from day 76 performed at the national arbovirus reference laboratory indicated a C value of 35.82). Semen samples collected on days 99 and 117 tested negative for Zika virus RNA. Attempts at virus isolation from the semen sample collected on day 23 failed to cultivate infectious particles.

It is very unlikely that transmission of Zika virus infection to patient 2 occurred through a mosquito bite. Although occasional interceptions of exotic mosquito species have occurred at international ports of entry into New Zealand, neither of the Aedes species of mosquito capable of transmitting Zika virus infection is established in the country (10). This case report and results of research into the duration of infectivity of Zika virus in semen can inform the evolving guidelines concerning the recommended duration of abstinence from sexual intercourse and the practice of barrier protection methods to prevent sexual transmission of Zika virus infection.

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Culex pipiens and Aedes triseriatus Mosquito Susceptibility to Zika Virus

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To the Editor: Zika virus, genus Flavivirus, has spread nearly uncontrolled since its introduction into the Western Hemisphere; autochthonous spread has occurred in ≥39 countries and territories, including several US territories. Transmission of Zika virus is usually by the bite of infected mosquitoes, and potential for emergence in areas with competent mosquito vectors is high (1). Future spread of Zika virus is unpredictable; however, eventual local spread in the United States is possible. As of July 13, 2016, a total of 1,306 travel-associated cases had been reported (ArboNET, https://www.cdc.gov/zika); substantial populations of Aedes (Stegomyia) aegypti (Linnaeus) mosquitoes exist in ≥16 states in the eastern, southeastern, and southwestern United States; and Ae. (Stegomyia) albopictus (Skuse) mosquitoes inhabit ≥28 states and continued expansion throughout the northern United States is probable (2). Mosquitoes of these 2 species have demonstrated the ability to transmit Zika virus (1).

The recent epidemic spread of Zika virus suggests that Ae. aegypti mosquitoes are the main vector; however, information about the role of other species in driving and maintaining Zika virus transmission is lacking. Of particular concern this summer (2016) is emergence and establishment of Zika virus in previously unaffected geographic areas; with the advent of mosquito season commencing in most of the continental United States, the likelihood of mosquito-borne transmission of Zika virus in states without populations of Ae. aegypti and Ae. albopictus mosquitoes remains unknown. To understand the potential risk for spread of Zika virus in temperate US states, we compared the relative abilities of Culex pipiens and Ae. triseriatus mosquitoes to transmit Zika virus in the laboratory. We used Ae. aegypti and Ae. albopictus mosquitoes as positive controls.

Laboratory colonies of mosquitoes used in this study were maintained at the University of Wisconsin–Madison, and vector competence for Zika virus was evaluated by using established procedures (3,4). Mosquitoes from each group were incapacitated (exposed to trimethylamine); legs were removed and collected. Salivary secretions were collected in capillary tubes containing a 1:1 ratio of fetal bovine serum and 50% sucrose. Mosquitoes were then placed

LETTERS

Emerging Infectious Diseases • www.cdc.gov/eid • Vol. 22, No. 10, October 2016 1857
mosquitoes because they are the natural and 858
species. The few vector competence studies conducted to 858
oral susceptibility of mosquitoes of the same or different 858
States because of geographic variations that may exist 858
fering mosquito–Zika virus combinations in the United 858
and epidemiologic) assessing interactions between dif 858
species in this country could be competent vectors. 858
we cannot rule out that anthropophilic mosquitoes of other 858
rus circulation in the United States occurs, it will be driven 858
concentrations (Table). However, none of these infected 858
mosquitoes disseminated virus and none were capable of 858
infection when exposed to mice with the highest viremia 858
samples were screened 858
legs, and transmission potential was indicated by virus- 858
positive salivary secretions. All samples were screened 858
by feeding on Zika virus-infected −/− mice (4). Mice (n 858
replicate) yielded infectious blood meal concentrations of 858
(4.74 log10 PFU/mL ± 0.45 (replicate no. 3). Blood meal 858
consistent with viremia concentrations of humans in the 858
field (4).

All samples from Cx. pipiens mosquitoes and all replicates 858
were negative for Zika virus by plaque assay (Table). In 858
contrast, Ae. triseriatus mosquitoes were susceptible to 858
infection when exposed to mice with the highest viremia 858
concentrations (Table). However, none of these infected 858
mosquitoes disseminated virus and none were capable of 858
transmitting the virus. Data from Ae. albopictus and Ae. 858
aegypti mosquitoes that had been exposed to the same mice 858
demonstrated that the viremia concentrations used could 858
productively infect mosquitoes. Of note, Ae. albopictus 858
mosquito infection rates were dose dependent (i.e., infection 858
rates increased with blood meal titer). Furthermore, data 858
generated from exposure to the same mice demonstrated 858
productive mosquito infection with these viremia 858
concentrations (4). It therefore seems likely that if Zika vi- 858
ruses of other species may be vectors, depending on geographic location. We focused on Cx. pipiens mosquitoes because they are ubiquitous (7), they are considered one of the principal vectors of West Nile virus in the northern half of the United States, and a recent report from Brazil suggests Cx. quinquefasciatus mosquitoes as potential Zika virus vectors (8). We chose Ae. triseriatus mosquitoes because they are the natural vector and overwintering host of La Crosse virus, they are extremely tolerant to a range of temperatures, they are distributed from Florida to eastern Canada (9), and they have been implicated as potential enzootic vectors for West Nile virus (10). To determine the risk for Zika virus transmission in the United States, surveillance of different human-biting mosquito species will be paramount. Although we expected that Cx. pipiens and Ae. triseriatus mosquitoes would not be competent Zika virus vectors, our experimental verification helps exclude uncertainties surrounding the potential vectors of this emerging pathogen.

### Table. Competence of mosquitoes, by species, as Zika virus vectors, 14 days after peroral infection, United States

<table>
<thead>
<tr>
<th>Mosquito species</th>
<th>Biological replicate 1, mean 6.02 log10 PFU/mL ± SD 0.67</th>
<th>Biological replicate 2, mean 4.74 log10 PFU/mL ± SD 0.06</th>
<th>Biological replicate 3, mean 6.83 log10 PFU/mL ± SD 0.45</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>I  D  T</td>
<td>I  D  T</td>
<td>I  D  T</td>
</tr>
<tr>
<td>Culex pipiens†</td>
<td>0/20 (0) 0/20 (0) 0/20 (0)</td>
<td>0/10 (0) 0/10 (0) 0/10 (0)</td>
<td>0/30 (0) 0/30 (0) 0/30 (0)</td>
</tr>
<tr>
<td>Aedes triseriatus‡</td>
<td>ND ND ND</td>
<td>0/20 (0) 0/20 (0) 0/20 (0)</td>
<td>4/13 (31) 0/4 (0) 0/4 (0)</td>
</tr>
<tr>
<td>Aedes albopictus§</td>
<td>9/9 (100) 6/9 (67) 2/9 (22)</td>
<td>1/6 (17) 0/1 (0) 0/1 (0)</td>
<td>ND ND ND</td>
</tr>
<tr>
<td>Aedes aegypti¶</td>
<td>ND ND ND</td>
<td>ND ND ND</td>
<td>17/17 (100) 12/17 (71) 4/17 (24)</td>
</tr>
</tbody>
</table>

* Zika virus strain PRVABC59 (GenBank accession no.KU501215) was originally isolated from a traveler to Puerto Rico in December 2015. I, infected; D, disseminated; ND, no data; T, transmitted. †Originated from egg rafts collected in Iowa in 2002 and colonized at the Iowa State University Medical Entomology Laboratory. ‡Originated from eggs collected in Iowa in 2002 and 2003 and colonized at the Iowa State University Medical Entomology Laboratory. §Originated from eggs collected in Missouri in 2002 and colonized at the Illinois Natural History Survey. ¶Black-eyed Liverpool strain.

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needed now, without further unconscionable delays, is a
more effective vaccine against this disease, it might emerge (
from YF since it declared the outbreak 4 months ago, and
Ministry of Health reports that there have been <400 deaths
(tory-confirmed) and 350 deaths (WHO) had reported 3,137 cases (847 labora-
tory) near countries (
would never be the case). As long as the Angola
epidemic area is not required to be vaccinated in advanced,
regulations. If a person traveling to a recognized YF-en
There has been little evidence to suggest when they return.
protection, but the greater threat is to their own country, if
vaccination against this virus; China does not have such
regulations require a recent (<10 years) verified history of
elators include YF-endemic areas, national and international

The WHO Strategic Advisory Group of Experts on Immuni-
ization and by others, but as of June 20, 2016, not applied
by WHO: that the YF vaccine administered at one fifth of
the regular dose could be used until the epidemic ends (5).

Despite vaccination campaigns in various provinces in
Angola, circulation of YF virus (YFV; family Flaviviridae,
genus Flavivirus) in some districts persists. Attempts to
control this epidemic are being made by application of the
effective YFV 17D vaccine that has been used for many de-
cades worldwide. Whereas recognition of cases of YF has
decreased in Angola, cases continue to occur there, and iso-
lated cases have been detected in persons who have visited
Angola as tourists or for business purposes. Furthermore,
cases in nearby Democratic Republic of the Congo have
increased. Because YF is not endemic to Asia, such patients
have the potential to serve as primary sources of YFV and
as index sources for subsequent clusters, outbreaks, or epi-
demics, not only in China, but elsewhere in Asia, which is
a nightmare scenario.

The principal mosquito vector of YFV is Aedes aegypti, which
is found in southern China and elsewhere in Asia, as are Ae. albopictus mosquitoes (6), which can also
transmit YFV and serve as a bridging vector between jungle
and urban cycles of YFV in a variety of ecosystems (7).
These mosquitoes feed on humans and are found perido-
mestically. Mosquitoes of these species also are capable of
transmitting dengue viruses, chikungunya virus, Zika virus,
and other human pathogens. Their presence should serve as
a warning to local health authorities of potential arbo-
virus disease outbreaks and, therefore, to maintain or initi-
ate mosquito vector control programs. Most industrialized
countries are aware of these warnings; the 40 YF-endemic
countries, predominantly tropical areas in Africa and Cen-
tral and South America (~90% of cases reported every year
occur in sub-Saharan Africa), maintain diagnostic compet-
ence and surveillance systems, including clinical findings,
testing of sick nonhuman primates and arthropods, and oth-
er indicators. Four countries that produce YF vaccine have
purchased stocks or have arrangements in place to obtain
sufficient doses in instances of immediate need.

Because destinations of an increasing number of trav-
erers include YF-endemic areas, national and international
regulations require a recent (<10 years) verified history of
vaccination against this virus; China does not have such
regulations. If a person traveling to a recognized YF-en-
demic area is not required to be vaccinated in advanced,
then they are essentially on their own with regard to self-
protection, but the greater threat is to their own country, if
and when they return.

Of ostensibly great concern has been 11 unvaccinated
YF-infected Chinese residents and workers who returned

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Yellow Fever—More a Policy
and Planning Problem than a
Biological One

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To the Editor: The recent and ongoing outbreak (epi-
demic) of yellow fever (YF) in Angola is cause for concern,
not only in West Africa, but also in contiguous and other
nearby countries (1). As of June 21, 2016, the World Health
Organization (WHO) had reported 3,137 cases (847 labora-
tory-confirmed) and 350 deaths (2), but at the present time,
it is not cause for panic or for extravagant claims of an “im-
pending global health threat” (3). As long as the Angola
Ministry of Health reports that there have been <400 deaths
from YF since it declared the outbreak 4 months ago, and
because there is an effective vaccine against this disease, it
is difficult to understand dire warnings of a global threat.

WHO considers the situation of high concern because of
the inadequate surveillance system in Angola, one that
is incapable of identifying new foci or areas where cases
might emerge (2). Such an inability suggests that many
more cases and deaths have already occurred (4). What is
needed now, without further unconscionable delays, is a

proper vaccination campaign, one that has been unachiev-
able to now. We here reaffirm what has been suggested by
the WHO Strategic Advisory Group of Experts on Immuni-
zation and by others, but as of June 20, 2016, not applied
by WHO: that the YF vaccine administered at one fifth of
the regular dose could be used until the epidemic ends (5).

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LETTERS