

Technical Notes

Reference Standard for Malaria Risk Areas

The primary reference standard used for the descriptions of malaria risk areas in this collection is the 2010 Edition of the Health Information for International Travel – commonly referred to as the “Yellow Book” written by the Centers for Disease Control and Prevention (CDC) and published on June 30, 2009.

The CDC’s Interactive Malaria Risk Map application was not used as the primary reference for malaria risk areas for the following reasons:

- The Interactive Map Application in current use is a “Beta” (test) version.
- The CDC has not validated their interactive map application to ensure that the information reported through the application is accurate, consistent, and reliable.
- The CDC has not disclosed their method of change control to ensure that the information reported through the application is accurate, consistent, and reliable.

The CDC’s Interactive Malaria Risk Map application has been used as a secondary or supplemental reference, to clarify or investigate the locations cited by the CDC in the Yellow Book. The CDC’s Interactive Malaria Risk Map has been used more extensively for reference in two particular instances:

1. Differentiation of urban locations from rural locations in countries or areas identified by the CDC as having malaria in rural areas:
By correlating location risk results provided by the CDC’s Interactive Malaria Risk Map with current population data, the urban/rural population cutoff for each country or area can be deduced and applied in order to provide malaria risk information for additional locations.
2. Determination of geographic boundaries of certain malaria endemic areas described in inexact terms (e.g. “along the border with...”) in the CDC Yellow Book.

For malaria outbreaks and other interim changes in malaria endemic areas, the following references are used:

- Morbidity and Mortality Weekly Report (published by the CDC)
- CDC Outbreak Notices (issued by the CDC)
- AABB Smart Brief (published by the AABB)
- AABB Weekly Reports (published by the AABB)
- AABB Regulatory Updates (published by the AABB)

Variability in Spelling of Location Names

Unfortunately, it is impossible to obtain 100% agreement on the translated English spelling of many location names. This is due to the fact that not all languages use the Roman alphabet to represent words and ideas. This is particularly apparent on the Asian continent, where Arabic, Cyrillic, Greek, Chinese, Japanese, and Korean writing systems exist (just to name a few).

In order to represent words and names in a way that is recognizable to English speaking people, words from different writing systems are approximated using the Roman alphabet, a process known as Romanization. Numerous systems have been developed to Romanize words from different languages. Some systems attempt to preserve the meaning of the original word, whereas other systems attempt to represent the word phonetically, thus approximating the pronunciation of the original word.

Wikipedia has a good article on Romanization that provides a good overview of the issues, challenges, and variety of translation systems in current use.

Please visit <http://en.wikipedia.org/wiki/Romanization> for additional information.

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The bottom line is this: foreign location names may have more than one “correct” spelling. This is inevitable and should be expected to a certain extent.

For users of these and other maps, it is important to bear in mind that the sound of a location name is more important than the exact spelling. Donor screeners should be trained to consider approximate matches in location name, particularly for locations in Asia.

International Standard for Division Names:

Fortunately, the International Standards Organization (ISO) has recently compiled and published an international standard for world countries and administrative divisions. The ISO 3166-2 standard has been applied to all province, state, department, district, prefecture, municipality, region, and other administrative division names referenced in this collection. Instances where the ISO name differs from the name used by the CDC have been noted below. In the instance of a city sharing the same name as the administrative division, the city name is spelled according to the ISO standard for the administrative division.

Technical Notes on Specific Countries / Maps

Afghanistan:

The reference elevation map obtained for Afghanistan details an elevation cutoff near to the 2,000 m elevation indicated in the CDC description, but not exactly at 2,000 m. As a result, the malaria risk screening map depicts malaria risk in areas below 2,112 m instead of 2,000 m for Afghanistan. This is a slight over-statement of the malaria risk area in Afghanistan.

Argentina:

Urban locations in Argentina were verified against the CDC’s Interactive Malaria Risk Map.

Armenia:

Armenia is divided into 10 provinces (called marzes) plus the capital city of Yerevan, which is designated as a special administrative region. Armenia has a province called Ararat, but there is not a province called Artashat, therefore it is concluded that the CDC’s reference to “... the Ararat and Artashat region ...” refers to the general area of the cities of Ararat and Artashat. Since the province of Ararat encompasses the areas described in the CDC description of malaria risk for Armenia, the entire province of Ararat has been identified as a malaria risk area.

http://en.wikipedia.org/wiki/Administrative_divisions_of_Armenia (Retrieved 4/18/2008)

Azerbaijan:

The reference elevation map obtained for Azerbaijan details an elevation cutoff near to the 1,500 m elevation indicated in the CDC description, but not exactly at 1,500 m. As a result, the malaria risk screening map depicts malaria risk in areas below 2,000 m instead of 1,500 m for Azerbaijan. This is a slight over-statement of the malaria risk area in Azerbaijan.

The elevations of all locations indicated within Azerbaijan were verified against the GeoNames database.

Urban locations in Azerbaijan were verified against the CDC’s Interactive Malaria Risk Map.

Bhutan:

The Geylegphug district is the former name of the Sarpang district and is not distinct from the Sarpang district.

http://en.wikipedia.org/wiki/Districts_of_Bhutan (Retrieved 7/14/2009)

The overlay for Bhutan has been revised to reflect both name variations for this district.

The reference elevation map obtained for Bhutan details an elevation cutoff near to the 1,700 m elevation indicated in the CDC description, but not exactly at 1,700 m. As a result, the malaria risk screening map depicts malaria risk in areas below 2,000 m instead of 1,700 m for Bhutan. This is a slight over-statement of the malaria risk area in Bhutan.

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Locations within the risk area in Bhutan were verified against the CDC's Interactive Malaria Risk Map. No urban areas were identified within the risk area.

Bolivia:

The reference elevation map obtained for Bolivia details an elevation cutoff near to the 2,500 m elevation indicated in the CDC description, but not exactly at 2,500 m. As a result, the malaria risk screening map depicts malaria risk in areas below 3,050 m instead of 2,500 m for Bolivia. This is a slight over-statement of the malaria risk area in Bolivia.

The following departments are entirely below 2,500 m: El Beni, Pando, and Santa Cruz. The departments of Chuquisaca, Cochabamba, La Paz, Potosí, and Tarija have areas above and below 2,500 m, whereas the Oruro department is completely above 2,500 m. Since the CDC does not identify malaria risk in areas below 2,500 m in Potosí department, Potosí has been color-coded as an area of no known risk.

Botswana:

Botswana is comprised of nine districts. The ISO 3166-2 standard does not include provinces by the name of Chobe or Ngamiland. Further research revealed that the districts of Chobe and Ngamiland were combined in 2001 to form the current North-West district, therefore the North-West district has been depicted as a malaria risk area.

The CDC risk description indicates that risk is present in areas north of 22°S latitude. The North-East district is located north of 22°S latitude; therefore the North-East district is also depicted as a malaria risk area.

Brazil:

The boundary of malaria risk areas in the states of Maranhão and Mato Grosso are estimated based on the CDC's description of "Risk in parts of Maranhão (western part), Mato Grosso (northern part)..."

Burma:

The reference elevation map obtained for Burma details an elevation cutoff near to the 1,000 m elevation indicated in the CDC description, but not exactly at 1,000 m. As a result, the malaria risk screening map depicts malaria risk in areas below 1,525 m instead of 1,000 m for Burma. This is a slight over-statement of the malaria risk area in Burma. Urban locations in Burma were verified against the CDC's Interactive Malaria Risk Map.

Cambodia:

The boundary of the non-malaria risk area surrounding Lake Tonle Sap is estimated based on the CDC's description of no risk "... around Lake Tonle Sap."

China:

The reference elevation map obtained for China details an elevation cutoff near to the 1,500 m elevation indicated in the CDC description, but not exactly at 1,500 m. As a result, the malaria risk overview map of China depicts malaria risk in areas below 1,525 m instead of 1,500 m for China. This is a slight over-statement of the malaria risk area in China.

The urban/rural population cutoff for China was deduced by correlating risk results for locations in China provided by the CDC's Interactive Malaria Risk Map with current population data obtained from the GeoNames database. This cutoff was applied to additional locations in China to determine malaria risk.

The city of Zhangye, located in Gansu municipality, is listed on the CDC's Interactive Malaria Risk Map as having no known risk, however verification of the population and elevation of this location against the GeoNames database indicates that this location is below 1500 m elevation and does

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not exceed the population cutoff for urban areas in China. As a result, this location is coded as a malaria risk location.

The city of Zhuozhou is listed on the CDC's Interactive Malaria Risk Map as being located in Beijing municipality; however verification of this location against the GeoNames database and other independent sources indicates that Zhuozhou is located in Hebei province.

The city of Baoji is listed on the CDC's Interactive Malaria Risk Map as being located in Gansu municipality; however verification of this location against the GeoNames database and other independent sources indicates that Baoji is located in Shaanxi province.

The city of Tongren, located in Guizhou province, is listed on the CDC's Interactive Malaria Risk Map as having no known risk, however verification of the population and elevation of this location against the GeoNames database indicates that this location is below 1500 m elevation and does not exceed the population cutoff for urban areas in China. As a result, this location is coded as a malaria risk location.

The city of Jishui, located in Henan province, is listed on the CDC's Interactive Malaria Risk Map as having no known risk, however verification of the population of this location against the GeoNames database indicates that this location is does not exceed the population cutoff for urban areas in China. As a result, this location is coded as a malaria risk location.

The city of Xinshi, located in Hubei province, is listed on the CDC's Interactive Malaria Risk Map as having no known risk, however verification of the population of this location against the GeoNames database indicates that this location is does not exceed the population cutoff for urban areas in China. As a result, this location is coded as a malaria risk location.

The city of Meihekou, located in Jilin province, is listed on the CDC's Interactive Malaria Risk Map as having no known risk, however verification of the population of this location against the GeoNames database indicates that this location is does not exceed the population cutoff for urban areas in China. As a result, this location is coded as a malaria risk location.

The city of Jishu, located in Jilin province, is listed on the CDC's Interactive Malaria Risk Map as having malaria risk, however verification of the population of this location against the GeoNames database indicates that this location exceeds the population cutoff for urban areas in China. As a result, this location is coded as a non-malaria risk location.

The city of Lishui, located in Zhejiang province, is listed on the CDC's Interactive Malaria Risk Map as having no known risk, however verification of the population of this location against the GeoNames database indicates that this location is does not meet exceed the population cutoff for urban areas in China. As a result, this location is coded as a malaria risk location.

The city of Shenjiamen, located in Zhejiang province, is listed on the CDC's Interactive Malaria Risk Map as having no known risk, however verification of the population of this location against the GeoNames database indicates that this location is does not exceed the population cutoff for urban areas in China. As a result, this location is coded as a malaria risk location.

The city of Fuyang, located in Zhejiang province, is listed on the CDC's Interactive Malaria Risk Map as having no known risk, however verification of the population of this location against the GeoNames database indicates that this location is does not exceed the population cutoff for urban areas in China. As a result, this location is coded as a malaria risk location.

The elevations of all non-urban locations indicated within Gansu, Guizhou, Shaanxi, Shanxi, and Sichuan provinces; and Nei Mongol, Ningxia, and Xinjiang autonomous regions were verified against the GeoNames database.

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NOTE: All locations within Chongqing municipality are listed as belonging to Sichuan province on the CDC's Interactive Malaria Risk Map. The interactive map does not reflect the existence of Chongqing municipality, which was created from a portion of Sichuan province on June 12, 1997.

Colombia:

The reference elevation map obtained for Colombia details an elevation cutoff near to the 1800m elevation indicated in the CDC description, but not exactly at 1800 m. As a result, the malaria risk screening map depicts malaria risk in areas below 2000 m instead of 1800m for Colombia. This is a slight over-statement of the malaria risk area in Colombia.

The urban/rural population cutoff for Colombia was deduced by correlating risk results for locations in Colombia provided by the CDC's Interactive Malaria Risk Map with current population data obtained from the GeoNames database. This cutoff was applied to additional locations in Colombia to determine malaria risk.

The elevations of all locations indicated within Colombia were verified against the GeoNames database.

Ecuador:

The reference elevation map obtained for Ecuador details an elevation cutoff near to the 1,500 m elevation indicated in the CDC description, but not exactly at 1,500 m. As a result, the malaria risk screening map depicts malaria risk in areas below 1,525 m instead of 1,500 m for Ecuador. This is a slight over-statement of the malaria risk area in Ecuador.

El Salvador:

Locations in El Salvador were verified against the CDC's Interactive Malaria Risk Map.

The town of Ciudad Arce is listed on the CDC's Interactive Malaria Risk Map as being located in Santa Ana department and having malaria risk, however verification of this location against the GeoNames database indicates that Ciudad Arce is located in the department of La Libertad and is therefore not within the malaria risk area as described in the CDC's 2010 Edition of the Yellow Book.

The town of Chalchuapa is listed on the CDC's Interactive Malaria Risk Map as being located in Ahuachapan department, however verification of this location against the GeoNames database and other independent sources indicates that Chalchuapa is located in Santa Ana department. Since the CDC's 2010 Edition of the Yellow Book states that malaria is present in rural areas in both Ahuachapan and Santa Ana departments, the malaria risk of this location is not affected by this finding.

Eritrea:

The reference elevation map obtained for Eritrea details an elevation cutoff near to the 2,200 m elevation indicated in the CDC description, but not exactly at 2,200 m. As a result, the malaria risk screening map depicts malaria risk in areas below 2,250 m instead of 2,200 m for Eritrea. This is a slight over-statement of the malaria risk area in Eritrea.

Ethiopia:

The composite malaria risk map shows malaria risk in areas below 2,500 m as indicated in the CDC description. The elevation of all locations indicated within Ethiopia were verified against the GeoNames database.

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Georgia

The CDC risk description refers to the Kveno Kartli region. ISO-3166-2 indicates a spelling of Kvemo Kartli for this region. The boundary of the malaria risk location in Georgia is estimated based on the CDC's description of risk in the area "... in the southeastern part of the country near the Azerbaijan border, mainly in the Kakheti and Kveno Kartli (sic) regions."

Guatemala:

The composite malaria risk map shows malaria risk in areas below 1,500 m as indicated in the CDC description.

The elevations of all locations indicated within Guatemala were verified against the GeoNames database.

Locations in Guatemala were verified against the CDC's Interactive Malaria Risk Map.

The town of Rabinal is listed on the CDC's Interactive Malaria Risk Map as having no known risk, however verification of this location against the GeoNames database and other independent sources indicates that this location is below the elevation of 1500 m and has a lower population than other locations below 1500 m that the CDC's Interactive Malaria Risk Map lists as having risk. As a result of this finding, the town of Rabinal has been identified as a risk area.

Guyana:

Urban locations in Guyana were verified against the CDC's Interactive Malaria Risk Map.

The reference elevation map obtained for Guyana details an elevation cutoff near to the 900 m elevation indicated in the CDC description, but not exactly at 900 m. As a result, the malaria risk screening map depicts malaria risk in areas below 1,000 m instead of 900 m for Guyana. This is a slight over-statement of the malaria risk area in Guyana.

The elevations of all locations indicated within Guyana were verified against the GeoNames database.

Honduras:

The composite malaria risk map shows malaria risk in areas below 1,000 m as indicated in the CDC description.

The elevations of all locations indicated within Honduras were verified against the GeoNames database.

India:

The composite malaria risk map shows malaria risk in areas below 2,000 m as indicated in the CDC description.

Indonesia:

The urban/rural population cutoff for Indonesia could not be deduced by correlating risk results for locations in Indonesia provided by the CDC's Interactive Malaria Risk Map with current population data obtained from the GeoNames database. As a result, location risk is indicated in accordance with results obtained for each location from the CDC's Interactive Malaria Risk Map.

Iran:

The urban/rural population cutoff for rural areas in Iran was deduced by correlating risk results for locations in Iran provided by the CDC's Interactive Malaria Risk Map with current population data obtained from the GeoNames database. This cutoff was applied to additional locations in Iran to determine malaria risk.

Population data obtained for the city of Nikshahr suggested that this location met the criteria for an urban location; however the population for Nikshahr could not be confirmed. As a result, this location was coded as a malaria risk location.

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Three province names cited by the CDC as areas of malaria risk vary slightly from the international standard names (per ISO 3166-2) as follows:

Sistan-Baluchestan (CDC): Sistan va Baluchestan

Ardebil (CDC): Ardabil (ISO)

The boundary of the malaria risk area in Kerman province is estimated, based on the CDC's description of risk in the area "... the southern tropical part of Kerman ..."

Iraq:

The reference elevation map obtained for Iraq details an elevation cutoff near to the 1,500 m elevation indicated in the CDC description, but not exactly at 1,500 m. As a result, the malaria risk screening map depicts malaria risk in areas below 1,525 m instead of 1,500 m for Iraq. This is a slight over-statement of the malaria risk area in Iraq.

Four province names cited by the CDC as areas of malaria risk vary slightly from the international standard names (per ISO 3166-2) as follows:

Duhok (CDC): Dahuk (ISO)

Erbil (CDC): Arbil (ISO)

Sulaimaninya (CDC): As Sulaimaninya (ISO)

Ta'mim (CDC): At Ta'mim (ISO)

Kenya:

The composite malaria risk map shows malaria risk in areas below 2,500 m as indicated in the CDC description.

Kyrgyzstan:

The boundary of the malaria risk location in Kyrgyzstan is estimated based on the CDC's description of risk in the area "... in the southern and western parts of the country along the borders of Tajikistan and Uzbekistan."

Malaysia:

The urban/rural population cutoff for rural areas in Malaysia was deduced by correlating risk results for locations in Malaysia provided by the CDC's Interactive Malaria Risk Map with current population data obtained from the GeoNames database. This cutoff was applied to additional locations in Malaysia to determine malaria risk.

Mexico:

The urban/rural population cutoff for rural areas in the Mexican states of Nayarit, Oaxaca, and Sinaloa was deduced by correlating risk results for locations in these three states provided by the CDC's Interactive Malaria Risk Map with current population data obtained from the GeoNames database. This cutoff was applied to additional locations in these states to determine malaria risk.

Malaria risk areas in Quintana Roo are based on a documented consultation with CDC Malaria Risk Branch personnel on 7/27/2009.

The non-malaria risk coastal areas in Quintana Roo have been estimated.

The malaria risk area along the Guatemala border in the state of Tabasco was verified against the CDC's Interactive Malaria Risk Map.

The geographic boundaries of the malaria risk area in the state of Chiapas along the Guatemala border could not be determined by evaluating risk results for locations Chiapas provided by the CDC's Interactive Malaria Risk Map. The CDC's Interactive Malaria Risk Map returned positive results for malaria risk for all locations in the state of Chiapas. As a result, the entire state of Chiapas has been identified as a malaria risk area.

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Namibia:

The area referred to as “the Caprivi Strip” by the CDC varies slightly from the international standard name (per ISO 3166-2), “Caprivi”.

Nepal:

The reference elevation map obtained for Nepal details an elevation cutoff near to the 1,200 m elevation indicated in the CDC description, but not exactly at 1,200 m. As a result, the malaria risk screening map depicts malaria risk in areas below 1,500 m instead of 1,200 m for Nepal. This is a slight over-statement of the malaria risk area in Nepal.

Nicaragua:

The urban/rural population cutoff for rural areas in Nicaragua was deduced by correlating risk results for locations in Nicaragua provided by the CDC’s Interactive Malaria Risk Map with current population data obtained from the GeoNames database. This cutoff was applied to additional locations in Nicaragua to determine malaria risk.

North Korea:

The malaria risk area in North Korea has been mapped to include the southern provinces of Pyongyang, Kangwon, Kumgangsan, Kaesong, and North & South Hwanghae.

Pakistan:

The reference elevation map obtained for Pakistan details an elevation cutoff near to the 2,500 m elevation indicated in the CDC description, but not exactly at 2,500 m. As a result, the malaria risk screening map depicts malaria risk in areas below 3,000 m instead of 2,500 m for Pakistan. This is a slight over-statement of the malaria risk area in Pakistan. The elevations of all locations indicated within Pakistan were verified against the GeoNames database.

Panama:

The urban/rural population cutoff for rural areas in Panama could not be determined based on information obtained from the CDC’s Interactive Malaria Risk Map, therefore all locations in risk areas in Panama have been identified as having malaria risk.

Papua New Guinea:

The reference elevation map obtained for Papua New Guinea details an elevation cutoff near to the 1,800 m elevation indicated in the CDC description, but not exactly at 1,800 m. As a result, the malaria risk screening map depicts malaria risk in areas below 2,000 m instead of 1,800 m for Papua New Guinea. This is a slight over-statement of the malaria risk area in Papua New Guinea.

Peru:

The composite malaria risk map shows malaria risk in areas below 2,000 m as indicated in the CDC description.

The elevations all locations indicated the non-risk area outside of the departments of Arequipa, Moquegua, Puno, and Tacna in Peru were verified against the GeoNames database.

Philippines:

The reference elevation map obtained for the Philippines details an elevation cutoff near to the 600 m elevation indicated in the CDC description, but not exactly at 600 m. As a result, the malaria risk screening map depicts malaria risk in areas below 750 m instead of 600 m for the Philippines. This is a slight over-statement of the malaria risk area in the Philippines.

The elevations of all locations indicated within the Philippines were verified against the GeoNames database.

The urban/rural population cutoff for rural areas on the islands of Luzon, Mindanao, and Palawan was deduced by correlating risk results for locations on the islands of Luzon, Mindanao, and

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Palawan provided by the CDC's Interactive Malaria Risk Map with current population data obtained from the GeoNames database. This cutoff was applied to additional locations on the islands of Luzon, Mindanao, and Palawan to determine malaria risk.

Russia:

The boundary of the malaria risk location in Russia is estimated based on the CDC's description of risk in the area "... by (the) border with Azerbaijan."

Saudi Arabia:

The composite malaria risk map shows malaria risk in areas below 2,000 m in 'Asir province as indicated in the CDC description.

The CDC risk description refers to Asir province. ISO-3166-2 indicates a spelling of 'Asir for this province.

South Korea:

The geographic boundaries of the malaria risk area in the provinces of Kyonggi and Kangwon could not be determined by evaluating risk results for locations in these provinces provided by the CDC's Interactive Malaria Risk Map. The CDC's Interactive Malaria Risk Map returned positive results for malaria risk for southern locations within these provinces. As a result, the entire provinces of Kyonggi and Kangwon have been identified as malaria risk areas.

The urban/rural population cutoff for rural areas in the provinces of Kyonggi and Kangwon was deduced by correlating risk results for locations in the provinces of Kyonggi and Kangwon provided by the CDC's Interactive Malaria Risk Map with current population data obtained from the GeoNames database. This cutoff was applied to additional locations in the provinces of Kyonggi and Kangwon to determine malaria risk.

The CDC's Interactive Malaria Risk Map returned a "No known risk" result for malaria risk in the city of Ansong, however population data obtained from the GeoNames database indicates that the population of this city is below the population of other locations within the provinces of Kyonggi and Kangwon that return a "Yes" result for malaria risk (via the CDC's interactive map). This suggests that the city of Ansong should be considered a rural location, therefore this location has been identified as a malaria risk location.

The CDC's Interactive Malaria Risk Map returned a "No known risk" result for malaria risk in the city of Pubal, however population data obtained from the GeoNames database indicates that the population of this city is below the population of other locations within the provinces of Kyonggi and Kangwon that return a "Yes" result for malaria risk (via the CDC's interactive map). This suggests that the city of Pubal should be considered a rural location, therefore this location has not been identified as a non-risk location.

The two province names cited by the CDC as areas of malaria risk vary from the international standard names (per ISO 3166-2) as follows:

Kyonggi (CDC): GYEONGGIDO (KYONGGI-DO) (ISO)

Kangwon (CDC): GANG'WEONDO (KANG-WON-DO) (ISO)

Swaziland:

The 2010 Yellow Book indicates that malaria is present "... in the northern and eastern areas bordering Mozambique and Zimbabwe ...", however Swaziland does not share a border with Zimbabwe.

Syria:

The name of Al-Hassaka province cited by the CDC varies slightly from the international standard name for the province (Al Hasakah, per ISO 3166-2).

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The boundary of the malaria risk area in Al Hasakah province is estimated based on the CDC's description of "Risk along the northern border in El Hassaka province."

Tajikistan:

The reference elevation map obtained for Tajikistan details an elevation cutoff near to the 2,000 m elevation indicated in the CDC description, but not exactly at 2,000 m. As a result, the malaria risk screening map depicts malaria risk in areas below 2,324 m instead of 2,000 m for Tajikistan. This is a slight over-statement of the malaria risk area in Tajikistan.

The elevations of all locations indicated within Tajikistan were verified against the GeoNames database.

Tanzania

The reference elevation map obtained for Tanzania details an elevation cutoff near to the 1,800 m elevation indicated in the CDC description, but not exactly at 1,800 m. As a result, the malaria risk screening map depicts malaria risk in areas below 2,000 m instead of 1,800 m for Tanzania. This is a slight over-statement of the malaria risk area in Tanzania.

Thailand:

The urban/rural population cutoff for rural areas in Thailand was deduced by correlating risk results for locations in the rural risk area provided by the CDC's Interactive Malaria Risk Map with current population data obtained from the GeoNames database. This cutoff was applied to additional locations in the rural risk area to determine malaria risk.

The boundary of malaria risk areas in mainland Thailand are estimated based on the CDC's description of "Malaria is present in rural forested areas that border Cambodia, Laos, and Myanmar (Burma)."

Turkey:

The boundary of the malaria risk location in Turkey is estimated based on the CDC's description of malaria "... by the border with Syria." As a result, the provinces that directly border Syria have been included in the risk area.

The location of Incirlik Air Force Base was obtained from:

http://www.airforcetimes.com/xml/news/2007/11/airforce_kurds_airstrikes_071112w/af071111af_Kurd_map_800.JPG (retrieved 5/5/2008)

Turkmenistan:

The boundary of the malaria risk location in Turkmenistan is estimated based on the CDC's description of malaria "... by (the) Afghanistan border."

Uzbekistan:

The boundary of the malaria risk location in Uzbekistan is estimated based on the CDC's description of malaria "... along the Afghanistan and Tajikistan border."

Venezuela:

All locations in malaria risk states in Venezuela were verified against the CDC's Interactive Malaria Risk Map to identify and confirm urban locations. Locations that did not return a match were presumed to be rural.

Vietnam:

The CDC indicates no risk in the Red River delta. According to Wikipedia, the Red River Delta area consists of the following provinces: Vinh Phuc, Bac Ninh, Hai Duong, Hung Yen, Ha Nam, Hai Phong, Thai Binh, Nam Dinh, Ninh Binh, Ho Tay, and the municipality of Hanoi.

http://en.wikipedia.org/wiki/Red_River_Delta (retrieved 5/7/2008)

Population data for locations in Vietnam were obtained from the GeoNames database.

All mapped locations in Vietnam were verified against the CDC's Interactive Malaria Risk Map.

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The CDC's Interactive Malaria Risk Map returned a "Yes" result for malaria risk in the city of Vinh Yen, however the GeoNames database indicates that Vinh Yen is the administrative seat of the province of Vinh Phuc. Vinh Phuc is within the area known as the Red River Delta, where malaria is not present according to the 2010 Edition of the CDC's Yellow Book. Accordingly, Vinh Yen has been identified as a non-risk location.

The CDC's Interactive Malaria Risk Map returned a "No known risk" result for malaria risk in the city of Dong Xoai, however population data obtained from the GeoNames database indicates that the population of this city is below the population of other locations within Vietnam that return a "Yes" result for malaria risk (via the CDC's interactive map). This suggests that the city of Dong Xoai should be considered a rural location. Since the location of Dong Xoai was determined to not be within the area known as the Red River Delta, this location has been identified as a malaria risk location.

Yemen:

The composite malaria risk map shows malaria risk in areas below 2,000 m as indicated in the CDC description.