DPRK is working to reduce malaria transmission to 70 percent of the 2011 incidence by 2017, and achieve elimination by 2025.

**Overview**

The Democratic People’s Republic of Korea (DPRK) has experienced a 93 percent reduction in malaria cases since 2001, from more than 140,000 to fewer than 11,000 in 2014. The national malaria program is categorized in the pre-elimination phase by the World Health Organization (WHO). DPRK first eliminated malaria in the early 1970s and remained malaria-free until cases reemerged in 1998 and quickly spread along the border with the Republic of Korea. Malaria cases are reported throughout the country, except in the three northern provinces of Jagang, Ryanggang, and North Hamgyong. The majority of cases occur in the three provinces bordering the demilitarized zone between DPRK and Republic of Korea (Kangwon, North Hwanghae, and South Hwanghae). Plasmodium vivax is the only malaria parasite found in DPRK, and the primary vector is Anopheles sinensis, a zoophilic mosquito that breeds in rice fields and other fresh, sun-exposed bodies of water. Secondary vectors include An. listeri, An. anthropophagus, and An. yatushi-roensis, which breed in low hills, rice fields, and wetlands.

Malaria in DPRK is unstable and seasonal, with more than 95 percent of annual cases in the past few years reported from May to October, peaking in the summer months. About 70 percent of all malaria cases occur among overnight workers in the agricultural and industrial sectors, and, as observed in...
other Asia Pacific countries, most of the at-risk population resides in rural areas.\textsuperscript{3,8} No malaria deaths have been reported in DPRK in more than 30 years, and mass chemoprophylactic efforts, called Mass Primaquine Preventive Treatment (MPPT), have been credited for the successful reduction of the malaria burden to low levels relative to the 2001 peak.\textsuperscript{7,8} In light of this progress in reducing transmission, DPRK launched a national malaria pre-elimination strategy in 2009 and updated it in 2012, emphasizing microstratification of risk areas, geographical reconnaissance to improve targeting of interventions, intensified surveillance, and community education, with an ultimate goal of national elimination by 2025.\textsuperscript{3} DPRK is also a country partner of the Asia Pacific Malaria Elimination Network (APMEN), a network composed of 18 Asia Pacific countries and other partner institutions working to eliminate malaria in the region.\textsuperscript{9}

**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.\textsuperscript{10} The end of World War II in 1945 divided the Korean Peninsula into North and South, separated by the demilitarized zone (DMZ).\textsuperscript{11} Although malaria case data specific to DPRK 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. After the war, the number of malaria cases in DPRK reportedly diminished, yet epidemic foci remained along the southern border.\textsuperscript{10,12} Radical elimination efforts by both DPRK and Republic of Korea, including mass distribution of bed nets and high coverage

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**Goals:**\textsuperscript{3}

1. By 2017, reduce national malaria incidence by 70 percent of the 2011 level.
2. By 2017, reduce malaria incidence in high-risk areas to less than 3 per 1,000 population.
3. Eliminate malaria by 2025.

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**Reported Malaria Cases***

*Malaria was eliminated from DPRK in the early 1970s, but in 1998 cases reemerged and quickly spread throughout the southern and central regions. An integrated response that included mass drug administration reduced the malaria burden by 93% between 2001 and 2014.*

* DPRK does not distinguish between local and imported when reporting case numbers.

*Source: World Health Organization, World Malaria Report 2015*
of indoor residual spraying (IRS) and antimalarial drugs, led to a dramatic decrease in *P. vivax* prevalence in the 1960s and 1970s, and by 1979 the WHO declared the entire Korean Peninsula malaria-free.\textsuperscript{13,14}

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.\textsuperscript{15} Soon after, malaria spread in the DMZ and in the Republic of Korea, but the first official indigenous case in the DPRK was not reported until 1998.\textsuperscript{4} Because DPRK had been free of malaria for so long, there was very limited capacity within the Ministry of Health (MoPH) to respond. With the assistance of WHO, the MoPH launched a national malaria control program (NMCP) in 1999, but it was not fully operational until 2001; cases increased dramatically during this three year period, with over 600,000 reported.\textsuperscript{14,16} The rapid increase in cases was due in part to heavy rainfall and subsequent flooding that led to an increase in stagnant water in rice fields, creating ideal breeding conditions for *An. sinensis*. Deforestation in the 1990s, coupled with changes in rice-field irrigation systems, also contributed to the resurgence. Further compounding the matter, the government response to the ballooning epidemic was delayed due to significant economic disruptions and intense flooding.\textsuperscript{3,12}

Beginning in 2002, with support from WHO, malaria control efforts for at-risk populations focused on MPPT. Over the next five years, this large-scale intervention proved successful in decreasing the national caseload from 98,852 confirmed cases in 2002 to 4,795 in 2007; reported cases during this same time period dropped from 241,000 to 7,436.\textsuperscript{1,16} In addition to MPPT, the NMCP introduced insecticide treated nets (ITNs) and IRS beginning in 2003, but coverage was low due to limited funds.\textsuperscript{14}

In 2008, DPRK successfully applied for a Global Fund Round 8 grant to expand its malaria control efforts and reorient its program toward pre-elimination. The US$21.5 million grant enabled the program to: 1) enhance case management through maximizing confirmed diagnosis and treatment; 2) implement an integrated vector control approach through delivery of IRS and long-lasting insecticide-treated nets (LLINs); 3) encourage community involvement and awareness through malaria education campaigns; and 4) improve national and local program management through capacity-building and training.\textsuperscript{4} However, delays in disbursement of funds led to poor coverage of planned interventions and the number of confirmed cases in 2008 increased by 70 percent to 16,989.\textsuperscript{1,17} MPPT was not conducted in 2008, but once it was implemented again in 2009, reported cases decreased by 29 percent.\textsuperscript{14} IRS and LLIN coverage improved once Round 8 funds were disbursed beginning in 2010, and the NMCP also initiated personal protection measures and community education campaigns.\textsuperscript{3,17}

The NMCP launched an updated pre-elimination strategy in late 2012, with the goals of reducing malaria incidence by 70 percent of the 2011 level by 2017 and achieving national elimination by 2025. Under the updated strategy, MPPT has been identified as a best practice and is a high priority for the program, as are annual IRS and LLIN distribution in medium- and high-risk areas. The NMCP is also using microstratification and geographical reconnaissance to improve targeting and monitoring of interventions, strengthening case management and outbreak response capabilities, and increasing staff technical capacity through regular trainings and skill development opportunities with partner organizations such as APMEN.\textsuperscript{3} In 2013, the first full year of implementation of the updated strategy, reported cases dropped to 14,407, a 34 percent decline from 2012. A further 27 percent decline was seen in 2014, with 10,535 cases reported.\textsuperscript{1,2}

### Eligibility for External Funding\textsuperscript{18–20}

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

### Economic Indicators\textsuperscript{21}

| GNI per capita (US$) | $1,045 or less |
| Country income classification | Low income |
| Total health expenditure per capita (US$) | N/A |
| Total expenditure on health as % of GDP | N/A |
| Private health expenditure as % of total health expenditure | 6 |

N/A: Data not available
Challenges to Eliminating Malaria

Characteristics of the *P. vivax* malaria parasite
Research conducted by the MoPH in 2000 indicated that there are two strains of *P. vivax* in DPRK, one with a short incubation period of 2–3 weeks, and the other with a significantly longer incubation period of 6–18 months. The majority (70–80 percent) of infections in DPRK are caused by the latter strain, which means that most annual infections do not manifest until the following transmission season. MPPT administered prior to the annual transmission season has proven very effective in reducing malaria incidence, but this program requires extensive time and human resources to ensure safety and high coverage.\(^16,17\)

Sustained financing for elimination
Economic and trade sanctions prevent DPRK from obtaining finances or supplies for malaria elimination activities to which other low-income countries have access. Although the country received Round 8 funding from the Global Fund and US$13.9 million has been allocated under the new funding model for the period 2014–2016, DPRK does not qualify for many other international aid programs. The country receives only sporadic donor support, and domestic resources are insufficient to cover the funding gaps.\(^7,22\) Until recently, Republic of Korea provided annual funds and materials to DPRK’s malaria program via WHO, but this support ceased once the Global Fund grant was awarded.\(^17\) Persistent food shortages and recent flooding have necessitated the diversion of aid toward malnutrition and other infectious diseases, compounding the malaria program’s financing challenges.\(^23,24\)

Cross-Border Collaboration
No formal cross-border collaboration exists between DPRK and Republic of Korea. This is problematic since most of DPRK’s cases are concentrated in the southern provinces bordering the DMZ. Political tension between the North and South is prohibitive to any formal agreement concerning a peninsula-wide approach to controlling malaria. Small-scale collaborative efforts between DPRK and provincial governments of Republic of Korea facilitated by non-governmental organizations have had success in the past, but these are limited in scope and hindered by ongoing political tensions.\(^25\)

Conclusion
With the support of WHO, the Global Fund, and UNICEF, DPRK has put forth a strong effort in developing and implementing a comprehensive malaria pre-elimination program to combat unstable and relapsing *P. vivax* with limited resources. Increased cross-border collaboration between the DPRK and the Republic of Korea, greater regional engagement through APMEN, reliable funding streams, and continued strengthening of program capacity and interventions are critical for successful elimination of malaria in DPRK by 2025.

Sources
About This Briefing

This Country Briefing was developed by the UCSF Global Health Group’s Malaria Elimination Initiative, in collaboration with the WHO Regional Office for South-East Asia. Malaria transmission risk maps were provided by the Malaria Atlas Project. This document was produced by Alistair Dawson; to send comments or for additional information about this work, please email Alistair.Dawson@ucsf.edu.