



Eliminating malaria in the REPUBLIC OF KOREA



The Republic of Korea, which was malaria-free from 1979 to 1993, is seeking to eliminate malaria for the second time by 2017.

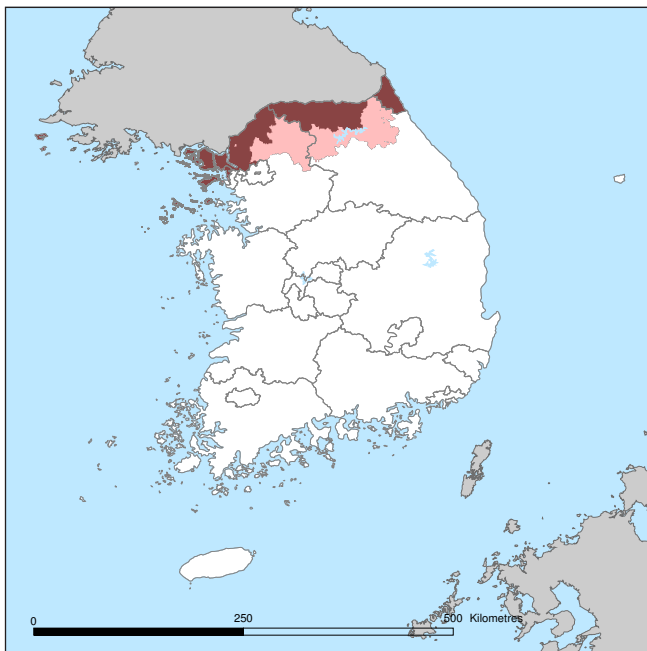
At a Glance^{1,3}

- 560** Local cases of malaria
(100% *P. vivax*)
- 0** Deaths from malaria
- 14** % population living in areas of active transmission
(total population: 50.1 million)
- 0.01** Annual parasite incidence
(cases/1,000 total population/year)
- N/A** % slide positivity rate

N/A: Data not available

Malaria Transmission Limits





Plasmodium vivax



Overview

The Republic of Korea is a densely populated country that is categorized in the malaria elimination phase by the World Health Organization (WHO).¹ The entire Korean Peninsula was declared free of malaria in 1979 by WHO, but in 1993, malaria reemerged and cases in the Republic of Korea increased rapidly, peaking in 2000 at 4,183.^{1,2} Since then, the Republic of Korea has achieved an 87 percent decline in cases, reporting just 560 local cases in 2014.^{1,3} *Plasmodium vivax* is the only malaria parasite present in the Korean Peninsula, causing unstable seasonal transmission from May through October, with 81 percent of cases occurring from June through September.⁴ *Anopheles sinensis* was previously thought to be the primary vector in the Republic of Korea.⁵ However, more recent data has implicated two other species, *An. pullus* and *An. kleini*, as primary vectors, with *An. sinensis* playing a secondary role in transmission.⁶ Adult males serving in the military are at greatest risk for malaria since most transmission occurs along the length of the demilitarized zone (DMZ) bordering the Democratic People's Republic of Korea (DPRK). Most cases, both military and civilian, are concentrated in the northern provinces of Gangwon and Gyeonggi, as well as the Incheon Metropolitan Area.^{7,8}

The significant decline in cases since 2000, when the Republic of Korea launched its malaria elimination campaign, can

-  Water
-  *P. vivax* free
-  Unstable transmission (API < 0.1)
-  Stable transmission (API ≥ 0.1)

P. vivax malaria risk is classified into no risk, unstable risk of <0.1 case per 1,000 population (API) and stable risk of ≥0.1 case per 1,000 population (API). Risk was defined using health management information system data and the transmission limits were further refined using temperature and aridity data. Data from the international travel and health guidelines (ITHG) were used to identify zero risk in certain cities, islands and other administrative areas.



be attributed to effective chemoprophylaxis for military personnel, the advent of a web-based surveillance and epidemic detection and response system, and improved stratification and identification of risk areas.⁴ In 2009, the Republic of Korea joined the Asia Pacific Malaria Elimination Network (APMEN), a network composed of 18 Asia Pacific countries and other stakeholders working to eliminate malaria in the region, helping to bolster political support for its national elimination efforts.⁹

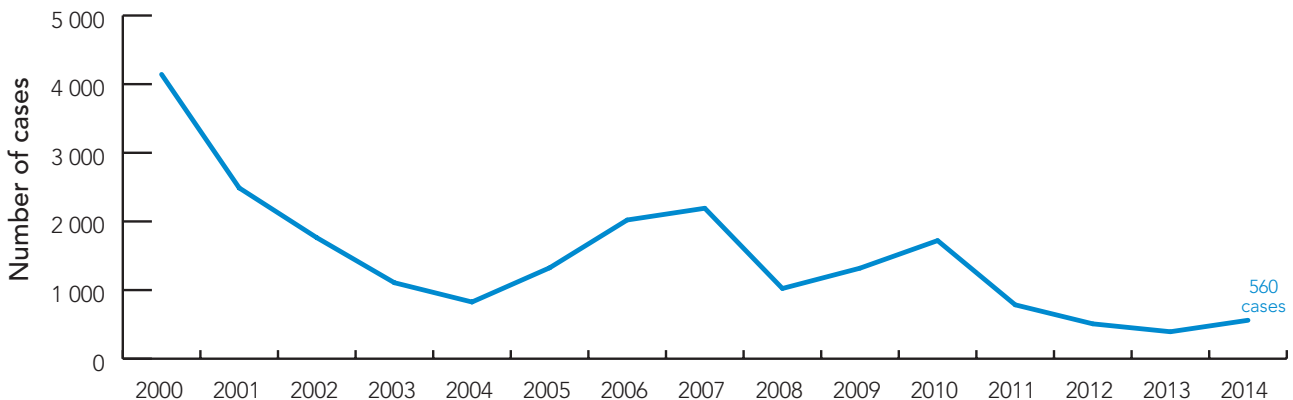
In 2010, a new Action Plan for Malaria Elimination was implemented with a national elimination goal of 2015. Strategies included: 1) reinforcement of control and prevention activities among military forces through increased collaboration with the Department of Defense; 2) intensification of epidemiological surveillance and rapid diagnosis in high-risk areas; 3) increased diagnostic capacity with quality assurance; 4) utilization of mapping to improve surveillance and case investigation; 5) improved collaboration with communities and medical institutions; and 6) promotion of malaria control activities in neighboring DPRK to prevent importation.⁸ Since

the Action Plan was launched, the Republic of Korea has experienced a 73 percent decrease in annual malaria cases.¹ However, in 2014, the malaria program pushed its elimination goal to 2017 in order to address the increasing threat of importation from DPRK through additional strengthening of surveillance, case investigation, and vector control coverage.^{4,10}

Progress Toward Elimination

P. vivax has been endemic and the cause of unstable malaria transmission on the Korean Peninsula for centuries. After Japan invaded Korea in 1910, there was no concerted effort to control malaria during the 35 years of its colonial occupation.¹¹ The end of World War II in 1945 divided the Korean Peninsula into North and South, separated by the DMZ.¹² Although malaria case data specific to the Republic of Korea was not available during the Korean War (1950–1953), it has been reported that thousands of national and foreign troops were afflicted by *P. vivax* throughout the Korean Peninsula as a result of wartime conditions.¹³

Reported Malaria Cases*



Since a peak in 2000, cases declined by 87 percent to 560 cases in 2014.

*Graph shows local cases only.

Source: World Health Organization, World Malaria Report 2015; Korea CDC

Goal:^{3,10} Achieve national malaria elimination level by 2017, defined as < 0.1 cases per 100,000 population



In 1959, the Republic of Korea established the National Malaria Eradication Service with assistance from WHO, and for the next two decades cases declined as a result of indoor residual spraying (IRS) with DDT, chloroquine treatment for blood-stage parasites, primaquine treatment for liver-stage parasites, and socioeconomic development.¹³ By 1979, the Republic of Korea was declared malaria-free by WHO, and shortly thereafter, DPRK declared that it, too, was malaria-free.²

However, in 1993, a soldier stationed in the DMZ was diagnosed with the first case of indigenous malaria on the Korean Peninsula in 14 years.¹⁴ It is unclear how transmission in the Republic of Korea was reintroduced or whether it originated in DPRK. Regardless of the source, the number of malaria cases increased exponentially over the next seven years, primarily among soldiers stationed in the DMZ-bordering provinces of Gangwon and Gyeonggi.^{15,16} Beginning in 1997, cases began to extend to the east and south as military veterans returned to their hometowns and civilians visited high-risk areas along the northern border.^{7,17} The government responded by launching a mass chemoprophylaxis campaign among military personnel in 1997, followed by the launch of a malaria elimination program in 2000, housed under the Korean Center for Disease Control & Prevention. Elimination efforts focused on early case detection and treatment, continued chemoprophylaxis using chloroquine and primaquine for soldiers deployed near the DMZ, vector control, and financial support to the DPRK for its malaria control efforts.¹⁵

As a result of these interventions, in the four years after the new elimination program launched, malaria cases declined by 80 percent, from 4,142 in 2000 to just 826 in 2004. This success was likely bolstered by the malaria control efforts carried out simultaneously by DPRK. However, after 2004, cases began to increase among both the military and civilian population, rising to 2,192 cases in 2007, then peaking again in 2010 at 1,721 cases.¹ The epidemiology of malaria infections also changed during this period: by 2007 over 60 percent of cases were among civilians, and local transmission was beginning to occur in previously non-prevalent areas.^{15,18-19} Reasons for these trends are unclear, although likely causes include increased urbanization in areas directly adjacent to rice fields and unusually warm autumn weather, which may have led to higher density mosquito populations and extended transmission seasons.^{16,20}

Since 2010, there has been a sharp decrease in malaria cases in the Republic of Korea, a decline of 73 percent.^{1,3}

Eligibility for External Funding²²⁻²⁴

The Global Fund to Fight AIDS, Tuberculosis and Malaria	No
U.S. Government's President's Malaria Initiative	No
World Bank International Development Association	No

Economic Indicators²⁵

GNI per capita (US\$)	\$27,090
Country income classification	High income
Total health expenditure per capita (US\$)	\$1,880
Total expenditure on health as % of GDP	7
Private health expenditure as % of total health expenditure	47

Implementation of a web-based surveillance system that is updated daily and facilitates real-time data sharing is one significant accomplishment of the elimination program, serving to improve case reporting and case investigation at all levels.⁴ In addition, mass chemoprophylaxis along the DMZ continues to be successful in dramatically reducing malaria among soldiers, although efficacy of prophylaxis has been hampered by poor compliance. A study from 2003–2007 found that fewer than 25 percent of soldiers took their prophylactic medications on a regular basis. This finding may help explain the emergence of chloroquine-resistant *P. vivax* in the Republic of Korea, the first examples of this type of resistance in temperate Asia.²¹

The Republic of Korea continues to strengthen its malaria elimination efforts as it moves toward its goal of national elimination by 2017. Redefining and restratifying risk areas in 2013 helped the program refine its targeting of surveillance and vector control interventions. Current priority areas include increasing case investigation coverage from the current 90 percent to 100 percent, including all military personnel; reducing the duration for diagnosis and treatment to less than three days after case presentation; increasing collaboration and information sharing with the military; and addressing the threat of importation from DPRK.⁴



Challenges to Eliminating Malaria

Cross-Border Collaboration

Beginning in 2001, the Republic of Korea provided annual aid to DPRK in the form of bed nets, antimalarial drugs, laboratory equipment, and insecticides; this aid was ceased when DPRK began receiving Global Fund support in 2009.²⁶ From 2003 to 2010, both countries participated in annual meetings hosted by the WHO to share control strategies and data, but political tensions have prevented the development of formal agreements on a peninsula-wide approach for malaria elimination. Small-scale collaborative efforts between provincial governments of Republic of Korea and DPRK facilitated by non-governmental organizations have had success in the past, but these are limited in scope and hindered by the

complicated political situation.²⁷ Since most of Republic of Korea's malaria cases are concentrated in the north along the DMZ, the lack of cooperation poses a threat to achievement of elimination.

Conclusion

The Republic of Korea has successfully responded to the *P. vivax* malaria resurgence, and is continually scaling up its efforts to eliminate malaria. The country benefits from strong national and regional political support for elimination from its government and through its membership in APMEN, as well as consistent financial support from domestic resources. However, the need for increased cross-border collaboration with DPRK is an obstacle that the Republic of Korea must address in order to achieve national elimination by 2017.

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Transmission Limits Map Sources

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About This Briefing

This Country Briefing was developed by the UCSF Global Health Group's Malaria Elimination Initiative, in partnership with the Korean Center for Disease Control and Prevention. To send comments or for additional information about this work, please email Anne.Bulchis@ucsf.edu.



The **Global Health Group** at the University of California, San Francisco is an 'action tank' dedicated to translating new approaches into large-scale action that improves the lives of millions of people. Launched in 2007, the UCSF Global Health Group's **Malaria Elimination Initiative (MEI)** works at global, regional, and national levels to accelerate progress toward malaria elimination in countries and regions that are paving the way for global malaria eradication. The MEI believes that global eradication of malaria is possible within a generation.

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The **Malaria Atlas Project (MAP)** provided the malaria transmission maps. MAP is committed to disseminating information on malaria risk, in partnership with malaria endemic countries, to guide malaria control and elimination globally. Find MAP online at: www.map.ox.ac.uk.

