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Prevalence and Risk Factors for Cancers of the Member Countries in the "Belt and Road" Initiative

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Abstract

Background We analyze the prevalence and risk factors of cancer in the member states of the “Belt and Road”, to explore the basis of health and medical cooperation between countries, and to provide a foundation for formulating cancer prevention and control policies for building the healthy "Belt and Road". **Methods** We apply incidence, mortality, age-standardized rates, and population attributable fractions (PAFs) to measure the prevalence and risk factors of cancers in the “Belt and Road” countries. **Results** Lung, breast, colorectal, stomach, liver, prostate, cervical, esophageal, thyroid, and uterine cancers are the most common and highest mortality cancers in the “Belt and Road” countries. For men, the highest cancer incidence and mortality is Hungary (ASR, 289.3 per 100,000 and ASR, 235.7 per 100,000, respectively), followed by Latvia (ASR, 288.6 per 100,000 and ASR, 196.5 per 100,000, respectively), the United Arab Emirates and Saudi Arabia enjoy the lowest (ASR, 34.3 per 100,000 and ASR, 36.1 per 100,000, respectively). The mortality and incidence rates of cancers in Greece and Brunei are highest in females (ASR, 238.7 per 100,000 and ASR, 192.3 per 100,000, respectively). Tobacco products, infectious factors, and ultraviolet rays are the three main cancer risk factors in the “Belt and Road” countries. **Conclusion** The overall burden of cancer in the “Belt and Road” member states remains substantial, while the corresponding cancer prevention and control policies need to be improved. Enhancing health cooperation among the member countries will contribute to the joint response to the risks and challenges posed by cancer. (249 words)

Key words the “Belt and Road”; cancer prevalence; risk factors; strategies

1 Background

More than 2,000 years ago, the industrious and brave people on the Eurasian continent explored many trades and cultural exchange routes that connected the major civilizations of Asia, Europe and Africa, and later generations collectively referred to them as the "Silk Road"^[1]. During his visits to Central and Southeast Asian countries in September and October 2013, Chinese President Xi Jinping proposed to jointly build the "Silk Road Economic Belt" and the "21st Century Maritime Silk Road". The "Belt and Road" achieves the common development and common prosperity of all member states by building a community of interests, destiny, and responsibility in all aspects of political mutual trust, economic integration, and cultural inclusiveness.

In recent years, with the development of society and the economy, the disease burden in low human development index (HDI) and medium HDI countries has shifted from being dominated by communicable, maternal, neonatal, and nutritional deficiency diseases (CMNN) to being dominated by non-communicable diseases (NCDs) and injuries ^[2]. And with the improvement of clinical diagnosis and treatment, cancer has been included in the ranks of chronic non-infectious diseases and is one of the main components of NCD disease burden. Cancer become the second leading cause of premature death after cardiovascular disease, accounting for about 4.5 million (29.8%) deaths globally in 2016 ^[3]. As health is a core issue of human development, China's the "Belt and Road" initiative provides a great opportunity for cooperation and collective action among multiple countries. In 2016, General Secretary Xi Jinping proposed to work together to build a healthy Silk Road, taking health as one of the important contents of the "Belt and Road" construction. The development of health undertakings is directly related to the national and regional sustainable development goals and is the driving force for the construction of the "Belt and Road" ^[4]. At present, member states face different types of cancers threats to varying degrees. Understanding the prevalence and risk factors in the "Belt and Road" member states is an important foundation for health cooperation between countries. Therefore, based on the global data of cancer and cancer country profiles released by the World Health Organization in 2020, we analyzed

the prevalence and risk factors of cancer in the member countries of the “Belt and Road” to provide a basis for formulating cancer prevention and control policies for building healthy "One Belt and One Road".

2 Materials and methods

2.1 Data source

We used data from the Global Cancer Observatory (gco.iarc.fr) ^[5] and Cancer Country Profiles (<https://www.who.int/cancer/country-profiles/en/>) ^[6] in 2020. Global Cancer Observatory, an online data set that provides a comprehensive assessment of the Global Cancer burden in 2020 based on GLOBOCAN estimates of morbidity, mortality, and prevalence for 36 cancer types grouped by sex and age in 185 countries or territories in 2020. The methods used in compiling the estimates in GLOBOCAN are country-specific, and the quality of the national estimates depends on the coverage, accuracy, and timeliness of the recorded incidence and mortality data in each country, and more details are described in elsewhere ^[7]. There is a lack of cancer-related data in Palestine and Yemen in this database. Therefore, this study collected and analyzed cancer data in other 64 member states.

2.2 Index definition

In this study, we used morbidity, mortality, and age-standardized rates to analyze and compare cancer incidence and death in "One Belt and One Road" countries. Incidence, generated by population-based cancer registries (PBCRs), is the number of new cases occurring in a specified period and geographic region which conveyed either as an absolute number of cases per annum or as a rate per 100,000 persons per year. Mortality, similarly, is used to measure the number of deaths per unit of time (overall or attributable to specific factors) in a population of a given size. It is usually expressed in units per 100,000 persons per year. Age-standardized rates (ASRs) per 100,000 person-years are corrected by the direct method and the world standard population to allow for the effects of the differences in age structure of a population. The methods used to estimate the global incidence and mortality in 2020 together with their uncertainty intervals (for all ages) can be found in elsewhere ^[8,9]. Population attributable

fractions (PAFs) refers to the proportion of the incidence or death of a disease attributable to a certain exposure factor in the total morbidity or death of a disease in the population, that is, the proportion of the morbidity or death of related diseases that can be reduced in the population after the elimination of exposure factors. The contribution of selected risk factors and the percentage of premature deaths from non-communicable diseases due to cancer was measured by PAFS in this article. The specific calculation method is detailed elsewhere ^[10].

"One Belt and One Road" member country refers to the cooperative organization of politics, economic, cultural, and other fields along the line, including 66 member countries. Apart from Cyprus, the Czech Republic, Greece, Hungary, Israel, and Singapore, the remaining 60 countries are all developing countries: (1) East Asia: China, Mongolia; (2) The association of south-east Asian nations (ASEAN): Singapore, Malaysia, Indonesia, Myanmar, Thailand, Laos, Cambodia, Vietnam, Brunei, and the Philippines; (3) West Asia: Iran, Iraq, Turkey, Syria, Jordan, Lebanon, Israel, Palestine, Saudi Arabia, Yemen, Oman, United Arab Emirates, Qatar, Kuwait, Bahrain, Greece, Cyprus, and Egypt's Sinai Peninsula; (4) South Asia: India, Pakistan, Bangladesh, Afghanistan, Sri Lanka, Maldives, Nepal, and Bhutan; (5) Central Asian: Kazakhstan, Uzbekistan, Turkmenistan, Tajikistan, and Kyrgyzstan; (6) The Commonwealth of Independent States (CIS) : Russia, Ukraine, Belarus, Georgia, Azerbaijan, Armenia, and the Republic of Moldova; (7) Central and Eastern Europe (CEE): Poland, Lithuania, Estonia, Latvia, Czech Republic, Slovakia, Hungary, Slovenia, Croatia, Bosnia and Herzegovina Mostly, Montenegro, Serbia, Albania, Romania, Bulgaria, and Macedonia.

2.3 Data analysis

We conducted a descriptive analysis and comparison of the incidence and death of cancers in the “Belt & Road” countries, as well as a visual presentation.

3 Results

3.1 Prevalence of cancers in global and geographical distribution of “the Belt & Road” countries

Breast, lung, colorectum, prostate, stomach, liver, cervix uteri, esophagus, thyroid,

and bladder cancers rank amongst the top ten newly cancers, and lung, colorectum, liver, stomach, breast, esophagus, prostate, cervix uteri, bladder, thyroid cancer rank amongst the top ten cancers in terms of deaths, with a total of 12,176,526 new cases and 6,532,679 deaths worldwide, respectively (table 1, figure a1, a2). The cancers with the highest morbidity and mortality in male and female worldwide are lung cancer and breast cancer, respectively (figure1). All along “the Belt & Road” member countries, the top ten new cancers are lung, breast, colorectum, stomach, liver, esophagus, prostate, cervix uteri, thyroid, and corpus uteri cancers. The top ten cancers with the highest mortality rate are lung, liver, stomach, colorectum, oesophagus, breast, cervix uteri, prostate, pancreas, and ovary cancers. Cancers with the highest morbidity and mortality in male and female are the same as in the world. The member countries of the “Belt and Road” has the lower of cancer incidence and the higher of cancer mortality compared to the world (Figure 1).

Among East Asian member countries, the cancers with the highest morbidity and mortality are lung cancer and digestive tract cancers. In the member countries of ASEAN, West Asia, South Asia, and Central Asia, this condition has a breast cancer and lung cancer predominance. In South Asia, lip and oral cavity cancers are the leading cause of mortality, and rank among the top five causes of morbidity. In the countries of CIS and CEE, the greatest number of new cases and deaths are from cancers of the colorectal cancer and lung, and of which the central and eastern European countries have a high incidence of male’s cancers, such as bladder and prostate. See more details in table 1 and figure 1.

Table 1. New Cases and Deaths of main cancers for global and geographical location of “the Belt & Road” countries Combined in 2020[n].

World		East Asia		ASEAN		West Asia		South Asia		Central Asia		CIS	
New cases	Deaths	New cases	Deaths	New cases	Deaths	New cases	Deaths	New cases	Deaths	New cases	Deaths	New cases	Deaths
2261419	684996	416559	117236	158820	58622	99116	33153	226537	115464	11377	4701	104903	34470
2206771	1796144	816048	715119	123221	109442	77575	68712	99734	91007	8717	7089	89929	76256
1931590	935173	555637	286262	106919	57022	61339	31821	84176	48909	6869	4077	110426	59948
1414259	375304	115462	51111	41048	15925	48716	16279	43223	21071	2288	1172	65160	21066
1089103	768793	479368	374422	32012	26596	34358	29065	78719	69390	8992	6985	52187	39424

905677	830180	412274	393212	99210	95617	39752	37598	28123	27307	3765	3585	8606	8199	
604127	341831	110075	59242	68249	38319	1487	694	142127	88663	4945	2678	22309	10820	1
604100	544076	324820	301508	10278	9704	-	-	98043	90947	3217	3053	886	865	
586202	43646	221093	9261	28475	3907	24919	2031	2058	325	-	-	17960	1242	
573278	212536	66242	29678	10810	5837	36575	14768	4632	2715	1454	655	20831	7928	3
-	-	70500	67994	2449	2385	17020	16375	18	18	1449	1392	28433	27909	2
-	-	-	-	-	-	1167	194	-	-	-	-	2350	624	
-	-	81964	16607	24227	7238	15208	4097	20316	7699	2493	777	41911	9938	2
-	-	55423	37568	29734	19067	13036	8733	55407	38604	2357	1534	19413	11686	1
-	-	50155	29741	35466	20217	24762	12822	7929	4622	102	65	-	-	
-	-	-	-	34992	26537	27973	20005	59876	43969	848	715	9769	5976	
-	-	118	42	2755	1338	3424	1440	386	268	1002	550	31322	12390	1
-	-													
		34	30	514	446	13750	11603	1023	905	2150	1864	946	809	
-	-	-	-	3030	1760	-	-	28756	11529	-	-	-	-	
-	-	-	-	1223	744	3986	1424	39161	23468	455	259	4068	2472	
-	-	-	-	8242	4780	-	-	171170	96257	744	374	13145	6489	
-	-	-	-	27190	18352	-	-	47	29	-	-	-	-	
-	-	-	-	-	-	123	31	-	-	-	-	-	-	
-	-	-	-	-	-	-	-	6353	4978	-	-	-	-	
-	-	-	-	-	-	-	-	3266	2007	-	-	-	-	
12176526	6532679	3775772	2489033	848864	523855	544286	310845	1201080	790151	63224	41525	644554	338511	4

a2. The mortality rate of both sex.

a3. Male incidence rate.

a4. Male mortality rate.

Figure 1. Comparison of estimated 2020 age-standardized rates (world) between Global and “One Belt &One Road” countries, all ages.

3.2 Distribution of cancer in each member country of the “Belt and Road”

Table 2 shows the total number of the top ten newly diagnosed cancer cases and deaths, the incidence and mortality ASRs separately in each member country of the “Belt and Road” in men and women. Among all the “Belt and Road” member countries, the country with the highest incidence and mortality of cancers among men is Hungary (ASR, 289.3 per 100,000 and ASR, 235.7 per 100,000, respectively), second is Latvian (ASR, 288.6 per 100,000 and ASR, 196.5 per 100,000, respectively), and the United Arab Emirates and Saudi Arabia enjoy the lowest rates of incidence and mortality,

respectively (ASR, 34.3 per 100,000 and ASR, 36.1 per 100,000, respectively). In female, the highest incidence rates are estimated in Greece (ASR, 238.7 per 100,000), followed by Mongolia, Turkey, Cyprus, Singapore, and Brunei. The country with the highest mortality rate is Brunei (ASR, 192.3 per 100,000), followed by Israel, Singapore, Cyprus, Greece, Mongolia. See Table 2 for more details.

Table 2. Incidence and Mortality Rates for “the Belt & Road” countries and Sex for the top ten cancers combined (Including Nonmelanoma Skin Cancer) in 2020

Country	Incidence				Mortality			
	Males		Females		Males		Females	
	Cases(n)	ASR(world)	Cases(n)	ASR(world)	Cases(n)	ASR(world)	Cases(n)	ASR(world)
China	2071503	110.9	1569685	152.5	1699192	57.6	915248	134.3
Mongolia	2731	208.3	2336	235.3	2346	126.1	1764	160.4
Singapore	9670	110.7	5818	186	9247	67.5	4057	189.7
Malaysia	17375	70.3	11809	104.2	20483	61.9	10506	121.2
Indonesia	127024	67.8	85670	97.1	171816	57.8	83581	116.4
Myanmar	24093	89.9	19613	153.6	30479	65.9	20023	98.9
Thailand	70395	94.1	52769	128.7	76657	57.6	42656	134.3
Laos	3395	112.5	2780	134.5	3540	72.8	2019	121.1
Cambodia	5985	89	4899	108	7570	60.7	4593	96.6
Vietnam	79763	89.9	62988	153.6	68348	57.6	38848	134.3
Brunei	369	105.9	205	180	449	74	152	192.3
Philippines	51138	93.4	36435	127	71068	66.7	34434	137.5
Iran	51511	84	36096	120.7	44621	55.8	23255	101.4
Iraq	9721	67.2	6856	91.2	14805	56.7	7312	107.2
Turkey	103677	143.7	66139	227.3	75896	65	33954	103.4
Syria	6653	76.5	4681	107.3	8938	62.9	4638	117.5
Jordan	3956	79.6	2577	118.8	4960	55.7	2067	125.5
Lebanon	4236	71.8	2631	116.7	4348	55.6	2065	120.2
Israel	11236	89.9	5034	153.6	11375	56.1	4352	190
Saudi Arabia	9945	38.11	5284	63.7	10856	36.1	3904	87.4
Oman	1486	89.9	935	153.6	1165	40.8	496	83.8
The united Arab emirates	1530	34.3	688	61.3	2186	54.7	639	134
Qatar	632	50.1	320	79.6	457	51.8	166	103.4
Kuwait	1304	45.6	632	78	1664	53.2	580	116.6
Bahrain	418	50.7	228	82.7	519	46.6	202	103.4
Greece	29098	109.9	15835	238.7	20671	55.3	9047	176.2
Cyprus	2217	95.81	1128	216.9	1791	57.6	740	185.4
Egypt	51272	103.7	39199	130.8	51142	57.6	29165	134.3
India	417198	43.2	290541	62	504113	45.84	309586	73.7

Pakistan	55079	48.4	38697	67.9	60613	49.7	37250	77.2
Bangladesh	60755	89.9	45215	153.6	51330	48.8	35279	68.7
Afghanistan	6776	61.4	5611	73.2	8437	59.82	5676	119.9
Sri Lanka	9627	45.5	6091	72.4	12153	37.97	5904	82.3
Maldives	194	68	136	94.1	211	51.1	88	115.4
Nepal	5890	39.3	4345	53.1	8279	39.2	5386	58.8
Bhutan	236	55.8	206	63.2	189	46.1	140	59.6
Kazakhstan	12181	89.9	8751	153.6	13802	56.9	7406	114.4
Uzbekistan	9834	58	7401	77.6	12834	50.3	7914	78.9
Turkmenistan	1980	69.2	1524	89.2	2721	56.6	1634	91
Tajikistan	1989	59.1	1597	71.5	2475	47.7	1526	71.2
Kyrgyzstan	2481	89.9	2020	153.6	2927	57.5	1752	94.1
Russia	216520	210.1	130042	124.6	235235	163.2	105157	58.3
Ukraine	58905	181.9	35480	108	62846	148.5	27173	52.2
Belarus	16723	244.7	9296	134.6	15288	167.8	6031	49.6
Georgia	4813	162.8	3480	115.3	4760	133.4	2666	62.1
Azerbaijan	5998	118.4	4458	88.4	5776	91	3302	51.1
Armenia	3987	205.9	2867	144.7	3327	125.7	2086	73.1
Moldova	5658	209.7	3883	143.9	4718	133.6	2590	66.9
Poland	78597	221.9	49900	137	76615	195.6	38215	77.2
Lithuania	6609	230.6	3177	99	6045	134.3	2553	57.6
Estonia	3406	287.2	1662	127.1	2781	180.3	1346	55.6
Latvian	4868	288.6	2346	131.8	4380	196.5	2008	67
Czechia	27844	256.2	10957	89.9	22335	134.3	7993	57.6
Slovakia	12182	261.1	6786	136.3	10156	134.3	5086	57.6
Hungary	25449	289.3	13502	147.3	24776	235.7	11648	89.1
Slovenia	6247	277.4	2839	103.32	4496	134.3	2001	57.6
Croatia	10628	251.8	6383	134.78	8667	192	4201	66.75
Bosnia and Herzegovina	6169	196.1	4475	137	4837	149.9	2834	73.5
Montenegro	1109	210.4	772	137	1036	134.3	526	57.6
Serbia	18585	228.5	11831	135.8	17640	130.9	8918	58.08
Albania	3296	130.8	2226	83.7	2102	98.7	979	37.3
Romania	40773	230	24545	133.7	33599	174.1	16596	67.81
Bulgaria	15896	153.6	8875	89.9	11846	162	6322	65.96
Macedonia	3448	200.4	2223	123.1	2702	157.1	1287	66.8

Among the top ten cancers in East Asian countries, the total incidence and mortality of cancer in Mongolia are respectively ASR, 158.0 per 100,000 and ASR, 128.8 per 100,000, and both are larger in females than in males. The highest cancer rates and deaths is liver cancer. The total cancer incidence and mortality in China are 146.3 per 100,000 and 84.4 per 100,000, respectively, and the highest cancer incidence

and mortality are lung cancer and breast cancer, respectively (figure 2).

Figure 2. Comparison of estimated 2020 age-standardized rates (world) between Global and East Asia countries, all ages.

Among the ASEAN countries, Singapore has the highest cancer incidence rate (ASR, 149.4 per 100,000) and the second highest mortality rate (ASR, 58.4 per 100,000), while Vietnam has the highest cancer mortality rate (ASR, 58.9 per 100,000). The countries with the highest overall cancer morbidity and mortality among men are Singapore and Laos (ASR, 132.9 per 100,000 and ASR, 80.4 per 100,000, respectively), while women are Brunei, with overall cancer incidence and mortality are ASR, 137.4 per 100,000 and ASR, 52.9 per 100,000, respectively. Cancers of the colorectum, lung, prostate, liver in men, and cancers of the breast, lung, colorectum, and cervix uteri in

women continue to be the most common fatal cancers (figure 3).

c3. Male incidence rate.

c4. Male mortality rate.

c5. Female incidence rate.

Figure 3. Comparison of estimated 2020 age-standardized rates (world) among ASEAN countries, all ages.

Among the member countries in West Asia, the highest cancer incidence rate in Cyprus, Greece, and Israel with a high cancer incidence of breast, prostate, lung, and colorectum, while Turkey, Egypt, and Syria have the highest cancer mortality, and lung, breast, liver, prostate, colorectum, and bladder deaths are the most. Cancer incidence and mortality rates are highest among men respectively in Greece (ASR, 238.7 per 100,000) and Turkey (ASR, 143.7 per 100,000), with lung, prostate, bladder, and colorectum as the main reasons. Israel, Greece, and Cyprus have the highest cancer incidence rates of breast, thyroid, corpus uteri, and colorectum in the women. The top three countries with the highest cancer mortality are Cyprus, Egypt, and Iraq, with principally deaths of cancer are breast, lung, colorectum, ovary, and cervix uteri; and of which, leukaemia, brain, and central nervous system are all in the top five cancer death types in Iraq. See Figure 4 for more details.

d1. The incidence rate of both sex.

d2. The mortality of both sex.

d3. Male incidence rate.

Figure 4. Comparison of estimated 2020 age-standardized rates (world) among West Asia countries, all ages.

Large distribution differences exist in the prevalence of cancers in South Asian member countries, with the total number of newly diagnosed cancer cases in Bhutan are much higher than other countries (ASR, 176.2 per 100,000). Bangladesh has some of the highest cancer incidence rates in men (ASR, 153.6 per 100,000), such as lung, prostate, and colorectum cancers. High incidence of cancers of breast, colorectum, non-Hodgkin lymphoma, and esophagus in women in Afghanistan (ASR, 119.9 per 100,000) and Maldives (ASR, 115.4 per 100,000). On the contrary, deaths are more evenly distributed across countries, with the most deaths from lung cancer and digestive system cancer in men, and most deaths from breast cancer and lung cancer in women. See Figure 5 for more details.

e3. Male incidence rate.

e4. Male mortality rate.

e5. Female incidence rate.

Figure 5. Comparison of estimated 2020 age-standardized rates (world) among South Asia countries, all ages.

Lung, prostate, colorectum, and stomach cancers in men in Kazakhstan and Uzbekistan is of very high incidence among the Central Asian countries, while the small difference of the incidence and death of cancers are observed in women, breast, cervix uteri, colorectum, corpus uteri, and stomach are the main ones (Figure 6).

Figure 6. Comparison of estimated 2020 age-standardized rates (world) among Central Asia countries, all ages.

Among the member states of the Commonwealth of Independent States, the highest cancer incidence among both sex, male, and female in Belarus and Russia with the top five most common cancers of prostate, breast, colorectum, lung, and corpus uteri. Similarly, the highest cancer mortality occurs in Armenia and The Republic of Moldova, with lung, breast, prostate, colorectum, and stomach cancers principally (Figure 7).

g1. The incidence rate of both sex.

g2. The mortality rate of both sex.

g3. Male incidence rate.

Figure 7. Comparison of estimated 2020 age-standardized rates (world) among CIS countries, all ages.

The incidence of cancer in the member states of Central and Eastern Europe is the highest among all the member states of the “Belt and Road”, the combined cancer incidence is over ASR, 200.0 per 100,000. The cancer mortality rate is relatively low, ASR, 100.0 per 100,000 on average. Hungary is the country with the most serious cancer incidence and death, with a total morbidity rate of ASR, 321.1 per 100,000 and a total mortality rate of ASR, 125.2 per 100,000. Prostate and breast cancers are the two commonly diagnosed cancer types, and lung, colorectum, breast, prostate cancers are the leading causes of cancer death (Figure 8).

h3. Male incidence rate.

h4. Male mortality rate.

h5. Female incidence rate.

Figure 8. Comparison of estimated 2020 age-standardized rates (world) among Central and eastern Europe countries, all ages.

3.3 Distribution of major cancers in the " Belt and Road" member states

The main cancer burdens in the member states of the “Belt and Road” are the cancer of lung, breast, colorectal, stomach, liver, prostate, and cervical. In terms of the incidence and mortality of lung cancer, CEE member countries carry the heaviest one, and the burden of men is approximately 4- to 5-fold that of women (Figure 9, i1). The incidence of breast cancer shows a greatly difference, ranging from ASR, 25.46 per 100,000 to ASR, 56.96 per 100,000. However, these is less marked in mortality (Figure 9, i2). The burden of colorectal cancer in men is twice that of women, and the burden of incidence is twice that of mortality as well. The heaviest burden of colorectal cancer is observed in CEE member states, followed by the CIS and ASEAN (Figure 9, i3). East Asian member states have the largest burden of morbidity and mortality of stomach cancer, which are 2-4 times and 1-5 times that of other member states, respectively (Figure 9, i4). The same happens in liver cancer which are 3-30 times and 6-30 times that of other member states, respectively (Figure 9, i5). The incidence of prostate cancer is relatively high, while the mortality is opposite; and the incidence and mortality burden of prostate cancer in CEE member states is the heaviest, with ASR, 53.81 per 100,000 and ASR, 14.26 per 100,000, respectively (Figure 9, i6). The incidence and mortality of cervical cancer are evenly distributed in Member States, with the exception

of the lowest incidence in West Asia, the morbidity and mortality in other member countries ranged from ASR, 11.00 per 100,000 to ASR, 17.00 per 100,000 and ASR, 5.00 per 100,000 to ASR, 10.00 per 100,000, respectively (Figure 9, i7).

i2. Breast cancer

i3. Colorectum cancer

i4. Stomach cancer

i5. Liver cancer

i6. Prostate cancer

i7. Cervical cancer

Figure 9. Bar chart of region-specific incidence and mortality age-standardized rates by sex for cancers in 2020.

3.4 Three main risk factors for cancers in the “Belt and Road” member states

According to our statistics, tobacco products, infectious factors, and ultraviolet rays are the three main risk factors for cancers in the “Belt and Road” member countries. Tobacco products are the biggest challenge facing all member states, with the highest burden of cancer incidence and mortality in East Asia and CEE (Figure 10, j1). The mean PAFs scores of tobacco products are estimated 30% and above in 10 member states: Serbia, Greece, Hungary, Bosnia and Herzegovina, Bulgaria, Croatia, Poland, Romania, Turkey, and China; and its’ value above 20% is estimated in a further 27 members. Infectious factors are the most predominant risk factors for cancers in ASEAN, CEE, and East Asia, with PAFs of 151.35%, 87.13%, and 37.00% respectively (Figure 10, j2). There are 5 member states with more than 30% of PAFs: Vietnam, Singapore, Romania, Mongolia, Laos, and 11 member states with more than 20%. The cancer burden caused by ultraviolet rays is mainly concentrated in the member states of CEE, CIS, Central Asia, and West Asia (Figure 10, j3). Similarly, more than 50% of PAFs, dominated by CEE, are estimated in 17 member states: Estonia, Georgia, Kazakhstan, Latvia, Hungary, Israel, Belarus, Bulgaria, Croatia, Cyprus, Czech Republic, Lithuania, Poland, Romania, Russia, Serbia, Slovenia, Ukraine. There are eight other member states with PAFs above 30%.

j1. Tobacco products

j2. Infectious factors

j3. Ultraviolet rays

Figure 10. Pie chart of Distribution of major cancer risk factors in the “Belt and Road” countries.

4 Discussion

Cancer poses a growing global threat to human health ^[11]. In 134 out of 183 countries, cancer is the first or second leading cause of premature death (i.e., 30-69 years of age), and in another 45 countries, cancer is ranked at third or fourth ^[12]. Death rates from non-communicable diseases, particularly cancer, are declining in most high-income countries, but not in low-income countries. By 2040, cancer incidence is projected to increase by the largest percentage in countries with low and medium HDI: from 2018 to 2040, the estimated increase is 100% in the low HDI tier and 75% in the middle HDI tier, looking at population changes alone ^[3]. Most of countries of the “Belt and Road” are developing countries other than Cyprus, Czech Republic, Greece, Hungary, Israel, and Singapore. Lung cancer, breast cancer, gastrointestinal cancer, prostate cancer, cervical cancer, thyroid cancer, and uterine cancer are the common challenges that the "Belt & Road" countries must face together. Countries with low - to mid-level HDI levels are currently ill-equipped to cope with the coming increase in the cancer burden. Thus, the health "One Belt and One Road" initiative offers new solutions to the challenge of the cancer burden in low - and medium-level HDI countries. Strengthening regional scientific and technological cooperation through targeted, resource-sharing, effective and cost-effective means, such as establishing combined laboratories or research centers, transferring international technology and knowledge, are necessary measure to reduce the burden of cancers ^[13,14].

Cancer is a complex disease, and the incidence and death of cancer vary widely among Member States. The highest lung and digestive tract cancers incidence has occurred in East Asia, whereas this condition has a breast cancer and lung cancer predominance in ASEAN, West Asia, South Asia, and Central Asia. In South Asia, lip cancer and oral cavity cancer are the leading causes of cancer deaths. South and Central Asia account for more than a third of the global oral cancer burden. In 2018, India had the highest burden of oral cancer, with approximately 120,000 new cases ^[3]. In the

member countries in CIS and CEE, colorectal cancer and lung cancer are the most diagnosed cancers with the highest mortality, and of which the CEE countries have a high incidence of male's cancers, such as bladder and prostate. These variations might be related to disparities in genetic vulnerability, lifestyle, and local environmental exposures among the different locations. For example, the ASR of alcohol-induced cancer deaths and DALY varies greatly between countries and regions. The highest burden of alcohol-induced cancers was observed in Eastern Europe, and the lowest in North Africa and the Middle East ^[15]. In countries with high HDI, the risk of colorectal cancer tends to be relatively high, and morbidity and mortality rates have stabilized or declined ^[16]. The increased prevalence of obesity and the increased consumption of dairy products and calcium have previously been associated with an increase in the risk of prostate cancer. In the black population, for instance, the incidence of prostate cancer is much higher ^[17]. Further, the inherent and growing disparities in medical practice and health infrastructure within and between countries also affect the patterns and trends in cancer mortality ^[18, 19, 20, 21]. Two major factors in the decline in prostate cancer deaths are likely to be prostate cancer associated with PSA testing (i.e., more cancers are found at an earlier stage) and better management of their patients ^[22].

Lung cancer remains the most common type of cancer globally, with an estimated 2.1 million new cases and 1.8 million deaths worldwide in 2018 ^[3]. Lung cancer is the leading cause of cancer morbidity and mortality in men among the “Belt and Road” countries as well. Smoking is the leading cause of lung cancer, accounting for 63 per cent of all lung cancer deaths globally and more than 90 per cent in countries where smoking is common in both sexes ^[23]. However, the burden of cancer deaths from tobacco products in the “Belt and Road” member countries is heavy, and tobacco control policies have been failed to adequately implement. In 2018, Turkey, the only member country, implemented five of the six MPOWER measures. Ten countries (Bulgaria, Czech Republic, Egypt, Nepal, Russia, Saudi Arabia, Slovenia, Thailand, Greece, and Iran) implemented three of the six MPOWER measures, but seven countries have not implemented the MPOWER measures. What's more, emerging tobacco products have challenged regulatory approach to control the public health burden of tobacco-related

cancers. Further research should be conducted to determine the risks of emerging tobacco products to accelerate progress in tobacco control, while limiting the hazards of existing traditional tobacco products.

The cancer burden among women in the “Belt and Road” countries is considerably high. Breast cancer remains a serious cancer burden in women. According to the latest data in 2020, breast cancer has surpassed lung cancer and for the first time become the most common cancer in the world (accounting for 11.7% of new cases), ranking the first among the types of cancer worldwide ^[24]. The rising prevalence of breast cancer is associated with the trend of earlier age at menarche, later age at birth, and parity ^[25]. Therefore, the incidence of breast cancer can be reduced through regular physical examination screening, postponation or reduction of fertility, reasonable weight control, moderate increase in the amount of exercise and other control measures. However, nine of the “Belt and Road” countries (Afghanistan, Azerbaijan, Brunei, Cambodia, Nepal, Tajikistan, Uzbekistan, Yemen, and Pakistan) have not yet conducted breast cancer screening. The starting age of the target population for breast cancer screening is mainly between 30 and 50 years old, the age of screening in Malaysia, Maldives and Bhutan is below 20 years old. Developing scientific and effective screening methods for breast cancer, improving breast cancer screening programs, and actively carrying out early diagnosis and treatment are still the key points of breast cancer prevention and treatment in the future.

In addition, cervical cancer carries the highest burden in less developed countries and regions in the “Belt and Road” countries ^[26], and nearly 100% of cervical cancers are caused by high-risk human papilloma virus (HPV) infection ^[27]. While cervical cancer is the only common cancer with a clear etiology and can be completely effectively prevented by tertiary prevention ^[28], and HPV vaccination can protect at least 80% of the target population ^[29]. Only 18 of the member countries have HPV vaccination programmes in place, of which, vaccination coverage of Bhutan, Brunei, Malaysia, and Turkmenistan are more than 80%, while Armenia, the Philippines, Singapore, and Indonesia are less than 5%. Moreover, there are 12 member states (i.e., Afghan, Egypt, Oman, Saudi Arabia, Tajikistan, Uzbekistan, Yemen, Pakistan,

Kyrgyzstan, Kuwait, Iraq, and Iraq) have not yet carried out cervical cancer screening. Therefore, the implementation of HPV vaccination plan and the development of the corresponding screening strategy is the main task of cervical cancer prevention and control in the “Belt and Road” member states.

Infectious agents are the key cause of cancer, particularly in low- and middle-income countries. It was estimated that in 2018, about one-eighth of the 18 million new cancer cases in the world were caused by infection ^[30]. Hepatitis B virus (HBV) infection, Hepatitis C virus (HCV) infection, liver fluke and *Clonorchis sinensis* remain the leading infectious factors leading to cancer in low- and middle-income countries ^[30,31,32]. Among other infectious factors, including HTLV-1 and large parasites, contribute little to the global burden of cancer, but are significant cause of cancer in endemic populations ^[33]. What's more, *Helicobacter pylori* is responsible for a large number of gastrointestinal cancers and deaths ^[34]. Combination therapy with antibacterial drugs has potential preventive effects. Since 1982, vaccines have been available to prevent HBV, and direct-acting antiviral drugs have the potential to cure more than 95 per cent of people infected with HCV ^[3]. Adequate infection control strategies, including cheap and reliable point-of-care diagnostic tests for specific infectious agents for screening, effective treatments, and therapeutic and preventive vaccines, should all play a broader role in cancer control programs. However, to realize these aspirations, a large amount of international investment is required. Therefore, the "Belt and Road" initiative provides a new platform for international health cooperation.

Ultraviolet radiation directly or indirectly induces DNA damage, leads to mutations, triggers inflammation and immunosuppression, finally leads to tumor growth. Photocarcinogenesis is a complex, multi-step pathway, which is triggered by the formation of dipyrimidine photoproducts and leads to the formation of mutations (initial stage). Sunburn and inflammation caused by persistent DNA lesions (including dipyrimidine photoproducts and oxidative DNA lesions) play a role in promoting the process of photocarcinogenesis ^[35]. The dipyrimidine photoproduct triggers ultraviolet-induced immunosuppression, leading to the failure of immune surveillance and the growth and development of cancer cells ^[36]. The incidence of both melanoma and non-

melanoma skin cancer is increasing worldwide, not only in Caucasians^[37], but also in Asians, where UV mutations are significantly more common in sun-exposed skin areas than in non-sun-exposed skin areas^[38]. The most effective way to reduce the incidence of skin cancer is to avoid unnecessary sun exposure and take personal precautions, such as wearing protective clothing, hats, applying sunscreen, and staying in a cool place, which can significantly reduce the risk of sun damage.

5. Conclusion

In summary, the challenges posed by cancer are consistent in the “Belt and Road” member countries: Lung cancer, breast cancer, gastrointestinal cancer, prostate cancer, cervical cancer, thyroid cancer, and uterine cancer are the biggest cancer burdens in the “Belt and Road” countries, and tobacco products, infectious factors, and ultraviolet rays are the main risk factors, while the corresponding cancer prevention and control policies need to be improved. Therefore, in the context of the health "Belt and One Road" initiative, the collaboration of multi-stakeholder and the sharing of resources will play a positive role in jointly coping with the risks and challenges brought by cancer and promoting the healthy development of the medical and health undertakings of all member states and the world.

Abbreviations

HDI	Human Development Index
CMNN	Communicable, Maternal, Neonatal, and Nutritional deficiency diseases
NCDs	Non-Communicable Diseases
PBCRs	Population-Based Cancer Registries
ASRs	Age-Standardized Rates
PAFs	Population Attributable Fractions
ASEAN	The Association of South-East Asian Nations
CIS	The Commonwealth of Independent States
CEE	Central and Eastern Europe

HPV	Human Papilloma Virus
HBV	Hepatitis B Virus
HCV	Hepatitis C Virus

Declarations

-Ethics approval and consent to participate

Not Applicable.

-Consent to publish

Yes.

-Availability of data and materials

Yes.

-Competing interests

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BW and FH participated in the design, data analysis and drafting of the first manuscript.

YH, YS, DW, and QW participated in the data collection and manuscript modification.

JW participated in the design of the study and review of the draft manuscript. All authors read and approved the final manuscript.

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