

CO226

Systematic Literature Review of First-Line Treatments of Patients With Advanced or Metastatic HER2-Positive Gastroesophageal Adenocarcinoma

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Background

- Gastroesophageal adenocarcinoma (GEA) is a subset of gastroesophageal carcinoma (GEC) that comprises adenocarcinomas arising in the stomach (gastric), esophagus, and gastroesophageal junction (GEJ). By anatomical subtype, an estimated 95% of gastric cancers and 65% of esophageal/GEJ cancers are adenocarcinomas<sup>1,2</sup>
- At an advanced or metastatic stage, they are considered sufficiently similar to be grouped together for treatment recommendations in clinical guidelines<sup>3</sup>
- Approximately 20% of patients with GEA have human epidermal growth factor receptor 2 (HER2)-positive tumors. Since 2010, the first-line treatment of choice for HER2-positive GEA has been a combination of platinum-based chemotherapy and trastuzumab/pembrolizumab
- The increasing incidence of GEA over time, along with recent developments in HER2-positive GEA, makes it pertinent to assess the clinical evidence and inform future comparative effectiveness research for innovative treatments in patients with this disease

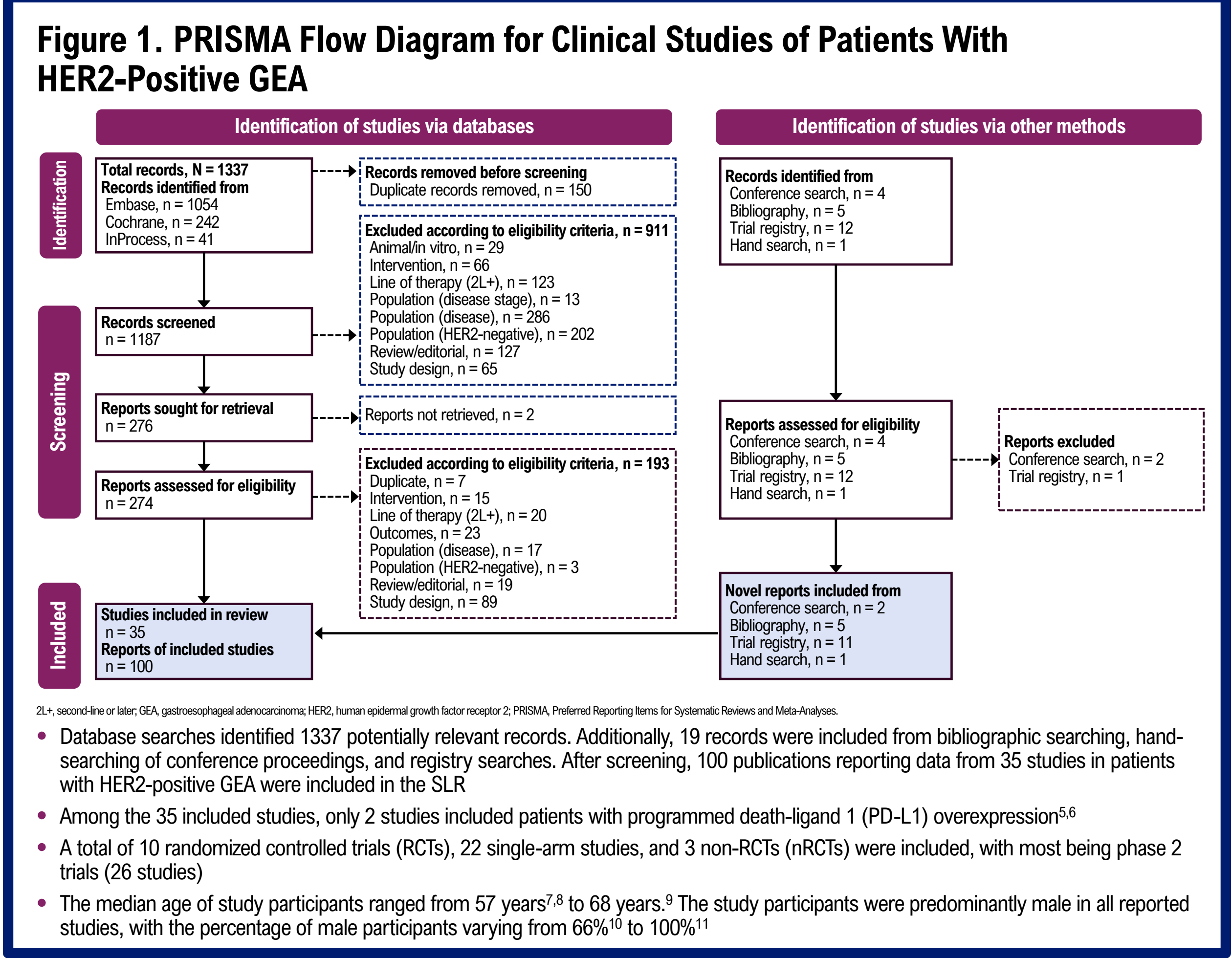
Objective

- To summarize the available evidence on clinical efficacy and safety among treatment-naïve patients with unresectable/inoperable advanced or metastatic HER2-positive GEA to inform future pharmacoeconomic research

Methods

- The systematic literature review (SLR) followed the Cochrane and Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) standards<sup>4</sup>
- A systematic literature search was conducted from the start of the database to the cutoff date of August 16, 2024, covering Embase, MEDLINE, MEDLINE In-Process, and the Cochrane Library. Additionally, bibliographic searching, hand searching of conference proceedings (2022–2024), and registry searches were also conducted
- The literature search results were screened according to the predefined inclusion criteria, first by title and abstract, and then by full text
- Screening (both title/abstract and full text) was performed by two independent reviewers, and any discrepancies were resolved by a third independent reviewer
- Studies included from the full-text screening were extracted into predefined extraction grids by a single reviewer, and all extractions were verified against the original sources by a second reviewer

Results



| Table 1. OS and PFS Data for Patients With HER2-Positive GEA in RCTs |  |  |                          |             |                           |                  |                            |                  |
|--|--|--|--------------------------|-------------|---------------------------|------------------|----------------------------|------------------|
| Study  | Study Setting                                    | Intervention                                     | Median Follow-Up, Months | Evaluable N | OS Estimates              |                  | PFS Estimates              |                  |
|  |  |  |                          |             | Median OS (95% CI) Months | HR (95% CI)      | Median PFS (95% CI) Months | HR (95% CI)      |
| Li 2024 <sup>8</sup>   | Phase 2, double-blind, multicenter               | HLX22 25 mg/kg + HLX02 + CAPOX                   | 14.3                     | 18          | Not reached (12.4–NE)     | 0.4 (0.13–1.45)  | 15.1 (6.8–NE)              | 0.50 (0.17–1.27) |
|  |  | HLX22 15 mg/kg + HLX02 + CAPOX                   | 14.3                     | 17          | Not reached (NE–NE)       | 0.3 (0.09–1.26)  | Not reached (8.8–NE)       | 0.10 (0.04–0.52) |
|  |  | Placebo + HLX02 + CAPOX                          | 14.3                     | 18          | Not reached (6.4–NE)      | Reference        | 8.2 (5.7–12.7)             | Reference        |
| Janjigian 2023 (KEYNOTE-811) <sup>5</sup>                            | Phase 3, double-blind, multicenter international | Pembrolizumab + trastuzumab + chemo              | 56                       | 350         | 20 (17.8–22.1)            | 0.90 (0.67–0.94) | 10 (8.6–12.2)              | 0.73 (0.61–0.87) |
|  |  | Placebo + trastuzumab + chemo                    | 56                       | 348         | 16.8 (14.9–18.7)          |                  | 8.1 (7.0–8.5)              |                  |
| Tabernero 2023 (JACOB) <sup>12</sup>                                 | Phase 3, double-blind, multicenter international | Trastuzumab + trastuzumab + chemo                | OS: 46.1<br>PFS: 50.4    | 388         | 18.1 (16.2–19.5)          | 0.85 (0.72–0.99) | 8.5 (8.3–9.7)              | 0.73 (0.62–0.85) |
|  |  | Placebo + trastuzumab + chemo                    | OS: 44.4<br>PFS: 47.4    | 392         | 14.2 (12.9–15.7)          |                  | 7.2 (6.4–8.2)              |                  |
| Stein 2022 (INTEGA) <sup>6</sup>                                     | Phase 2, open-label, multicenter                 | Trastuzumab + nivolumab + ipilimumab             | 18.8                     | 44          | 23.3                      | NR               | 3.2                        | NR               |
|  |  | Trastuzumab + nivolumab + FOLFOX                 | 18.8                     | 44          | 22.1                      |                  | 10.7                       |                  |
| Zhao 2022 (SYLT/FNF-004) <sup>13</sup>                               | Phase 2, open-label, multicenter                 | ivPOF  | 41                       | 3           | NR                        | 0.50 (0.11–2.31) | NR                         | 0.50 (0.11–2.31) |
|  |  | mFOLFOXp   | 41                       | 4           | NR                        | 0.17 (0.03–1.06) | NR                         | 0.10 (0.02–0.66) |
| Shah 2017 (HELIOSE) <sup>14</sup>                                    | Phase 2, double-blind, multicenter international | High-dose trastuzumab + capecitabine + cisplatin | NR                       | 124         | 10.61 (9.4–12.42)         | 1.24 (0.86–1.78) | 5.6                        | 1.04 (0.76–1.40) |
|  |  | SoC trastuzumab + capecitabine + cisplatin       | NR                       | 124         | 12.48 (10.8–13.86)        |                  | 5.7                        |                  |
| Hecht 2016 (TRIO-013/LOGIC) <sup>15</sup>                            | Phase 3, double-blind, multicenter               | CAPOX + lapatinib                                | 23                       | 272         | 11.9 (10.4–13.8)          | 0.91 (0.74–1.10) | 6 (5.6–7.0)                | 0.82 (0.68–1.00) |
|  |  | CAPOX + placebo                                  | 23                       | 273         | 10.4 (9.1–11.3)           |                  | 5.4 (4.4–5.7)              |                  |
| Bang 2010 (ToGA) <sup>16</sup>                                       | Phase 3, open-label, multicenter international   | Trastuzumab + fluoropyrimidine + cisplatin       | 18.6                     | 294         | 13.8 (12–16)              | 0.74 (0.60–0.91) | 6.7 (6–8)                  | 0.71 (0.59–0.85) |
|  |  | Chemo  | 18.6                     | 290         | 11.1 (10–13)              |                  | 5.5 (5–6)                  |                  |

- A summary of overall survival (OS) and progression-free survival (PFS) data was reported in 8 of the 10 included RCTs
  - Since the pivotal trastuzumab trial (ToGA), only 1 RCT has met its primary endpoint, for the combination of pembrolizumab, trastuzumab, and chemotherapy compared to placebo, trastuzumab, and chemotherapy<sup>5</sup>
  - Among the included single-arm studies or nRCTs, 23 studies reported data for OS evaluating trastuzumab in combination with chemotherapy or other targeted agents
    - A study of chemotherapy-only regimens reported the median OS of patients receiving modified docetaxel, cisplatin, and 5-fluorouracil (mDCF) to be 24.9 months<sup>17</sup>
    - Among the studies investigating HER2-targeted therapies without immuno-oncology (IO) products, median OS ranged from 6.3 months with lapatinib + capecitabine<sup>18</sup> to 36.5 months with zanidatamab + standard chemotherapy<sup>19</sup>
      - The OS rates were also particularly high for zanidatamab + standard chemotherapy, reaching 87% at 12 months, 65% at 24 months, and 59% at 30 months<sup>19</sup>
    - Among 3 studies that assessed IO-containing regimens + HER2-targeted therapy, median OS ranged from 19.3 months (global phase 3)<sup>20</sup> to 27.3 months (phase 1b/2 in Korea)<sup>21</sup> for pembrolizumab + trastuzumab with chemotherapy while the OS was not reached for the third study, as of December 20, 2021, with the combination of nivolumab, trastuzumab, oxaliplatin and the fluoropyrimidine derivative S1 (tegafur, gimeracil, oteracil potassium)/capecitabine<sup>22</sup>
  - Among single-arm studies or nRCTs, 24 reported data for PFS evaluating trastuzumab with chemotherapy or other targeted agents
    - A study of chemotherapy-only regimens reported the median PFS of patients receiving mDCF to be 13 months<sup>17</sup>
    - Among the studies investigating HER2-targeted therapies without an IO product, median PFS ranged from 4.3 months with lapatinib + capecitabine<sup>18</sup> to 14 months with capecitabine and oxaliplatin (CAPOX) + bevacizumab + trastuzumab.<sup>23</sup> A median PFS of 12.5 months was reported for zanidatamab + standard chemotherapy over a median follow-up of 48 months<sup>19</sup>
    - In IO-containing regimens, often combined with HER2-targeted therapy, median PFS ranged from 8.6 months for pembrolizumab + trastuzumab with capecitabine and cisplatin<sup>20</sup> to 16.7 months with the combination of zanidatamab, tislelizumab (an anti-programmed cell death protein 1 [PD-1] immune checkpoint inhibitor), and CAPOX<sup>24</sup>
  - Overall response rate (ORR) was reported in 9 RCTs and ranged from 34% with trastuzumab + nivolumab + ipilimumab<sup>6</sup> to 82.4% with HLX22 + HLX02 + CAPOX<sup>8</sup>
  - ORR was also reported in 23 single-arm studies and nRCTs, with results varying across different treatment combinations from 13% with lapatinib + capecitabine<sup>18</sup> to 93.8% observed with trastuzumab + docetaxel/cisplatin/S1<sup>25</sup>
  - Duration of response (DOR) was reported in 6 RCTs and ranged from 5.8 months with trastuzumab + nivolumab + ipilimumab<sup>6</sup> to 12.4 months with 25 mg/kg HLX22 + HLX02 + CAPOX<sup>8</sup>
  - DOR was reported in 10 single-arm studies and nRCTs, with results varying across different treatment combinations
    - Among the studies investigating HER2-targeted therapies without IO, DOR ranged from 7.3 months with trastuzumab + S1 + cisplatin<sup>26</sup> to 20.4 months with zanidatamab + CAPOX<sup>19</sup>
    - Among the IO-containing regimens, combined with HER2-targeted therapy, the DOR ranged from 9.4 months with pembrolizumab + trastuzumab + chemotherapy<sup>21</sup> to 22.8 months for zanidatamab combined with tislelizumab and CAPOX<sup>24</sup>

| Table 2. OS and PFS Data in Patients With HER2-Positive GEA and PD-L1 Overexpression |                                |                                      |                          |             |                           |         |                  |                            |        |                  |  |
|--|--------------------------------|--------------------------------------|--------------------------|-------------|---------------------------|---------|------------------|----------------------------|--------|------------------|--|
| Study  | Population                     | Intervention                         | Median Follow-Up, Months | Evaluable N | OS Estimates              |         |                  | PFS Estimates              |        |                  |  |
|  |                                |                                      |                          |             | Median OS (95% CI) Months | n (%)   | HR (95% CI)      | Median PFS (95% CI) Months | n (%)  | HR (95% CI)      |  |
| Janjigian 2023 (KEYNOTE-811) <sup>5</sup>  | PD-L1 CPS ≥1                   | Pembrolizumab + trastuzumab + chemo  | 56                       | 298         | 20.1 (17.9–22.9)          | NR      | 0.79 (0.66–0.95) | 10.9 (8.5–12.5)            | NR     | 0.72 (0.60–0.87) |  |
|  |                                | Placebo + trastuzumab + chemo        | 56                       | 296         | 15.7 (13.5–18.5)          | NR      |                  | 7.3 (6.8–8.4)              | NR     |                  |  |
|  | PD-L1 CPS ≥5                   | Pembrolizumab + trastuzumab + chemo  | NR                       | 186         | 20.8 (18.1–24.5)          | NR      | 0.76 (0.59–0.96) | 10.9 (8.3–13.0)            | NR     | 0.72 (0.57–0.92) |  |
|  |                                | Placebo + trastuzumab + chemo        | NR                       | 171         | 16.0 (13.7–19.9)          | NR      |                  | 8.1 (6.8–9.7)              | NR     |                  |  |
| Stein 2022 (INTEGA) <sup>6</sup>   | HER2-positive and PD-L1 CPS ≥1 | Trastuzumab + nivolumab + ipilimumab | 14.3                     | 31          | 16.4                      | 17 (54) | NR               | 2.2                        | 4 (14) | NR               |  |
|  |                                | Trastuzumab + nivolumab + FOLFOX     | 14.3                     | 28          | 21.6                      | 20 (71) |                  | 10.7                       | 9 (33) |                  |  |
|  | HER2-positive and PD-L1 CPS ≥5 | Trastuzumab + nivolumab + ipilimumab | 14.3                     | 24          | 12.6 (7.7–NE)             | NR      |                  | NR                         | NR     | NR               |  |
|  |                                | Trastuzumab + nivolumab + FOLFOX     | 14.3                     | 22          | 21.9 (12.9–NE)            | NR      | NR               |                            | NR     | NR               |  |

Chemo, chemotherapy; CPS, combined positive score; FOLFOX, fluorine acid, 5-fluorouracil, and oxaliplatin; GEA, gastroesophageal adenocarcinoma; HER2, human epidermal growth factor receptor 2; HR, hazard ratio; NE, not estimable; NR, not reported; OS, overall survival; PD-L1, programmed death-ligand 1; PFS, progression-free survival.

- Only 2 RCTs (and no other studies) reported subgroup data in patients with HER2-positive GEA and PD-L1 overexpression<sup>5, 6</sup>
- A phase 3 RCT demonstrated that the anti-PD-1 antibody pembrolizumab + trastuzumab and chemotherapy significantly improved OS and PFS vs trastuzumab and chemotherapy alone in the subset of patients with HER2-positive gastric/GEJ cancer and a PD-L1 combined positive score (CPS) ≥1 as well as ≥5<sup>5</sup>
- The INTEGA study showed that in the population with CPS ≥1, significantly prolonged OS and PFS were observed with trastuzumab + nivolumab and FOLFOX vs trastuzumab + nivolumab and ipilimumab<sup>6</sup>

- Chemo, chemotherapy; CPS, combined positive score; FOLFOX, folinic acid, 5-fluorouracil, and oxaliplatin; GEA, gastroesophageal adenocarcinoma; HER2, human epidermal growth factor receptor 2; HR, hazard ratio; NE, not estimable; NR, not reported; OS, overall survival; PD-L1, programmed death-ligand 1; PFS, progression-free survival.

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| Table 3. OS and PFS Data in Patients With HER2 IHC 2+ vs IHC 3+ Scores in RCTs |   |  |                          |             |                           |                  |                            |                  |    |
|--|---|--|--------------------------|-------------|---------------------------|------------------|----------------------------|------------------|----|
| Study  | Population                                  | Intervention                               | Median Follow-Up, Months | Evaluable N | OS Estimates              |                  | PFS Estimates              |                  |    |
|  |   |  |                          |             | Median OS (95% CI) Months | HR (95% CI)      | Median PFS (95% CI) Months | HR (95% CI)      |    |
| Tabernero 2023 (JACOB) <sup>12</sup>   | HER2-positive (IHC 2+/ISH+)                 | Pertuzumab + trastuzumab + chemo           | 46.1                     | 129         | 13.0                      | 0.85 (0.65–1.11) | NR                         | NR               |    |
|  | HER2-positive (IHC 3+)                      | Placebo + trastuzumab + chemo              | 44.4                     | 130         | 11.9                      |                  | NR                         |                  |    |
|  | HER2-positive (IHC 2+)                      | Trastuzumab + nivolumab + ipilimumab       | 14.3                     | 40          | NR                        | NR               | 3.4                        | NR               |    |
|  |   | Trastuzumab + nivolumab + FOLFOX           | 14.3                     | 36          | NR                        | NR               | 10.7                       |                  |    |
|  | HER2-positive (IHC 2+/ISH+)                 | Trastuzumab + nivolumab + ipilimumab       | 14.3                     | 7           | 6.4 (1.8–NE)              | NR               | 1.4 (1.2–NE)               | NR               |    |
| Trastuzumab + nivolumab + FOLFOX   |   | 14.3                                       | 6                        | NE (NE–NE)  | 5.2 (1.6–NE)              |                  |                            |                  |    |
| Stein 2022 (INTEGA) <sup>6</sup>   | HER2-positive (IHC 2+/ISH+)                 | Trastuzumab + nivolumab + ipilimumab       | 18.8                     | 7           | 6.4                       | NR               | NR                         | NR               |    |
|  |   | Trastuzumab + nivolumab + FOLFOX           | 18.8                     | 7           | 34.1                      |                  | NR                         |                  |    |
|  | HER2-positive (IHC 3+)                      | Trastuzumab + nivolumab + ipilimumab       | 14.3                     | 33          | 26.2 (11.5–NE)            | NR               | 4.4 (2.1–9.3)              | NR               |    |
|  |   | Trastuzumab + nivolumab + FOLFOX           | 14.3                     | 30          | 22.7 (21.9–NE)            |                  | 11.3 (9.2–14.6)            |                  |    |
|  | HER2-positive (IHC 3+)                      | Trastuzumab + nivolumab + ipilimumab       | 18.8                     | 33          | 32.2                      | NR               | NR                         | NR               |    |
|  |   | Trastuzumab + nivolumab + FOLFOX           | 18.8                     | 30          | 23                        |                  | NR                         |                  |    |
|  | Hecht 2016 (TRIO-013/LOGIC) <sup>15</sup>   | HER2-positive (IHC 2+/FISH+)               | CAPOX + lapatinib        | 24          | 58                        | NR               | 0.79 (0.50–1.25)           | NR               | NR |
|  |   |  | CAPOX + placebo          | 24          | 50                        | NR               |                            | NR               |    |
| HER2-positive (IHC 2-3+/FISH+)   |   | CAPOX + lapatinib                          | 24                       | 201         | NR                        | 0.86 (0.68–1.09) | NR                         | NR               |    |
|  |   | CAPOX + placebo                            | 24                       | 204         | NR                        |                  | NR                         |                  |    |
| HER2-positive (IHC 3+/FISH+)   |   | CAPOX + lapatinib                          | 24                       | 143         | NR                        | 0.90 (0.69–1.18) | NR                         | NR               |    |
| Bang 2010 (ToGA) <sup>16</sup>   | HER2-positive (IHC 0/FISH+ or IHC 1+/FISH+) | Trastuzumab + fluoropyrimidine + cisplatin | 18.6                     | 61          | 10.0                      | 1.07 (0.70–1.62) | 5.3                        | 1.00 (0.69–1.45) |    |
|  |   | Chemo                                      | 18.6                     | 70          | 8.7                       |                  | 4.8                        |                  |    |
|  | HER2-positive (IHC 2+/FISH+ or IHC 3+)      | Trastuzumab + fluoropyrimidine + cisplatin | 18.6                     | 228         | 16.0                      | 0.65 (0.51–0.83) | 7.6                        | 0.64 (0.51–0.79) |    |
|  |   | Chemo                                      | 18.6                     | 218         | 11.8                      |                  | 5.5                        |                  |    |

CAPOX, capecitabine and oxaliplatin; chemo, chemotherapy; FISH, fluorescence ISH; FOLFOX, folinic acid, 5-fluorouracil, and oxaliplatin; HER2, human epidermal growth factor receptor 2; HR, hazard ratio; IHC, immunohistochemistry; ISH, in situ hybridization; NE, not estimable; NR, not reported; OS, overall survival; PFS, progression-free survival; RCT, randomized controlled trial.

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| Table 4. OS and PFS Data in Patients With IHC 2+ vs IHC 3+ Scores in Single-Arm Studies and nRCTs |                                       |  |                                |             |                           |                          |                            |                           |
|---|---------------------------------------|--|--------------------------------|-------------|---------------------------|--------------------------|----------------------------|---------------------------|
| Study   | Population                            | Intervention   | Median Follow-Up, Months       | Evaluable N | Median OS (95% CI) Months | OS Estimates HR (95% CI) | Median PFS (95% CI) Months | PFS Estimates HR (95% CI) |
| Lee 2022 (PANTHERA) <sup>20</sup>   | HER2-positive (IHC 2+/SISH+)          | Pembrolizumab + trastuzumab + capecitabine + cisplatin | 18.2                           | 13          | 21.1                      | NR                       | 9.0                        | NR                        |
|   |                                       | HER2-positive (IHC 3+)                                 | 18.2                           | 30          | 19.3                      |                          | 8.5                        |                           |
|   | Takahari 2019 (HIGHSOX) <sup>27</sup> | HER2-positive (IHC 2+/SISH+)                           | Trastuzumab + oxaliplatin + S1 | 20.6        | 75                        | 16.3                     | NR                         | NR                        |
| HER2-positive (IHC 3+)  |                                       |  | 20.6                           | 75          | 25.9                      | NR                       | NR                         | NR                        |

HER2, human epidermal growth factor receptor 2; HR, hazard ratio; IHC, immunohistochemistry; SISH, in situ hybridization; nRCT, non-randomized controlled trial; NR, not reported; OS, overall survival; PFS, progression-free survival; S1, tegaserod, gemtani, otersted, pemetrexed; SISH, silver SISH.

- The SLR identified subgroup data for patients with different immunohistochemistry (IHC) scores in 4 RCTs<sup>6,12,15,16</sup> and 2 single-arm studies<sup>20,27</sup>
- Patients with HER2 positivity confirmed via IHC 3+ score demonstrated prolonged median OS<sup>6,12</sup> and median PFS<sup>6</sup> compared with patients with HER2 positivity confirmed by an IHC 2+ and in situ hybridization positivity. Similar improvements in median OS and PFS were observed in lower (IHC 0 to 1+) versus higher (IHC 2+) HER2 expression subgroups, with statistically significant results being observed in comparison with standard chemotherapy in the higher HER2 expression subgroup that received trastuzumab + fluoropyrimidine + cisplatin<sup>27</sup>

HER2, human epidermal growth factor receptor 2; HR, hazard ratio; IHC, immunohistochemistry; ISH, in situ hybridization; nRCT, non-randomized controlled trial; NR, not reported; OS, overall survival; PFS, progression-free survival; S1, tegafur, gimeracil, oteracil potassium; SSH, shiver SSH.

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Conclusions

- No new HER2-targeted treatment since trastuzumab has demonstrated OS benefits in combination regimens for first-line HER2-positive GEA as per RCT evidence
- Dual blockade of HER2 and PD-L1, with the addition of IO to trastuzumab plus chemotherapy, has been shown to improve survival for the subset of patients with confirmed PD-L1 overexpression
- Following treatment with HER2-targeted agents, patients with higher HER2 expression (ie, higher IHC score) generally demonstrated improved survival outcomes when compared with patients with lower HER2 expression
- Multiple trials investigating novel regimens and combinations, including IO therapies and/or targeted agents such as zanidatamab, have demonstrated the potential for improved survival outcomes and durable response for patients with HER2-positive GEA in early phase studies; confirmatory phase 3 trials are currently underway in first-line HER2-positive GEA