.764                         | 0.494                         |                               |                               |                               |                               |
| Age                     | 0.138                       | 0.526                         | 0.845                         | 0.677                         |                               |                               |                               |                               |
| Smoking history         | 0.629                       | 0.624                         | 0.924                         | 0.754                         |                               |                               |                               |                               |
| ECOG                    | 0.08                        | 0.328                         | 0.33                          | 0.000                         | 0.001                         | 0.02                          | 0.028                         |
| Metastasis number       | 0.105                       | 0.05                          | 0.146                         | 0.001                         | 0.086                         | 0.068                         | 0.694                         |
| BRCA mutation status    | 0.002                       |                               | 0.008                         |                               | 0.026                         | 0.059                         |                               |
| PD-L1 expression        | 0.135                       | 0.074                         | 0.819                         | 0.967                         | 0.102                         | 0.952                         | 0.188                         | 0.896                         |
| TMB                     | 0.118                       |                               | 0.045                         |                               | 0.416                         | 0.702                         | 0.734                         | 0.876                         |
| Treatment line          | 0.253                       |                               | 0.232                         |                               | 0.074                         | 0.258                         | 0.666                         |
| Combined therapy        | 0.174                       |                               | 0.261                         |                               | 0.696                         |                               | 0.919                         |
| Lymphocyte number       | 0.53                        |                               | 0.41                          |                               | 0.151                         | 0.041                         | 0.031                         | 0.003                         |
| LDH                     | 0.105                       | 0.012                         |                               |                               | 0.018                         | 0.072                         | 0.041                         | 0.052                         | 0.026                         |

**Supplementary Table 2** Analysis of factors affecting the efficacy and outcomes of PARPi/anti-PD-1 therapy

ORR, objective response rate; DCR, disease control rate; PFS, progression-free survival; OS, overall survival; ECOG, Eastern Cooperative Oncology Group; BRCA, breast cancer susceptibility gene; PD-L1, programmed death-ligand 1; TMB, tumor mutation burden; LDH, Lactate dehydrogenase.
### Supplementary Table 3 Biomarker-based efficacy analysis of PARPi/anti-PD-1 therapy.

ORR, objective response rate; DCR, disease control rate; BRCA, breast cancer susceptibility gene; LDH, Lactate dehydrogenase.

| Biomarker       | ORR No.(%)[95%CI] | P values | Biomarker       | DCR No.(%)[95%CI] | P values |
|-----------------|-------------------|----------|-----------------|-------------------|----------|
| BRCA+           | 60.0 (32.3-83.7)  | 0.002    | BRCA+           | 93.3 (68.1-99.8)  | 0.381    |
| BRCA-           | 8.0 (1.0-26.0)    |          | BRCA-           | 80.0 (59.3-93.2)  |          |
| TMB<10m/Mb      | 19.2 (6.6-39.4)   | 0.147    | LDH<250U/L      | 96.4 (81.7-99.9)  | 0.006    |
| TMB≥10m/Mb      | 42.9 (17.7-71.1)  |          | LDH≥250U/L      | 58.3 (27.7-84.8)  |          |

### Supplementary Table 4 ΔTMB of before and after-treatment in blood samples-available population

TMB, tumor mutation burden; ΔTMB=TMB₂-TMB₁.

| Patient number | TMB₁ | TMB₂ | ΔTMB | efficacy |
|----------------|------|------|------|----------|
| 1              | 0.00 | 1.08 | 1.08 | PD       |
| 2              | 6.45 | 8.608| 2.15 | PD       |
| 3              | 2.15 | 2.15 | 0.00 | SD       |
| 4              | 1.08 | 9.68 | 8.60 | SD       |
| 5              | 8.60 | 7.52 | -1.08| PD       |
| 6              | 6.45 | 6.45 | 0.00 | SD       |
| 7              | 19.35| 20.43| 1.08 | PR       |
| 8              | 0.00 | 2.15 | 2.15 | PR       |
| 9              | 7.53 | 0.00 | -7.53| SD       |
| 10             | 8.60 | 7.52 | -1.08| SD       |
| 11             | 0.00 | 2.15 | 2.15 | PR       |
| 12             | 1.08 | 3.23 | 2.15 | PD       |
| 13             | 10.75| 10.75| 0.00 | SD       |
| 14             | 7.53 | 0.00 | -7.53| SD       |
| 15             | 4.30 | 9.68 | 5.38 | PR       |
| 16             | 16.13| 15.05| -1.08| PR       |
| 17             | 3.23 | 1.08 | -2.15| PR       |
| 18             | 2.15 | 2.15 | 0    | SD       |
| Characteristic             | PARPi/ICI/chemotherapy (n=22) | PARPi/ICI (n=18) | P value |
|---------------------------|-------------------------------|-----------------|---------|
| Age, n (%)                |                               |                 | 0.173   |
| <65                       | 18 (81.8)                     | 11 (61.1)       |         |
| ≥65                       | 4 (28.2)                      | 7 (38.9)        |         |
| Gender, n (%)             |                               |                 |         |
| Male                      | 13 (59.1)                     | 13 (72.2)       | 0.510   |
| Female                    | 9 (40.9)                      | 5 (21.8)        |         |
| ECOG, n (%)               |                               |                 |         |
| 0–1                       | 17 (77.3)                     | 10 (55.6)       | 0.185   |
| ≥2                        | 5 (22.7)                      | 8 (44.4)        |         |
| Smoking history, n (%)    |                               |                 |         |
| Current or former         | 14 (63.6)                     | 9 (50.0)        | 0.523   |
| Never                     | 8 (36.4)                      | 9 (50.0)        |         |
| Metastasis number, n (%)  |                               |                 |         |
| Number<3                  | 16 (72.7)                     | 12 (66.7)       | 0.738   |
| Number≥3                  | 6 (27.3)                      | 6 (33.3)        |         |
| BRCA status, n (%)        |                               |                 |         |
| Mutation                  | 10 (45.5)                     | 5 (27.8)        | 0.332   |
| Wild-type                 | 12 (54.5)                     | 13 (72.2)       |         |
| PD-L1 expression, n (%)   |                               |                 |         |
| <1%                       | 15 (68.2)                     | 10 (55.6)       | 0.517   |
| ≥1%                       | 7 (31.8)                      | 8 (44.4)        |         |
| TMB, n (%)                |                               |                 |         |
| <10m/Mb                   | 15 (68.2)                     | 11 (61.1)       | 0.744   |
| ≥10m/Mb                   | 7 (31.8)                      | 7 (38.9)        |         |
| Lymphocyte number, n (%)  |                               |                 |         |
| <0.8*10^9/L               | 9 (40.9)                      | 5 (27.8)        | 0.510   |
| ≥0.8*10^9/L               | 13 (59.1)                     | 13 (72.2)       |         |
| LDH, n (%)                |                               |                 |         |
| <250U/L                   | 15 (68.2)                     | 13 (72.2)       | 1.000   |
| ≥250U/L                   | 7 (31.8)                      | 5 (27.8)        |         |

**Supplementary Table 5** Clinical characteristics of chemotherapy-based subgroups

ECOG, Eastern Cooperative Oncology Group; BRCA, breast cancer susceptibility gene; PD-L1, programmed death-ligand 1; TMB, tumor mutation burden; LDH, Lactate dehydrogenase.
Supplementary Figure 1 PD-L1-based subgroup analysis of PFS (a) and OS (b)

Supplementary Figure 2 Chemotherapy-based subgroup analysis of PFS (a) and OS (b)

Supplementary Figure 3 Duration of response in efficacy-evaluable population.