# RESEARCH

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# Survival rate of ovarian cancer in Asian countries: a systematic review and metaanalysis

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### Abstract

**Background** Ovarian cancer is amongst one of the most commonly occurring cancers affecting women, and the leading cause of gynecologic related cancer death. Its poor prognosis and high mortality rates can be attributed to the absence of specific signs and symptoms until advance stages, which frequently leads to late diagnosis. Survival rate of patients diagnosed with ovarian cancer can be used in order to better assess current standard of care; the aim of this study is to evaluate the survival rate of ovarian cancer patients in Asia.

**Methods** Systematic review was performed on articles that were published by the end of August 2021 in five international databases, including Medline / PubMed, ProQuest, Scopus, Web of Knowledge, and Google Scholar. The Newcastle-Ottawa quality evaluation form was used for cohort studies to evaluate the quality of the articles. The Cochran-Q and I<sup>2</sup> tests were used to calculate the heterogeneity of the studies. The Meta-regression analysis was also done according to when the study was published.

**Results** A total of 667 articles were reviewed, from which 108 were included in this study because they passed the criteria. Based on a randomized model, the survival rates of ovarian cancer after 1, 3 and 5 years were respectively 73.65% (95% Cl, 68.66–78.64), 61.31% (95% Cl, 55.39–67.23) and 59.60% (95% Cl, 56.06–63.13). Additionally, based on meta-regression analysis, there was no relationship between the year of study and survival rate.

**Conclusions** The 1-year survival rate was higher than that of 3- and 5-year for ovarian cancer. This study provides invaluable information that can not only help establish better standard of care for treatment of ovarian cancer, but also assist in development of superior health interventions for prevention and treatment of the disease.

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#### Background

Cancer is amongst the most common causes of death globally and is predicted to be a major contributor to poor quality of life in the 21st century [1, 2]. Ovarian cancer is commonly occurring cancers among women. It has been estimated that 190,000 new cases of ovarian cancer are reported annually worldwide, and its incidence is more prevalent in developed countries. In most cases, because of lack of specific signs and symptoms and absence of proper screening, ovarian cancer is detected in later stages of the disease, which often leads to poor outcomes [3]. While the incidence rate of ovarian cancer is less than breast cancer, it is estimated to be three times more lethal, and by the year 2040, its mortality rate is predicted to increase significantly [4].

Ovarian cancer incidence and epidemiology patterns vary globally and are correlated with various risk factors that can contribute to development of the disease [5]. Non-Hispanic white women have been reported to have the highest prevalence of ovarian cancer (12.0 per 100,000), followed by Hispanic women (10.3 per 100,000), non-Hispanic blacks (9.4 per 100,000), and Asian / Pacific Island women (9.2 per 100,000). Additionally, ovarian cancer mortality has a different global pattern, and is the highest amongst black women, which is mostly due to the differences in prevention, diagnostic and treatment strategies [6].

There is growing evidence to suggest that the management of ovarian cancer should be personalized, taking into account the patient's performance status. [7]. It is essential to be able to predict the incidence rate of ovarian cancer and its survival rate given this information can help develop and enhance strategies and interventions for prevention and early diagnosis of the disease. The survival rate of ovarian cancer is related to many factors, including the stage and degree of disease, age, histology, appropriate surgical treatment, appropriate chemotherapy, and tumor site [8]. Furthermore, several risk factors can contribute to the development of cancer. Identifying and addressing these risk factors can potentially aid in cancer prevention. Moreover, elucidating the mortality rates of the disease, and global incident patterns can help develop strategies aimed at prevention. Currently, there are no comprehensive studies on the survival rate of ovarian cancer in Asian countries. Therefore, this systematic review and meta-analysis were conducted to determine the survival rate of ovarian cancer in Asian countries.

#### Mehtods

The present study is a systematic review and meta-analysis of ovarian cancer survival rate. The method by which the present study is reporting is based on the PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analysis) checklist [9].

#### Search Strategy

In this study, authors surveyed five databases: Medline / PubMed, ProQuest, Scopus and the Web of Knowledge and Google scholar for grey literature and included studies published by the end of August 2021. Keywords that were selected to search databases included.

Ovarian Neoplasms [Mesh], Survival OR Survival Analysis OR Survival Rate, Asian Countries (Names of countries) (Appendix 1).

The data that were collected were entered onto End-Note, X7 software and duplicated articles were deleted. Two researchers examined the articles independently, using search strategies that are presented in Appendix 1.

#### Inclusion and exclusion criteria

This study included observational studies (cross-sectional, case-control, and cohort studies) on ovarian cancer survival that were published by the end of August 2021 and were published in English. Review and metaanalysis studies or studies that did not report sample size or survival confidence interval were excluded.

#### Quality evaluation and data extraction

The Newcastle-Ottawa Quality Assessment Checklist was employed to consider the quality of the selected manuscripts [10].

Two investigators performed the initial search of the studies. After screening studies and extracting results, the quality of the manuscripts were determined independently by two other investigators. If the two investigators were in disagreement, the preselected leader of the team would give their final opinion on the article.

All articles, which were included in this study were selected from a pre-determined checklist. This checklist encompassed the author's name, publication year, study period, sample size, cancer type, country, and survival rates of 1, 3, and 5 year. Data extraction was done independently by two researchers.

#### Statistical analysis

The Cochran Q test (with a significance level of less than 0.1) and  $I^2$  statistics were used to determine the heterogeneity between studies. In the presence of heterogeneity, the Random-Effects Model was used by the Inverse-Variance Method, and if there was no heterogeneity, the fixed effects model was used. Meta-regression analysis and subgroup analysis were used in case of heterogeneity between studies. Analysis was performed on STATA software version 16 and MEDCALC version 14.

#### Additional analysis

The year in which the study was published was utilized in Meta-Regression analysis due to the high heterogeneity of the studies.

#### **Bias Risk among Studies**

The Random Effects Model is utilized to reduce the risk of bias in studies [11, 12]. Egger diffusion bias evaluation test was also utilized to determine the risk of diffusion bias (publication bias) [13].

#### Results

#### Study selection

2377 articles were found after searching all international databases, and after omitting duplicated articles, 667 articles were included in the review stage. After careful examination of the titles and abstracts of the selected articles, 426 articles were considered for the next step. At this stage, the full text of the articles was reviewed, and 108 retrospective cohort articles were part of the final analysis. The references of imported articles were also reviewed to add applicable studies. The study selection process is shown in Fig. 1.



Fig. 1 Flowchart of the included eligible studies in systematic review

#### **Study characteristics**

The articles were chosen from January of 1989 to August 2021. 108 studies over the mentioned period were eligible. 56 articles from China, 13 articles from Hong Kong, 21 papers from India, 13 articles from Iran, 2 articles from Israel, 57 articles from Japan, 29 papers from South Korea, 2 papers from Kuwait, 16 papers from Singapore, 11 articles from Taiwan, 16 papers from Thailand, and 14 articles from Turkey were reviewed. Descriptive information for these studies is provided in Table 1. The median follow-up period in the studies was 9 years.

#### **Quality Appraisal**

The results of the quality assessment of manuscripts are shown in Appendix 2. Based on the review using the relevant checklist, 79 studies were determined to be of good quality, and 29 articles had average quality.

#### Heterogeneity

The result of the chi-squared test and I<sup>2</sup> index elucidated that there is significant heterogeneity between studies. According to the analysis, 1 year survival of ovarian cancer was:  $I^2=99.93\%$ , P<0.001; 3 years was:  $I^2=99.96\%$ , P<0.001); and 5 years was:  $I^2=99.92\%$ , P<0.001). As a result, a random-effects model was used for all analysis.

#### **Results of the Meta-Analysis**

First, the articles were sorted based on the year of publication, and then the survival was differentiated into 1, 3, and 5 years. Meta-regression was also completed based on the year of the study.

#### 1-year Survival Rate of Ovarian Cancer in Asian Countries

From the total number of articles that were included in the final analysis of this paper, 41 studies showed that based on a random-effect model, the 1-year survival was 73.65% (95% CI, 68.66–78.64). (Fig. 2)

#### 3-year Survival Rate of Ovarian Cancer in Asian Countries

From the total number of articles that were included in the final analysis of this paper, 50 studies showed that based on a random-effect model the 3-year survival was 61.31% (95% CI, 55.39–67.23).(Fig. 2).

#### 5-year Survival Rate of Ovarian Cancer in Asian Countries

From the total number of articles that were included in the final analysis of this paper,159 showed that based on a random-effect model, the 5-year survival was 59.60% (95% CI, 56.06–63.13).(Fig. 2).

#### **Ovarian Cancer survival rate by Asian Country**

Results of ovarian cancer survival rate in 12 countries are shown in Table 2; Fig. 3. The highest 1, 3, and 5 years survival rates are respectively in Iran (93.80), Turkey (84.0), and Turkey (85.27), and the lowest survival rates are respectively seen in Singapore (63.23) and India (46.72).

# Metaregression Ovarian Cancer Survival Rate in Asian Countries

Although in the recent years, the 1-year survival (Reg Coef=0.6756, p=0.119) and 3-year survival (Reg Coef=0.6012, p=0.287) has increased, this increase was not statistically significant. Also the 5 year survival rate has decreased (Reg Coef=-0.1205, p=0.678), while this decrease was also not signifant. (Fig. 4)

#### **Publication Bias**

Ultimately, we chose the funnel plots to evaluate the release bias for 1, 3, and 5 years ovarian cancer survival rate in Asian countries. The results of the egger test confirmed this bias (Appendix 3).

Bias for 1 year: 1.86, 95% CI = -11.14 to 14.87; P=0.7738.

Bias for 3 years: 2.40, 95% CI = -11.76 to 16.56; P=0.7346.

Bias for 5 years: 2.64, 95% CI = -2.16 to 7.46; P=0.2795.

#### Discussion

In the present study, we conducted a meta-analysis to evaluate the 1, 3 and 5 year survival rate of ovarian cancer across 12 Asian countries. The mean 1-year survival in this study was estimated to be 73.65%. According to the results, Iran's 1-year survival rate was estimated to be the highest and was 93.80% and Singapore's 1-year survival rate was evaluated to be the lowest and was 63.23%. In a 2013 cohort study of women with ovarian cancer in Denmark, Grann et al. found that the overall 1-year survival rate between 2000 and 2002 was 73% and between 2009 and 2011 was 69% [14]. In a 2012 study, the 1-year survival rate of ovarian cancer between 1978 and 2002 was evaluated to be 74.6% in Finland, 75.6% in Norway, 79.3% in Sweden, 60.7% in Ireland., 60.7% in England, 62.9% in Northern Ireland, 60.8% in Scotland, 62.9% in Wales, 70.9% in Austria, 69.7% in Germany, 69.5% in the Netherlands, 78.5% in Switzerland, 64.9% in the Czech Republic, 4.64% in Poland, 1.56% in Slovakia, 69.6% in Italy, 68.8% in Slovenia and 63.6% in Spain [15]. In 2017, another study by Stewart et al. reviewed ovarian cancer survival rate between 2001 and 2009 in 37 states, which includes 80% of the population of the United States. The survival rate for ovarian cancer in women between 15 and 90 years old was 72.3% from 2001 to 2003 and increased to 73.3% from 2004 to 2009 [16]. The estimated 1-year survival rate in the present study is higher than in the previous studies. Only Finland, Sweden, and Switzerland have slightly higher survival rates.

The 3-year survival rate of ovarian cancer in this study was estimated to be 61.31%. The highest and lowest

#### Table 1 Basic Information of Included Studies

Instructure         Index Number	Order	Author (year)	Location	Time period	Sample size	<b>Ovary Survival Rate</b>		
Image         Constraint         Constraint         Constraint         Constraint         Constraint           1         Anab. M2009         Iran         2008-2004         1246         -         -         0.0006           2         Anab. M2009         Iran         2008-2004         1246         -         -         0.0006           2         Mab. M2009         Iran         2008-2004         91         -         -         0.0006           5         Birla 2014         India         1994-9406         51.00%         2.000%         2.300%           6         Birla 2014         China         1999-2009         7.3         -         -         7.50%           7         Bar., Colt5         China         2000-2015         13         -         -         9.14%           10         Chen/CA2018         Taiwan         2000-2010         101         5.130%         3.70%         4.100%           11         Chen/CA2018         Taiwan         2008-2010         101         5.130%         3.70%         5.10%           12         Chen/CA2018         Taiwan         2008-2010         101         5.130%         3.70%         5.10%           13         Chen/CA20						1-year survival rate	3-year survival rate	5-year survival rate
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3Anda, M2009Iran2002 200412461.00%4Myhan A2008Tukey1982-2009918.00%23.80%6Bik R2016China1993-199448.0551.90%29.00%23.80%6Bik R2016China1993-20097373.06-73.067Banc/2015Tukey2000-20135247.00%75.06%8Borkaya, X2017Tukey2000-201351.075.40%10Chanc A2018Singapore1863-201213.375.40%11Chenc A2018Taiwan2000-201151.0030.06%41.60%12Chenc A2018Taiwan1992-200010151.30%31.70%41.60%13Chen,Y A2013Singapore1861-19771.881.00%40.00%52.00%14Chenk,Y C2015China200-201181.615Chen,Y A2011Singapore1861-19771.881.00%40.00%52.00%16Chuichur,K 2011Singapore1861-19771.881.00%41.00%52.00%17Chak,X 5,2011Singapore1862-19771.881.00%47.00%41.00%18Chuichur,K 2011Singapore199-201241.0041.00%52.00%53.00%47.00%19Chak,X 5,2011S	2	Aoki D.2014	Japan	2005-2011	4672	-	-	92.00%
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nm         nm         line         line         line         line         line           13         Chen, J. G. 2011         China         1992-2000         101         51.30%         34.70%         32.70%           14         Chen, M. C2018         Taiwan         1979-2008         121         87.00%         -         61.00%           15         Chen, X. 2011         Singapore         1989-1997         718         81.80%         67.50%         52.00%           16         China, K. S. 2011         Singapore         1989-2002         47.78         89.10%         72.60%         65.90%           18         Chung,H.H.2007         South Korea         1993-2002         47.78         89.10%         72.60%         43.80%           21         Disknic,R.2011         India         1991-1905         69         63.80%         47.80%         18.80%           22         Examerita,L2014         Turkey         2008-2012         95.60%         42.60%         42.60%           23         Egementas/L2014         Turkey         1995-2010         42         -         81.40%           24         Gaarmaghami,L2011         Turkey         2005-2012         95.80%         92.50%         92.50% </td <td>11</td> <td>Chen C A 2018</td> <td>Taiwan</td> <td>2000-2011</td> <td>510</td> <td>_</td> <td>-</td> <td>84.60%</td>	11	Chen C A 2018	Taiwan	2000-2011	510	_	-	84.60%
International Control         Contro         Control <thcontrol< td="" th<=""><td>12</td><td>Chen \$ 2014</td><td>China</td><td>2008-2010</td><td>107</td><td>_</td><td>30.90%</td><td>41.80%</td></thcontrol<>	12	Chen \$ 2014	China	2008-2010	107	_	30.90%	41.80%
Indext         Chenk AC2018         Taiwan         1979-2008         101         15.0%         1.5%         1.6%           15         Chenk AC2018         Taiwan         2007-2011         816         -         -         5000%           16         Chak K S, 2011         Singapore         1968-1972         901         81800%         67.50%         61.20%           16         Chus K S, 2001         Singapore         1968-1972         901         4400%         4400%         52.00%           17         Chun K S, 2001         Singapore         1993-2002         4778         89.10%         72.50%         65.90%           20         Dan Nie 2019         Chung M Lanor         2008-2014         178         -         -         41.30%           21         Dikhin R, 2011         India         1993-2020         4778         89.10%         72.50%         65.90%           22         E Alawahi/2019         Kuawat         2005-2012         63.80%         72.60%         82.50%           23         Egemen Ertas/2014         Turkey         1995-2010         42         -         -         42.60%           24         Gaarmaghami,F2001         India         2005-2012         92.00%         2	12	Chen I G 2011	China	1992-2000	107	51 30%	34.70%	32 70%
In         Chen, M.L. 2010         Tarkini         197 22000         121         Dr. X00         1         Of X000           16         Chia, K. S. 2011         Singapore         1968-1997         718         BL20%         67.50%         61.20%           17         Chia, K. S. 2011         Singapore         1968-1972         904         -         -         -           18         Chul (Lhur, K.2011         Singapore         1989-2002         4/78         89.10%         72.50%         65.50%           20         Dan Nie.2019         Chung         2038-2014         778         89.10%         72.50%         65.50%           21         Dikhik, R.2011         India         1991-199         69         63.80%         42.80%         18.80%           22         E. Alawadhi/2019         Kwait         2005-700         21         79.00%         -         42.60%           23         Egemen Ertas/2011         Iran         1998-2002         430         -         42.00%         43.0%           24         Gaermaghami, E2008         Iran         1998-2012         42         -         -         42.00%           25         Gauray Das/2020         India         2005-7012         958	14	Chen M C 2018	Taiwan	1070 2008	101	97.00%	-	61.00%
13         Chen, 10, 20, 13         China         20, 20, 11         10         1         52, 20, 30           16         Chia, K.S., 2011         Singapore         1968–1972         901         44,00%         52,00%         61,00%           17         Chu, K.S., 2011         Singapore         1968–1972         901         44,00%         52,00%         65,00%           18         Chung, H.J.2007         South Kors         1993–2002         4778         89,10%         72,50%         65,00%           20         Dan Nie, 2019         China         2008–2014         178         -         -         41,30%           21         Dikshir, R.2011         India         1991–1995         69         63,80%         7,20%         42,60%           22         E, Alawahi,2019         Kuwai         2005–2012         142         -         -         41,40%           23         Egemen Ertas, L2014         Turkey         2005–2016         42         -         -         43,0%           24         Gaeram Paghami, E2001         India         2005–2016         42         -         -         43,0%           25         Gaurang Dami, E2003         India         2001–2017         32         -	14	Chen V 0 2015	Chipa	2001 2011	016	07.0070	-	50.00%
International and a strain a strain and a strain a	15	Chie K S 2011	Cingaporo	1069 1007	710	-	-	59.00% 61.20%
Char K. 3, 2001         Singapore         1981-1972         901         44, 0076         52,00%           IS         Churd, MA201         Singapore         1983-2002         4778         89.10%         72.50%         65.90%           19         Chung, H.H.2007         South Korea         1993-2002         4778         89.10%         72.50%         65.90%           20         Dan Nie.2019         China         1095-2010         478         89.10%         72.50%         43.00%           22         E.Alawadhi,2019         Kuwait         2005-2009         221         79.00%         -         42.60%           23         Egemen Eras,12014         Turkey         1995-2010         42         -         -         81.40%           24         Gaermaghami,F2011         Iran         1995-2012         452         -         -         64.70%           25         Guaranghami,F2008         Iran         2005-2017         32         -         -         30.00%           26         Guarguan Luk2017         China         2003-2016         143         -         -         99.00%           30         Guarguan Lik2017         China         2003-2016         143         -         -         <	17	Chia, K. S., 2011	Singapore	1908-1997	718	44.00%	07.30%	01.20% E2.00%
Instruction         Church (Intruction)         South Korea         1993-2002         4/0         -         -         -         -           10         Church (Intruction)         South Korea         1993-2002         4/78         89.10%         72.50%         65.90%           20         Dan Nie 2019         Chura         2008-2014         178         -         -         41.30%           21         Dikshi, R.2011         India         1991-1995         6.9         63.80%         47.90%         18.80%           22         E.Alawadh.2019         Kuwait         2005-2012         9.00%         2.1         -         -         81.40%           24         Gaermaghami, E2011         Iran         1998-2008         186         -         42.00%         43.0%           25         Gaura Das2020         India         1097-2004         21         -         -         39.00%           26         Gek-Hising Lin.2007         China         2001-2017         32         -         -         39.00%           28         Guanguan Liz2017         China         2001-2013         539         -         -         39.00%           29         Guek.2018         China         2002-2015	17	Chia, K. S., 2001	Singapore	1968-1972	901	44.00%	44.00%	52.00%
Index         Change Heizard         South Notes         1995-2002         47/78         aps         72.50%         55.50%           Dank Nie 2019         Chia         2005-2009         221         79.00%         -         41.30%           21         Dikshit, R. 2011         India         1991-1995         69         63.80%         47.80%         18.80%           22         E. Alawadhi,2019         Kuwait         2005-2009         221         79.00%         -         42.00%           23         Egemen Ertas,12014         Turkey         1995-2010         42         -         42.00%         43.0%           24         Gaermaghami,F2011         Iran         1995-2010         42         -         -         64.70%           25         Gauray Das,2020         India         2005-2012         958         92.50%         92.50%         92.50%           26         Guengquan Liu.2017         China         2001-2013         33         -         -         30.00%           29         Guenguan Liu.2017         China         2002-2013         136         -         -         92.10%           20         Guvenguan Liu.2017         China         2005-2013         136         -	18	Churchun,K.2011	Singapore	1989-2008	40	-	-	-
20         Dan Nie 2019         China         2008-2014         178         -         -         -         41.0%           12         Diskin R, 2011         India         1991-995         69         63.80%         47.80%         18.80%           23         Egemen Ertas, 2014         Turkey         1995-2010         42         -         -         81.80%           24         Gaemmaghami, F2011         Iran         1998-2008         186         -         42.00%         43.0%           25         Gaura Vas, 2020         Irai         1997-2004         21         -         -         64.70%           26         Gek-Hsiang Lim.2009         Singapore         1978-1982         1422         -         -         43.00%           27         Ghaermmaghami, F.2008         Iran         1997-2004         21         -         -         49.00%           28         Guangquan Liu.2017         China         2001-2013         539         -         -         99.00%           31         Han/X2016         China         2001-2013         536         -         -         68.00%           32         Hee-Beom Yang, 2020         South Kora         1995-2011         71         -	19	Chung,H.H.2007	South Korea	1993-2002	4//8	89.10%	72.50%	65.90%
21         Dirknit, R. 2011         India         1991–1995         6-9         6-380%         47.80%         18.80%           22         E. Alawachi,2019         Kuwait         2005–2009         221         79.00%         -         42.60%           24         Gaemnaghami, F.2011         Iran         1998–2008         186         -         42.00%         43.0%           24         Gaemmaghami, F.2011         Iran         1998–2008         186         -         42.00%         43.0%           25         Gaurav Das, 2020         India         2005–2012         958         92.50%         92.50%         92.50%           26         Gek-Hsiang Lim.2009         Singapor         1978–1982         1422         -         -         30.00%           28         Guangquan Liu.2017         China         2001–2013         32         -         -         90.00%           30         Guvenal, T.2013         Turkey         2001–2013         536         -         -         92.00%           31         Han,Y.2016         China         2002–2015         136         -         -         68.00%           32         Hee-Beom Yang.2020         Sout Korea         1995–2011         71 <t< td=""><td>20</td><td>Dan Nie.2019</td><td>China</td><td>2008-2014</td><td>1/8</td><td>-</td><td>-</td><td>41.30%</td></t<>	20	Dan Nie.2019	China	2008-2014	1/8	-	-	41.30%
22         E. Mawadhi, 2019         Kuwatt         2005–2009         221         /900%         -         4         200%           23<	21	Dikshit, R. 2011	India	1991-1995	69	63.80%	47.80%	18.80%
Igenen Irtas, 2014         Turkey         1995-2010         42         -         -         81.40%           24         Gaemmaghami, F.2011         Iran         1998-2008         186         -         42.00%         43.0%           25         Gaurav Das, 2020         India         2005-2012         958         92.50%         92.50%         92.50%           26         Gek-Hslang Lim.2009         Singapore         1978-1982         1422         -         -         64.70%           27         Ghaemmaghami, F.2008         Iran         1997-2004         21         -         -         30.00%           28         Guang quan Liu.2017         China         2001-2013         539         -         -         90.00%           30         Guvenal, T.2013         Turkey         2001-2013         539         -         -         90.00%           31         Han, Y.2016         China         2000-2015         136         -         -         90.00%           32         Hee-Beom Yang, 2020         Suth Kore         1995-2011         71         -         -         68.00%           34         Higash, M.2011         Japan         1986-2008         1582         -         -	22	E. Alawadhi,2019	Kuwait	2005-2009	221	/9.00%	-	42.60%
24         Gaermanghami, F.2011         Iran         1998-2008         186         -         42.00%         43.0%           25         Gaurav Das,2020         India         2005-2012         95.8         92.50%         92.50%         92.50%           26         Gek-Hsiang Lim.2009         Singapore         1978-1982         1422         -         -         39.00%           27         Ghaemmaghami, F.2008         Iran         1997-2004         21         -         -         39.00%           28         Guangquan Liu.2017         China         2001-2017         32         -         -         96.00%           29         Gue,J.2018         China         2001-2013         539         -         -         97.00%           30         Guevanal, T.2013         Turkey         2010-2013         536         -         -         91.00%           31         Han,Y.2016         South Korea         1995-2016         80         -         -         68.00%           32         Hee-Beom Yang,2020         South Korea         1995-2016         80         -         -         68.00%           33         Helpman, L2005         Israel         1995-2011         71         - <t< td=""><td>23</td><td>Egemen Ertas,I.2014</td><td>Turkey</td><td>1995–2010</td><td>42</td><td>-</td><td>-</td><td>81.40%</td></t<>	23	Egemen Ertas,I.2014	Turkey	1995–2010	42	-	-	81.40%
25         Gaurav Das, 2020         India         2005–2012         958         92.50%         92.50%         92.50%         92.50%           26         Gaek-Hsiang Lim.2009         Singapore         1978–1982         1422         -         -         64.70%           27         Ghammaghami, E208         Ira         201–2017         32         -         -         30.00%           28         Guangquan Liu.2017         China         2001–2013         539         -         -         96.80%           30         Guvenal, T.2013         Turkey         2001–2013         539         -         -         99.00%           31         Han, Y.2016         China         2001–2013         536         -         -         92.10%           32         Hee-Beom Yang, 2020         South Korea         1995–2011         71         -         -         68.00%           34         Higash, M.2011         Japan         1995–2018         1582         -         -         80.00%           35         Hong, D.2011         South Korea         1995–2016         80         -         -         80.00%           36         Jayalekshmi, P,2011         India         1991–1997         35         <	24	Gaemmaghami, F.2011	Iran	1998–2008	186	-	42.00%	43.0%
26         Gek-Hsiang Lim.2009         Singapore         1978–1982         1422         -         -         -         64.70%           27         Ghaemmaghami, F.2008         Iran         1997–2004         21         -         -         39.00%           28         Guangquan Liu.2017         China         2003–2016         143         -         -         96.80%           30         Gue,J.2018         Turkey         2001–2013         539         -         -         99.00%           31         Han,Y.2016         China         2003–2015         136         -         -         99.00%           32         Hee-Beom Yang.2020         South Korea         1995–2016         80         -         -         68.00%           33         Helpan,L.2005         Israel         1995–2016         80         -         -         80.00%           34         Higash, M.2011         Japan         1986–2008         1582         -         -         80.00%           35         Hong.D.2011         India         1991–1997         35         62.90%         36.40%         26.00%           36         Jayalekshmi,P.2011         India         1901–2017         25         -         <	25	Gaurav Das,2020	India	2005-2012	958	92.50%	92.50%	92.50%
27         Ghaemmaghami, F.2008         Iran         1997-2004         21         -         -         3900%           28         Guangquan Liu.2017         China         2001-2017         32         -         -         30.00%           29         Gue, J.218         China         2001-2013         539         -         -         99.00%           31         Han, Y.2016         China         2000-2015         136         -         -         92.10%           32         Hee-Beom Yang.2020         South Korea         1995-2016         80         -         -         92.10%           33         Helpman, L2005         Israel         1995-2011         71         -         -         68.00%           34         Higash, M.2011         Japan         1986-2008         1582         -         -         80.00%           35         Hong,D.2011         South Korea         2002-2017         25         -         -         80.00%           36         Japal X2017         China         2012-2017         25         -         -         80.00%           37         Jiang X.2017         China         2002-2017         25         -         -         80.00%	26	Gek-Hsiang Lim.2009	Singapore	1978–1982	1422	-	-	64.70%
28         Guangquan Liu 2017         China         2001-2017         32         -         -         -         30.00%           29         Gue,J 2018         China         2003-2016         143         -         -         96.80%           30         Guvenal, T.2013         Turkey         2001-2013         539         -         -         99.00%           31         Han,Y 2016         China         2000-2015         136         -         -         57.90%           32         Hee-Beom Yang,2020         South Kora         1995-2016         80         -         -         68.00%           34         Higash, M.2011         Japan         1986-2008         1582         -         -         68.00%           35         Hong,D.2011         South Kora         2002-2017         25         -         -         80.00%           36         Jaayalekshmi, P.2011         India         1991-1997         35         6.20%         36.40%         26.00%           37         Jaag X.2017         China         2002-2017         25         -         -         88.90%           38         Jianjun LU,2019         China         2002-2017         35         -         -	27	Ghaemmaghami, F.2008	Iran	1997–2004	21	-	-	39.00%
29         Gue,J.2018         China         2003–2016         143         -         -         96.80%           30         Guvenal,T.2013         Turkey         2001–2013         539         -         -         99.00%           31         Han,Y.2016         China         2000–2015         136         -         -         99.00%           32         Hee-Beom Yang,2020         South Kora         1995–2011         71         -         -         68.00%           33         Helpman, L2005         Isael         1995–2011         71         -         -         68.00%           34         Higash, M.2011         Japan         1985–2005         18         -         -         80.00%           35         Hong,D.2011         India         1991–1997         35         62.90%         36.40%         26.00%           36         Jayalekshmi, P.2011         India         200–2017         25         -         -         38.90%           37         Jiang X.2017         China         2002–2017         25         -         -         84.85%           39         Jie Yin,2019         China         2002–2016         40         -         7.00%         35.00% <td>28</td> <td>Guangquan Liu.2017</td> <td>China</td> <td>2001-2017</td> <td>32</td> <td>-</td> <td>-</td> <td>30.00%</td>	28	Guangquan Liu.2017	China	2001-2017	32	-	-	30.00%
30         Guvenal, T.2013         Turkey         2001–2013         539         -         -         9.00%           31         Han, Y.2016         China         2000–2015         136         -         -         92.10%           32         Hee-Beom Yang, 2020         South Korea         1995–2016         80         -         -         68.00%           33         Helpman, L2005         Israel         1995–2016         80         -         -         68.00%           34         Higash, M.2011         Japan         1985–2008         158         -         -         80.00%           35         Hong, D.2011         South Korea         200–2005         18         -         -         80.00%           36         Jayalekshmi, P.2011         India         1991–1997         35         62.90%         36.40%         26.00%           37         Jiang X.2017         China         2002–2017         25         -         -         88.90%           38         Jilanjun LU,2019         China         2002–2017         25         -         -         87.50%           39         Je Yin,2019         China         2002–2007         353         -         -         65.50%<	29	Gue,J.2018	China	2003-2016	143	-	-	96.80%
31         Han,Y.2016         China         2000-2015         136         -         -         92.10%           32         Hee-Beom Yang,2020         South Korea         1995-2016         80         -         -         57.90%           33         Helpman, L2005         Israel         1995-2011         71         -         -         68.00%           34         Higash, M.2011         Japan         1986-2008         1582         -         -         80.00%           35         Hong,D.2011         South Korea         200-2005         18         -         -         80.00%           36         Jayalekshmi, P,2011         India         1991-1997         35         62.90%         36.40%         26.00%           37         Jiang X.2017         China         200-2017         25         -         -         88.90%           39         Jianjun LU2019         China         200-2016         40         -         -         84.85%           40         Jin, F.1998         China         200-2016         40         -         -         50.21%           41         K.Kritpracha.2008         Thailand         1987-1998         105         -         -         65.00% <td>30</td> <td>Guvenal, T.2013</td> <td>Turkey</td> <td>2001-2013</td> <td>539</td> <td>-</td> <td>-</td> <td>99.00%</td>	30	Guvenal, T.2013	Turkey	2001-2013	539	-	-	99.00%
32         Hee-Beom Yang,2020         South Korea         1995–2016         80         -         -         57,90%           33         Helpman, L2005         Israel         1995–2011         71         -         -         68,00%           34         Higash, M.2011         Japan         1986–2008         1582         -         -         91,70%           35         Hong,D.2011         South Korea         2000–2005         18         -         -         80,00%           36         Jayalekshmi, P,2011         India         1991–1997         35         62,90%         36,40%         26,60%           37         Jiang X,2017         China         2002–2017         25         -         -         88,90%           38         Jilanjun LU,2019         China         201–2013         74         -          87,50%           40         Jin, F.1998         China         2002–2016         40         -          87,50%           41         KKritpracha.2008         Thailand         1987–1998         105         -         -         65,50%           43         Kang S.2013         China         205–2007         335         -         -         -	31	Han,Y.2016	China	2000-2015	136	-	-	92.10%
33         Helpman, L2005         Israel         1995-2011         71         -         -         68.00%           34         Higash, M.2011         Japan         1986-2008         1582         -         -         91.70%           35         Hong, D.2011         South Korea         2000-2005         18         -         -         80.00%           36         Jayalekshmi, P.2011         India         191-1997         35         62.90%         36.40%         26.00%           37         Jiang X.2017         China         2002-2017         25         -         -         38.90%           38         Jilanjun LU,2019         China         2001-2016         40         -         -         84.85%           39         Jer Yin,2019         China         2000-2016         40         -         -         87.50%           40         Jin, F.1998         China         1988-1991         941         65.90%         47.20%         41.50%           41         K.Kritpracha.2008         Thailand         1987-1998         105         -         -         55.0%           42         Kaili 2012         China         2005-2007         335         -         -         -	32	Hee-Beom Yang,2020	South Korea	1995–2016	80	-	-	57.90%
34         Higash, M.2011         Japan         1986-2008         1582         -         -         91.70%           35         Hong, D.2011         South Korea         2000-2005         18         -         -         80.00%           36         Jayalekshmi, P., 2011         India         1991-1997         35         62.90%         36.40%         26.00%           37         Jiang X.2017         China         2002-2017         25         -         -         -         84.85%           38         Jilanjun LU,2019         China         2011-2013         74         -         -         -         84.85%           39         Jie Yin,2019         China         2000-2016         400         -         -         -         84.85%           40         Jin, F.1998         China         1988-1991         941         65.90%         47.20%         41.50%           41         KKritpracha.2008         Thailand         1987-1998         105         -         -         65.50%           41         KKritpracha.2008         Thailand         1987-1998         105         -         -         65.50%           42         Kaing S.2013         China         2002-2018         <	33	Helpman, L.2005	Israel	1995-2011	71	-	-	68.00%
35         Hong,D.2011         South Korea         2000–2005         18         -         -         80.00%           36         Jayalekshmi, P,2011         India         1991–1997         35         62.90%         36.40%         26.00%           37         Jiang X.2017         China         2002–2017         25         -         -         38.90%           38         Jilanjun LU,2019         China         2011–2013         74         -         -         84.85%           39         Jie Yin,2019         China         2000–2016         40         -         -         87.50%           40         Jin, F.1998         China         1988–1991         941         65.90%         41.50%         41.50%           41         KKritpracha.2008         Thailand         1987–1998         105         -         -         50.21%           42         Kaili.2012         China         2005–2007         335         -         -         65.50%           43         Kang S.2013         China         2002–2008         213         59.40%         57.80%         53.00%           44         Karabult B.2005         Turkey         1999–2003         26         51.00%         -	34	Higash, M.2011	Japan	1986-2008	1582	-	-	91.70%
36         Jayalekshmi, P,2011         India         191–1997         35         62,90%         36,40%         26,00%           37         Jiang X.2017         China         2002–2017         25         -         -         38,90%           38         Jilanjun LU,2019         China         2011–2013         74         -         -         84,85%           39         Jie Yin,2019         China         200–2016         40         -         -         87,50%           40         Jin, F.1998         China         1988–1991         941         65,90%         47,20%         41,50%           41         K.Kritpracha.2008         Thailand         1987–1998         105         -         -         50,21%           42         Kalil.2012         China         2005–2007         335         -         -         65,50%           43         Kang S.2013         China         2002–2008         213         59,40%         57,80%         53,00%           44         Karabulut B.2005         Turkey         1999–2003         26         51,00%         -         -           45         Karimi Zarchi M,0.2015         Iran         2006–2013         170         -         -	35	Hong,D.2011	South Korea	2000-2005	18	-	-	80.00%
37       Jiang X.2017       China       202-2017       25       -       -       38.90%         38       Jilanjun LU,2019       China       2011-2013       74       -       -       84.85%         39       Jie Yin,2019       China       200-2016       40       -       -       87.50%         40       Jin, F.1998       China       1988-1991       941       65.90%       47.20%       41.50%         41       K.Kritpracha.2008       Thailand       1987-1998       105       -       -       50.21%         42       Kalil.2012       China       2005-2007       335       -       -       65.50%         43       Kang S.2013       China       2002-2008       213       59.40%       57.80%       53.00%         44       Karabult B.2005       Turkey       1999-2003       26       51.00%       -       -       -         45       Karimi Zarchi M.0.2015       Iran       2006-2012       120       -       -       8.34%         46       Khunnarong, J.2008       Thailand       1996-2003       170       -       -       6.00%         47       Ku-F-C.2017       Taiwan       2000-2013       891<	36	Jayalekshmi, P.,2011	India	1991-1997	35	62.90%	36.40%	26.00%
38Jilanjun LU,2019China2011-201374A84.85%39Jie Yin,2019China2000-20164087.50%40Jin, F.1998China1988-199194165.90%47.20%41.50%41K.Kritpracha.2008Thailand1987-199810550.21%42Kalil.2012China2005-200733565.00%43Kang S.2013China2005-200733559.40%57.80%53.00%44Karabult B.2005Turkey1999-20032651.00%45Karimi Zarchi M,0.2015Iran2006-201212083.34%46Khunarong,J.2008Thailand1996-200317083.34%47Ku-F-C.2017Taiwan2000-201389160.00%48Kwang-Beom Lee.2006South Korea1997-20035260.00%49Law, S. C.2011China1966-2001183183.00%69.00%63.50%50Loka A.2002Japan1985-1994149440.90%51Martin, N,2011Thailand1900-200019368.40%52.30%48.50%	37	Jiang X.2017	China	2002-2017	25	-	-	38.90%
39       Jie Yin,2019       China       2000–2016       40       -       -       87.50%         40       Jin, F.1998       China       1988–1991       941       65.90%       47.20%       41.50%         41       K.Kritpracha.2008       Thailand       1987–1998       105       -       -       50.21%         42       Kaili.2012       China       2005–2007       335       -       -       65.50%         43       Kang S.2013       China       2005–2007       335       -       -       65.50%         44       Karabulut B.2005       China       2002–2008       213       59.40%       57.80%       53.00%         45       Karabulut B.2005       Turkey       1999–2003       26       51.00%       -       -         45       Karimi Zarchi M,0.2015       Iran       2006–2012       120       -       -       83.34%         46       Khunarong, J.2008       Thailand       1996–2003       170       -       -       60.00%         47       Ku-F-C.2017       Taiwan       2000–2013       891       -       -       60.00%         48       Kwang-Beom Lee.2006       South Koree       1997–2003       52	38	Jilanjun LU,2019	China	2011-2013	74	-	-	84.85%
40Jin, F.1998China1988-199194165.90%47.20%41.50%41K.Kritpracha.2008Thailand1987-199810550.21%42Kaili.2012China2005-200733565.50%43Kang S.2013China2002-200821359.40%57.80%53.00%44Karabulut B.2005Turkey1999-20032651.00%45Karimi Zarchi M,0.2015Iran2006-201212083.34%46Khunarong, J.2008Thailand1996-200317084.90%47Ku-F-C.2017Taiwan2000-201389160.00%48Kwang-Beom Lee.2006South Korea1977-20035260.00%49Law, S.C.2011China1966-2001183183.00%69.00%63.50%50Loka A.2002Japan1985-1994149440.90%51Martin, N,2011Thailand1900-200019368.40%52.30%48.50%	39	Jie Yin,2019	China	2000-2016	40	-	-	87.50%
41       K.Kritpracha.2008       Thailand       1987-1998       105       -       -       50.21%         42       Kaili.2012       China       2005-2007       335       -       -       65.50%         43       Kang S.2013       China       2002-2008       213       59.40%       57.80%       53.00%         44       Karabulut B.2005       Turkey       1999-2003       26       51.00%       -       -         45       Karimi Zarchi M,0.2015       Iran       2006-2012       120       -       -       83.34%         46       Khunarong,J.2008       Thailand       1996-2003       170       -       -       64.90%         47       Ku-F-C.2017       Taiwan       2000-2013       891       -       -       60.00%         48       Kwang-Beom Lee.2006       South Kore       1997-2003       52       -       -       60.00%         49       Law, S. C.2011       China       1996-2001       1831       83.00%       69.00%       63.50%         50       Loka A.2002       Japan       1985-1994       1494       -       -       40.90%         51       Martin, N.2011       Thailand       1990-2000 <td< td=""><td>40</td><td>Jin, F.1998</td><td>China</td><td>1988–1991</td><td>941</td><td>65.90%</td><td>47.20%</td><td>41.50%</td></td<>	40	Jin, F.1998	China	1988–1991	941	65.90%	47.20%	41.50%
42       Kaili 2012       China       2005-2007       335       -       -       65.0%         43       Kang S.2013       China       2002-2008       213       59.40%       57.80%       53.00%         44       Karabulut B.2005       Turkey       1999-2003       26       51.00%       -       -         45       Karimi Zarchi M.0.2015       Iran       2006-2012       120       -       -       83.34%         46       Khunarong J.2008       Thailand       1996-2003       170       -       -       54.90%         47       Ku-F-C.2017       Taiwan       2000-2013       891       -       -       -       57.50%         48       Kwang-Beom Lee.2006       South Korea       1997-2003       52       -       -       60.00%         49       Law, S. C.2011       China       1996-2001       1831       83.00%       69.00%       63.50%         50       Loka A.2002       Japan       1985-1994       1494       -       -       40.90%         51       Martin, N.2011       Thailand       1990-2000       193       68.40%       52.30%       48.50%	41	K.Kritpracha.2008	Thailand	1987–1998	105	-	-	50.21%
43       Kang S.2013       China       202-2008       213       59.40%       57.80%       53.00%         44       Karabulut B.2005       Turkey       1999-2003       26       51.00%       -       -         45       Karimi Zarchi M.2015       Iran       2006-2012       120       -       -       83.34%         46       Khunarong, J.2008       Thailand       1996-2003       170       -       -       54.90%         47       Ku-F-C.2017       Taiwan       2000-2013       891       -       -       37.50%         48       Kwang-Beom Lee.2006       South Korea       1997-2003       52       -       -       60.00%         49       Law, S. C.2011       China       1996-2001       1831       83.00%       69.00%       63.50%         50       Loka A.2002       Japan       1985-1994       1494       -       -       40.90%         51       Martin, N.2011       Thailand       1990-2000       193       68.40%       52.30%       48.50%	42	Kaili.2012	China	2005-2007	335	-	-	65.50%
44Karabulut B.2005Turkey1999-20032651.00%45Karimi Zarchi M,0.2015Iran2006-201212083.34%46Khunnarong, J.2008Thailand1996-200317054.90%47Ku-F-C.2017Taiwan2000-201389137.50%48Kwang-Beom Lee.2006South Korea1997-20035260.00%49Law, S. C.2011China1996-2001183183.00%69.00%63.50%50Loka A.2002Japan1985-1994149440.90%51Martin, N,2011Thailand1990-200019368.40%52.30%48.50%	43	Kang S.2013	China	2002-2008	213	59.40%	57.80%	53.00%
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48       Kwang-Beom Lee.2006       South Korea       1997–2003       52       -       -       60.00%         49       Law, S. C.2011       China       1996–2001       1831       83.00%       69.00%       63.50%         50       Loka A.2002       Japan       1985–1994       1494       -       -       40.90%         51       Martin, N,2011       Thailand       1990–2000       193       68.40%       52.30%       48.50%	47	Ku-F-C.2017	Taiwan	2000-2013	891	-	-	37.50%
49         Law, S. C.2011         China         1996–2001         1831         83.00%         69.00%         63.50%           50         Loka A.2002         Japan         1985–1994         1494         -         -         40.90%           51         Martin, N,2011         Thailand         1990–2000         193         68.40%         52.30%         48.50%	48	Kwang-Beom Lee 2006	South Korea	1997-2003	52	-	-	60.00%
Solution	49	Law, S. C.2011	China	1996-2001	1831	83.00%	69.00%	63.50%
51         Martin, N,2011         Thailand         1990–2000         193         68.40%         52.30%         48.50%	50	l oka A.2002	lapan	1985-1994	1494	-	-	40.90%
2	51	Martin, N 2011	Thailand	1990-2000	193	68.40%	52.30%	48.50%
52 Matsuda 7 2010 Japan 1993–1999 491 52 00%	52	Matsuda T 2010	lapan	1993-1999	491	-	-	52.00%

#### Table 1 (continued)

International         Japan         1988-2011         16         -         -           53         Matsumoto H.2013         Japan         1998-2011         16         -         -           54         Menczer J.2012         Israel         1994-1999         225         -         -         -           55         Min K.W2012         South Korea         1995-2006         129         -         -         -           56         Mok J.E.2006         South Korea         1993-2004         10         60.00%         -         -           57         Nagase S.2019         Japan         2015-2010         752         -         -         -           58         Nakagawa-Senda,2017         Japan         2006-2008         865         -         -         -           59         Nakashima N.1989         Japan         1905-1987         7.1         -         -         -           61         Pandey D.2004         India         1915-2004         43         -         -         -         -           62         Park J.Y.2006         South Korea         201-2005         46         -         -         6.633%           63         Piura B.1999 <td< th=""><th></th></td<>	
53       Matsumoto H.2013       Japan       198–2011       16       -       -         54       Menczer J.2012       Israel       1994–1999       225       -       -         55       Min K.W.2012       South Korea       1995–2006       129       -       -         56       Mok J.E.2006       South Korea       1993–2004       10       60.00%       -         57       Nagase S.2019       Japan       2015–2010       752       -       -         58       Nakagawa-Senda,2017       Japan       2006–2008       865       -       -         59       Nakashima N.1989       Japan       1955–1987       71       -       -         60       Natee J.2006       Thailand       1995–2004       43       -       -         61       Pandey D.2004       India       1981–2000       58       -       73.10%         62       Park J.Y.2006       South Korea       2001–2055       46       -       66.63%         63       Piura B.1999       Israel       1978–1998       11       -       50.00%         64       R.Kobayashi.2017       Japan       1996–2004       31       -       69.20%	5-year survival rate
54Menczer J.2012Israel1994-199922555Min K.W.2012South Korel1995-200612956Mok J.E.2006South Korel1993-20041060.00%57Nagase S.2019Japan2015 - 201075258Nakashiran N.1989Japan1065 - 19877.160Natee J.2006Thailand195 - 20044.361Pandey D.2004India1981 - 20054.6-6.6.3%-62Park J.Y.2006South Korel201 - 20154.6-6.6.3%-63Piura B.1999Israel1978 - 197411064R. Kobayashi.2017Japan191 - 201411065S.Kuntito.2012Japan196 - 20043.166Saita T.195Japan196 - 20043.167Saka K.2011Japan196 - 20043.168Saita T.195Japan198 - 200918069Saka K.2011Japan198 - 2009180 <t< td=""><td>73.10%</td></t<>	73.10%
55Min K.W.2012South Korea1995-200612956Mok J.E.2006South Korea1933-20041060.00%57Nagase S.2019Japan2015-201075258Nakashima N.1989Japan1965-19877160Natee J.2006Thailand1995-20044361Pandey D.2004India1981-2000587.10%62Park J.Y.2006South Korea201-200546-66.33%63Piura B.1999Israel1978-199811-50.00%64R. Kobayashi.2017Japan1991-201411065S.Kuntito.2012Japan1991-201411066Saitor.11995Japan2013-201313867Sakai K.2011Japan1982-102018068Sankaranarayananl R.199India1982-198245269Sator.Nagase,2019Japan2013-2015752770Hasani S,2019Iapan201-2015752771Inoue S,2019Japan201-2015752771Inoue S,2019Japan201-2015752772Sozen H.2015InoueJap	-
56Mok J.E.2006South Korea1993-20041060.00%-57Nagase S.2019Japan2015 - 201075258Nakagawa-Senda,2017Japan2006-200886559Nakashima N.1989Japan1965-19877160Natee J.2006Thailand1995-20044361Pandey D.2004India1981-20005866.3%62Park J.Y.2006South Korea201-200546-66.63%63Piura B.1999Israel1978-198811-50.00%64R. Kobayashi.2017Japan1991-201411065S.Kuntito.2012Japan1996-200431-69.20%66Saito T.1995Japan2013-201313867Sakai K.2011Japan1986-200918068Sankaranarayanal R.199India1982-198245269Satoru Nagase,2019Japan2010-2015752770Hasani S,2019Iran2011-201717971Incue S,2019Japan2006-2008130950.50%72Sozen H.2015Trake130950.50%	79.10%
57Nagase S.2019Japan2015 - 201075258Nakagawa-Senda,2017Japan2006-200886559Nakashima N.1989Japan1965-19877160Natee J.2006Thailand1995-20044361Pandey D.2004India1981-200058-73.10%62Park J.Y.2006South Korea2001-200546-66.63%63Piura B.1999Israel1978-199811-50.00%64R. Kobayashi.2017Japan1991-201411065S.Kuntito.2012Japan1996-200431-69.20%66Saito T.1995Japan2013-201313867Sakai K.2011Japan1982-198245268Sankaranarayananl R.1995India1982-198245269Satoru Nagase,2019Japan2010-2015752770Hasani S,2019Iran2011-201717971Inoue S,2019Japan2006-2008130950.50%71Inoue S,2019Japan2006-2008130950.50%72Sozen H.2015Turkey1998-201050	42.00%
58Nakagawa-Senda,2017Japan2006–200886559Nakashima N.1989Japan1965–19877160Natee J.2006Thailand1995–20044361Pandey D.2004India1981–200058-73.10%62Park J.Y.2006South Korea2001–200546-66.63%63Piura B.1999Israel1978–199811-50.00%64R.Kobayashi.2017Japan1991–201411065S.Kuntito.2012Japan1996–200431-69.20%66Saito T.1995Japan1986–200918067Sakai K.2011Japan1986–200918068Sankaranarayananl R.1995India1982–198245269Satoru Nagase,2019Japan2011–2017752770Hasani S,2019Iran2011–201717971Inoue S,2019Japan2006–2008130950.50%-72Sozen H.2015Turkey198–201050	88.50%
59         Nakaima N.1989         Japan         1965–1987         71         -         -           60         Natee J.2006         Thailand         1995–2004         43         -         -           61         Pandey D.2004         India         1981–2000         58         -         73.10%           62         Park J.Y.2006         South Korea         2001–2005         46         -         66.63%           63         Piura B.1999         Israel         1978–1998         11         -         50.00%           64         R. Kobayashi.2017         Japan         1991–2014         110         -         -           65         S.Kunito.2012         Japan         1996–2004         31         -         69.20%           66         Saito T.1995         Japan         1996–2004         31         -         69.20%           67         Sakai K.2011         Japan         1986–2009         180         -         -         -           68         Sankaranarayananl R.1995         India         1982–1982         452         -         -         -           69         Satoru Nagase,2019         Japan         2010–2015         7527         -         -	51.00%
60Natee J.2006Thailand1995–20044361Pandey D.2004India1981–200058-73.10%62Park J.Y.2006South Korea2001–200546-66.63%63Piura B.1999Israel1978–199811-50.00%64R. Kobayashi.2017Japan1991–201411065S.Kuntito.2012Japan1996–200431-69.20%66Saito T.1995Japan2013–201313867Sakai K.2011Japan1986–200918068Sankaranarayananl R.1995India1982–198245269Satoru Nagase,2019Japan2011–2017752770Hasani S,2019Iran2011–201717971Inoue S,2019Japan206–2008130950.50%-72Sozen H.2015Turkey198–201050	69.30%
61Pandey D.2004India1981–200058-73.10%62Park J.Y.2006South Korea2001–200546-66.33%63Piura B.1999Israel1978–199811-50.00%64R. Kobayashi.2017Japan1991–201411065S.Kuntito.2012Japan1996–200431-69.20%66Saito T.1995Japan2013–201313867Sakai K.2011Japan1986–200918068Sankaranarayananl R.1995India1982–198245269Satoru Nagase,2019Japan2010–2015752770Hasani S,2019Iran2011–201717971Inoue S,2019Japan2006–2008130950.50%-72Sozen H.2015Turkey1998–201050	85.20%
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63Piura B.1999Israel1978–199811-50.00%64R. Kobayashi.2017Japan1991–201411065S.Kuntito.2012Japan1996–200431-69.20%66Saito T.1995Japan2013–201313867Sakai K.2011Japan1986–200918068Sankaranarayananl R.1995India1982–198245269Satoru Nagase,2019Japan2010–2015752770Hasani S,2019Iran2011–201717971Inoue S,2019Japan2006–2008130950.50%-72Sozen H.2015Turkey1998–201050	-
64       R. Kobayashi.2017       Japan       1991–2014       110       -       -         65       S.Kuntito.2012       Japan       1996–2004       31       -       69.20%         66       Saito T.1995       Japan       2013–2013       138       -       -         67       Sakai K.2011       Japan       1986–2009       180       -       -         68       Sankaranarayananl R.1995       India       1982–1982       452       -       -         69       Satoru Nagase,2019       Japan       2010–2015       7527       -       -         70       Hasani S,2019       Iran       2011–2017       179       -       -         71       Inoue S,2019       Japan       2006–2008       1309       50.50%       -         72       Sozen H.2015       Turkey       1998–2010       50       -       -	-
65       S.Kuntito.2012       Japan       1996–2004       31       -       69.20%         66       Saito T.1995       Japan       2013–2013       138       -       -         67       Sakai K.2011       Japan       1986–2009       180       -       -         68       Sankaranarayananl R.1995       India       1982–1982       452       -       -         69       Satoru Nagase,2019       Japan       2010–2015       7527       -       -         70       Hasani S,2019       Iran       2011–2017       179       -       -         71       Inoue S,2019       Japan       2006–2008       1309       50.50%       -         72       Sozen H.2015       Turkey       1998–2010       50       -       -	88 20%
66       Saito T.1995       Japan       2013–2013       138       -       -         67       Sakai K.2011       Japan       1986–2009       180       -       -         68       Sankaranarayananl R.1995       India       1982–1982       452       -       -         69       Satoru Nagase,2019       Japan       2010–2015       7527       -       -         70       Hasani S,2019       Iran       2011–2017       179       -       -         71       Inoue S,2019       Japan       2006–2008       1309       50.50%       -         72       Sozen H.2015       Turkey       1998–2010       50       -       -	84 70%
60060160160160160160167Sakai K.2011Japan1986–200918068Sankaranarayananl R.1995India1982–198245269Satoru Nagase,2019Japan2010–2015752770Hasani S,2019Iran2011–201717971Inoue S,2019Japan2006–2008130950.50%-72Sozen H.2015Turkey1998–201050	74 20%
68       Sankaranarayananl R.1995       India       1982–1982       452       -       -         69       Satoru Nagase,2019       Japan       2010–2015       7527       -       -         70       Hasani S,2019       Iran       2011–2017       179       -       -         71       Inoue S,2019       Japan       2006–2008       1309       50.50%       -         72       Sozen H.2015       Turkey       1998–2010       50       -       -	62.90%
69       Satoru Nagase,2019       Japan       2010–2015       7527       -       -         70       Hasani S,2019       Iran       2011–2017       179       -       -         71       Inoue S,2019       Japan       2006–2008       1309       50.50%       -         72       Sozen H.2015       Turkey       1998–2010       50       -       -	61.50%
Os     Datafil (Vagas) (2019     Dapafil     2010-2013     7327     -       70     Hasani S,2019     Iran     2011-2017     179     -       71     Inoue S,2019     Japan     2006-2008     1309     50.50%     -       72     Sozen H.2015     Turkey     1998-2010     50     -     -	88 50%
70         Inam         2011–2017         179         -         -         -           71         Inoue \$,2019         Japan         2006–2008         1309         50.50%         -           72         Sozen H.2015         Turkey         1998–2010         50         -         -	49.1004
71         Indue 5,2019         Japan         2006–2008         1509         50.50%         -           72         Sozen H.2015         Turkey         1998–2010         50         -         -	40.10%
72 SOZEN H.2015 IURKEY 1998–2010 SU	23.00%
70 Griebers (1901) Theiler J. 1000, 1000, 170, 01,100( 56,000)	92.00%
73 Sripiung, H.2011 Inailand 1990–1999 173 81.10% 56.20%	48.60%
74 SUN D.H.2015 SOUTH KOREA 1995–2013 193 68.50% 81.10%	-
75 Suita S.2002 Japan 1975–2000 60	/5.00%
76 Sumitsawan, Y.2011 Thailand 1993–1997 162 90.30% /1.10%	66.20%
// Sun H.D.2011 laiwan 1948–2010 16/	96.50%
78 Surprasert P.2006 Thailand 1995–2005 1076	55.40%
79 Swaminathan, R., 2011 India 1990–1999 808	27.40%
80 Taek sang Lee. 2013 South Korea 1997–2008 1032	94.50%
81 Taskin S.2013 Turkey 2001–2010 297	51.60%
82 Teramukai S.2007 Japan 1994–2000 768	54.00%
83 Terzi A.2013 Japan 1984–2001 156 - 90.60%	54.00%
84 Tong X.2008 China 1948–2007 76	91.80%
85 Tsubamoto H.2013 Japan 1996–2009 73	74.00%
86 Tsukuma, H., 2006 Japan 1993–1996 373 78.20% 56.20%	48.20%
87 Uegaki K.2014 Japan 2001–2011 51	85.70%
88 Uygun K.2003 Turkey 1979–1998 952 89.00% 84.00%	81.00%
89 Vandana Jain,2019 India 2004–2016 14 - 40.52%	33.00%
90 Vatanasapt, V. 1998 Thailand 1985–1992 253 57.50% 39.40%	34.00%
91 Veras E.2009 Japan 1985–2006 122 - 90.00%	68.00%
92 Wang P.H.2014 Taiwan 1994–2010 44	55.80%
93 Yamagami W,2019 Japan 2004–2008 9747	94.90%
94 Wong K.H.2012 Hong Kong 1997–2006 2941	63.10%
95 Xiang, Y. B. 2011 China 1992–1995 1087 66.40% 48.40%	42.70%
96 Xishan, H.2011 China 1991–1999 1124 77.20% 62.70%	59.70%
97 Y.M.Kim.2006 South Korea 1991–2004 35	92.00%
98 Yamagami W.2015 Japan 2007–2007 3681	31.90%
99 Yamagami W.2017 Japan 1975–2012 9384	90.50%
100 Yamamoto S.2011 Japan 1992–2003 254 83.40% 81.40%	68.80%
101 Yeole, B. B. 2011 India 1992–1994 2029 49.70% 29.10%	22.80%
102 Yong Kuei lim.2011 Singapore 2000–2009 75	84.00%
103 Yuk J.S.2018 Korea 2006–2010 78.826 - 95.70%	88.90%
104 Zeng H.2018 China 2003–2005 678	38.90%

Order	Author (year)	Location	Time period	Sample size	<b>Ovary Survival Rate</b>		
					1-year survival rate	3-year survival rate	5-year survival rate
105	Zhao Q.2017	China	2010-2015	50	-	-	83.60%
106	Zhao T I.2016	China	1997-2014	102	98.70%	96.40%	-
107	Zhao T I.2017	China	1997-2015	53	-	-	69.00%
108	Ziying Lei,2020	China	2010-2017	584	-	60.30%	-

Table 1 (continued)



Fig. 2 1,3 and 5-year Survival Rate of Ovarian Cancer in Asian Countries

3-year survival rates in our study were found to be 84% in Turkey and 46.72% in India respectively. According to a study published in 2014 by Anuradha et al., women with invasive epithelial ovarian cancer in 2005 had a 3-year cancer survival rate of 57% in Western Australia and 50% in South Australia [17]. Cabasag et al. studied 3-year survival rate of ovarian cancer between 2014 and 2010 in Australia, Canada, Denmark, Ireland, New Zealand, Norway, and the United Kingdom where the results were 56.4%, 50.1%, 53.6%, 44.8%, 45.5%, 57.2%, and 47.3% respectively [18].

The 5-year survival rate of ovarian cancer in the present study is 59.60%. Turkey, with 85.27%, has the highest, and India, with 36.06%, has the lowest 5-year survival rate. In the United States, the incidence of ovarian cancer is relatively low, with a 5-year survival rate of 53% in patients undergoing surgery and 8% in patients that do not undergo surgery. In Canada, the 5-year survival rate of ovarian cancer was estimated to be between 37 and 43%, and in Japan, the United Kingdom, France, and Sweden was respectively 55%, 43%, 43%, and 45% [19]. Studies which were conducted in the Netherlands and Korea illustrated that the 5-year survival rate in the Netherlands rose from 18% to 1993 to 28% in 2004, and reported the 5-year survival rate of ovarian cancer in Korea in 2011 to be 60% [20, 21].

From 2000 to 2007, the 5-year survival rate for European women with ovarian cancer was 38%. However, the 5-year survival rate for this cancer was lower in Ireland and the United Kingdom, where it was reported to be 31%, as compared to the results of our current study. Moreover, in Eastern Europe, Southern Europe, Central Europe, and Northern Europe, the 5-year survival rate were estimated to be 34.4%, 38%, 40.5%, and 41.1% respectively [22]. In Western and Southern Australia, the 5-year survival of invasive epithelial ovarian cancer is estimated to be 46% and 40%, respectively. Additionally, the 5-year survival rate of ovarian cancer between 2003 and 2008 was approximately 44% in United States, 43% in England, 45% in Canada, 55% in Japan, 37% in Denmark, and 45% Sweden [17]. Srivastava et al. found that the 5-year survival rate in Caucasian women has surged from 40.7 to 45% from 1992 to 2008; however, the 5-year survival rate decreased in African American women from 47.9 to 40.3% over the same period and decreased to 36% from 2006 to 2012 [23]. In a 2020 study, Bian et al. studied the effects of a previous malignancy on ovarian cancer survival rate between 2004 and 2015. They reported a 5-year survival rate of ovarian cancer with a

val rate of ovarian Cancer in Asian Countries base on each country and year of survival		
inalysis and heterogeneity of surv	Year of Survival	
Result of meta-ai	Total	
Table 2	Country	

Country Tot	al Yea	ir of Survival										
	-				ß				5			
	z	Effect estimate	2	٩	z	Effect estimate	2	٩	z	Effect estimate	<sup>2</sup>	٩
China	56 9	72.56 (63.75, 81.37)	99.33	≤ 0.001	13	53.02 (43.65, 62.39)	99.29	≤ 0.001		34 54.75 (46.89, 62.61)	99.25	≤ 0.001
HongKong	13 3	82.17 (54.16, 110.19)	76.66	≤ 0.001	4	65.00 (40.95, 89.06)	99.91	≤ 0.001		6 59.83 (38.05, 81.62)	99.92	≤ 0.001
India	21 5	64.22 (48.32, 80.11)	99.50	≤ 0.001	7	46.72 ( 32.30, 61.14)	99.15	≤ 0.001		9 36.06 (23.59, 48.54)	99.22	≤ 0.001
Iran	13 1	93.80 (89.33, 98.27)	NR	NR	2	63.63 (21.30, 105.97)	98.67	≤ 0.001		10 60.39 (50.82, 69.96)	94.52	≤ 0.001
Israel	2 NR	NR	NR	NR	NR	NR	NR	NR		2 64.54 (50.64, 78.44)	17.57	0.271
Japan	57 4	71.89 (57.56, 86.22)	99.53	≤ 0.001	œ	75.71 (58.90, 92.53)	99.64	≤ 0.001		45 63.87 (57.26, 70.48)	99.94	≤ 0.001
Korea	29 7	81.52 (70.97, 92.07)	99.65	≤ 0.001	∞	72.69 (58.13, 87.26)	99.88	≤ 0.001		14 70.90 (58.88, 82.93)	99.83	≤ 0.001
Kuwait	2 1	79.00 (73.44, 84.55)	NR	NR	NR	NR	NR	NR		1 42.60 (35.89, 49.30)	NR	NR
Singapore	16 3	63.23 (41.84, 84.61)	66.66	≤ 0.001	m	55.74 (42.49, 68.99)	96.66	≤ 0.001		10 56.03 (45.71, 66.34)	99.92	≤ 0.001
Taiwan	11	87.00 (86.39, 87.60)	NR	NR	NR	NR	NR	NR		10 54.94 (37.98, 71.90)	71.94	≤ 0.001
Thailand	16 4	74.41 ( 60.27, 88.55)	95.57	≤ 0.001	4	54.66 ( 41.78, 67.54)	92.50	≤ 0.001		8 55.03 (44.95, 65.10)	99.75	≤ 0.001
Turkey	14 3	63.47 (36.03, 90.92)	93.79	≤ 0.001	<del>, -</del>	84.00 (81.62, 86.37)	NR	≤ 0.001		10 85.27 (76.26, 94.28)	94.59	≤ 0.001
Overall	250 41	73.65 (68.66, 78.64)	99.93	≤ 0.001	50	61.31 (55.39, 67.23)	96.66	≤ 0.001		159 59.60 (56.06, 63.13)	98.88	≤ 0.001
*NR; Not reported												



Fig. 3 1-year survival rate, 3-year survival rate, and 5-year survival rate of ovarian Cancer in Asian Countries



Fig. 4 Bubble plot of standard error by point estimate for assessment of meta-regression (1, 3, and 5-year Ovarian cancer survival rate) [A: 1-year survival rate, B: 3-year survival rate, C: 5-year survival rate]

previous malignancy to be 35.1%, and with no previous malignancy to be 43.2% [24]. A retrospective study conducted in China, which analyzed 63 pathological cases of ovarian cancer from 2000 to 2018, reported a 5-year survival rate of 69% in patients who underwent surgery for treatment. The study also found an overall 5-year survival rate of 80% for all patients [25].

A 2020 cohort study by Beachler et al. reported an overall 5-year survival rate of 47.7% in advanced ovarian cancer patients in the United States from 2018 to 2010 [26].

The findings of our study indicate that the survival rate of ovarian cancer is higher in Asian countries when compared to those in Europe, America, Australia, and Africa.

Ovarian cancer is generally less common in Asia and the Middle East and has better outcomes than in the United States and Europe. Ovarian cancer is also diagnosed in women in Asia and the Middle East at a younger age, which may be a contributing factor to better survival rates [19]. Generally, this difference in survival could be related to different risk factors, increased cancer incidence, or more specific reporting of the death rates, which needs to be thoroughly investigated in future studies. It can also be caused by different treatment methods such as the use of lymphadenectomy [27, 28], which can lead to different survival in patients in different regions.

#### The strength and limitations

The type and quality of the studies included in this study are among the study's limitations. Also, the volume of sample studies and the number of studies conducted in each country can affect the results of the present study. In addition, more than half of Asian countries have not published any studies on ovarian cancer survival rate, so more accurate studies are needed for precise assessment, especially in unreported countries. The power of the present study is the introduction of observational studies with follow-up design (cohort) and meta-regression analysis to identify heterogeneity sources.

#### Conclusion

Ovarian cancer can be one of the most important cancers among women and can be fatal if diagnosed late. The survival rate of ovarian cancer in the present study shows that in most cases, Asian countries have a higher survival rate than European countries, and these results can be a basis for developing treatment strategies and health interventions. One of the reasons for the higher survival of this cancer in Asian countries can be due to the difference in the type of cancer as well as the cancer BIRAD. Also, the difference in diet and lifestyle in Asian countries compared to European countries can be another reason for the difference in survival in these two continents. It seems that a healthier life than an industrial life can have an effect on cancer survival. However, it is highly preventable by recognizing risk factors. With improved disease management, early detection and better treatment, ovarian cancer mortality can be better managed and even prevented. It is also recommended for future studies to investigate different treatments and make better decisions for more effective treatment that can bring more survival for patients. In addition, it is recommended to investigate risk factors, genetic differences, differences in the type of cancer and degree of cancer, and nutritional differences for further studies.

#### Supplementary Information

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Supplementary Material 1 Supplementary Material 2 Supplementary Material 3

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#### Authors' contributions

HG is the lead author and guarantor and contributed to interpreting the data and revising the manuscript. MV and ZM planned the study and led the drafting and revising of the manuscript. MV, ZM, HAN, SH, AK, SS and RF contributed to interpreting the data and drafting and revising the manuscript. All authors approved the submitted version of the manuscript. All authors have contributed to the preparation of the manuscript, have read, and approved the submitted manuscript. All authors listed meet the authorship criteria according to the latest guidelines of the International Committee of Medical Journal Editors and agree with the manuscript. The work is original and not under consideration by any other journal.

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#### Data Availability

The data that support the findings of this study are available from the corresponding author, [HGH], upon reasonable request.

#### Declarations

#### Ethics approval and consent to participate

The Ethics Committee approved this study at Shiraz University of Medical Sciences (IR.SUMS.REC.1400.650).

#### **Consent for publication**

Not applicable.

#### **Competing interests**

The authors declare no competing interests.

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