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Knowledge and attitudes towards Zika virus among medical students in King Abdulaziz University, Jeddah, Saudi Arabia



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ABSTRACT

Zika Virus (ZIKV) and its associated consequences remain vital public health challenge of international concerns. The current study was done to assess knowledge and attitudes towards ZIKV and the factors associated with good knowledge among medical students in King Abdulaziz University, Jeddah. A cross-sectional study was conducted among 426 students. They were selected through multistage stratified random sample method, 2016. A validated, confidential, interviewing questionnaire contained 25 knowledge and 10 attitude items was used. Descriptive and inferential statistics were done.

Results revealed that Facebook was the commonest source of ZIKV information. About half of the participants correctly identified mosquito bites and vertical route as ZIKV transmission modes. However, smaller percentages recognized the sexual and blood transmission modes. Calculations of knowledge score revealed that 77.5%, 15.0%, and 7.5% of the participants obtained poor, fair, and satisfactory scores, respectively. Age, educational year and attending ZIKV training were significantly associated with good knowledge ($p < 0.05$). Concerning attitudes, about half of the participants agreed that ZIKV could add new burden on healthcare system of the affected countries. Most of participants were interested in learning more about ZIKV, emerging diseases and travel epidemiology.

In conclusion, medical students had limited knowledge about ZIKV, and good attitudes towards learning about it. Conduction of ZIKV educational programs, and development of courses about emerging disease epidemiology are required.

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Introduction

Nowadays, the world is living in the era of eco-epidemiology. There are many emerging and re-emerging diseases which originating from animals and associated with diseases in both human and animals. These diseases cause significant morbidity, mortality and outbreaks in many countries [1–3]. Zika virus (ZIKV) is an emerging RNA arbovirus from the *Flaviviridae* family. It was isolated for the first time from the Rhesus monkey in Zika Forest of Uganda, 1947 [4,5]. The current ZIKV epidemic began in Brazil in 2015. It is then

spreading then to many other parts of the South and North America, several Pacific islands and other countries. In January 2017, The WHO reported that 75 countries around the world notified the continuing of ZIKV mosquito-borne transmission, and 46 of these countries are in the Latin American and Caribbean territories. The virus has recently spread throughout the whole Americas [6,7]. ZIKV continues to spread geographically to areas where the competent vectors and other suitable environmental factors are existing [7].

The main mode transmission of ZIKV is through bite of an infected female *Aedes* (*Ae.*) mosquitos. The chief vector associated with ZIKV transmission is *Aedes Aegypti*. Transmission can also occur through other thirty-eight *Aedes* species as *Ae. albopictus*, *Ae. africanus*, *Ae. luteocephalus*, *Ae. vitattus*, *Ae. furcifer*, *Ae. hensilli* and *Ae. apicoargenteus*. *Ae. aegypti* mosquito lives and breeds near people and their homes. *Aedes* laying eggs in stagnant water collections in the puddles, buckets, flower pots, empty cans and other containers [4,8].

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Vertical transmission is another ZIKV mode of infection. During 2016, a proven evidence of causal relationship (causality) was established between microcephaly and other neurological lesions in the infected newborns and the confirmed congenital ZIKV transmission [9]. In 2017, twenty-nine countries or territories have reported microcephaly and other CNS malformations potentially associated with ZIKV infection, or suggestive of congenital infection [6]. Furthermore, it was suspected that ZIKV can be also transmitted after birth through breast feeding [10]. ZIKV infection is suggested to cause abortion and miscarriage.

Sexual transmission is a third possible transmission route [11]. A recent systematic review, 2017, reported that ZIKV RNA was detected in semen as late as 188 days (range: 3–188) following onset of symptom, and infectious virus was isolated in semen up to 69 days after onset. No study reported ZIKV isolation from female genital samples, but detection occurred up to 13 days after onset of symptom [12]. The WHO, January 2017, reported that 13 countries have reported evidence of person-to-person transmission of ZIKV [6].

Blood-borne route can also transmit ZIKV. This can occur as most of the cases are asymptomatic, and the viral transmission is suggested to occur during the acute phase of infection [4]. On the other hand, additional modes of transmission as saliva are still under studies [11].

ZIKV infection is generally asymptomatic in about 80% of cases [13,14]. The main manifestations of the symptomatic cases are low grade fever, conjunctivitis, arthralgia, myalgia, and maculopapular rash. Severe cases are unusual and most of them do not need hospitalization [4].

Although ZIKV has been reported for rather a long period of time, however, its rapid resurgence, new transmission routes and its implication to microcephaly and Guillain-Barré Syndrome (GBS) made it a currently important public health problem [15,16]. Worldwide, 21 countries or territories have reported an increased incidence of GBS and/or laboratory confirmation of a Zika virus infection among GBS cases in 2017 [6]. ZIKV was suggested to be classified as “Category V Notifiable Infectious Disease” resembling other dangerous emerging diseases as Ebola and Middle East Respiratory Syndrome (MERS). Therefore, it represents a public health challenge for endemic areas and for the field of travel epidemiology [17]. Combined effort is required for reduction of ZIKV transmission in the infected countries, and for prevention of its transmission into new areas [18]. However, until now there is no licensed ZIKV medical measures (vaccines, preventive drugs or treatment) [18]. It is expected that arrival of ZIKV vaccine may take a minimum of 3–5 years after the initial year of non-human primate testing. However, experts proposed that this duration is an optimistic time for production and license of the vaccine, and it may need up to 20 years [19].

Medical students, as the future practitioners, should have sufficient information about ZIKV [20]. Such knowledge is needed as the virus is rapidly manifesting itself in a pandemic alarm [21]. Furthermore, few studies were conducted about knowledge and attitudes of health providers towards ZIKV. Such studies were mainly done in countries where ZIKA is circulating, and based only on few knowledge questions [22,23]. Knowledge and attitude ZIKV researches allow to obtain insight information to address people’s need and continuing overall response to ZIKV epidemic [6]. In addition, medical students in the Kingdom of Saudi Arabia (KSA) need to have adequate information about ZIKV as it can be transmitted to the country due to existence of the same *Ae. mosquito*, and the existence of another similar arbovirus which is Dengue Fever (DF). Three DF serotypes; Dengue virus type 1 (DENV-1), DENV- 2 and DENV-3, are circulating in the Western region of KSA. There is an increasing incidence of DF over years with confirmation of endemic occurrence of the disease in Jeddah. Furthermore, *Aedes Aegypti mosquito*

is also the main vector of DF transmission (similar to ZIKV) [24]. KSA also hosts one of the largest annual mass gathering worldwide. About 7 million pilgrims are expected to visit Kingdom KSA for Umrah and Hajj yearly, and thousands of them came from Latin American where ZIKV is circulating [25,26]. Preparedness for Hajj mass gatherings is required in the current era of globalization and international travelling [27]. However, no comprehensive epidemiological studies were conducted to identify knowledge and attitudes of the medical students towards ZIKV. So, such study is needed.

The objective of the study

The objective of the study was to assess the level of knowledge and attitudes of medical students enrolled in King Abdulaziz University (KAU) towards ZIKV, and to identify factors associated with their good level knowledge about it.

Material and methods

A cross-sectional study

A cross-sectional study was conducted during 2016. The study was done among medical students who completed the freshman year (2nd–6th year) in KAU, Jeddah, Saudi Arabia

Sampling

Medical student participants were selected through a multi-stage stratified random sample technique. Stratification took into consideration the students’ educational year and gender. The sample size was calculated using the following equation [28]:

$$n = \frac{z^2 \times p \times q}{d^2}$$

where “n” is the minimal calculated sample size, “Z” is a constant equal 1.96. It was assumed the estimated prevalence of good students’ knowledge about ZIKV is 0.5 (taken as the most conservative value as there is no previous study done among medical students in Jeddah). So, “p” = 0.5, “q” = 1 – 0.5 = 0.5 and “d” was set at level of 0.048. At confidence level of 95%, the minimum sample size will be 417 students.

Data collection

A validated, confidential, interviewing questionnaire was used. For preparing of the questionnaire, searching and reviewing of all previous researches done on the topics of “epidemiology of ZIKV”, and the “knowledge and attitudes towards ZIKV” were done. Electronic bibliographic of PubMed, EMBASE, the Cochrane Library, and the web sites of CDC, WHO, Google, Google Scholar, were explored for the published researches till 2016. All articles were scrutinized and the most suitable articles were selected.

The questionnaire inquired about personal and socio-demographic data of medical students. Their source of information about ZIKV was also determined. It contained 25 Multiple Choice Questions (MCQs) for evaluating participants’ knowledge about ZIKV. These questions assessed their knowledge about the time and the place of isolation of ZIKV for the first time and the commonest affected World’s region nowadays. They were also asked about the modes of ZIKV transmission, its incubation period, symptoms and the most dangerous ZIKV complication among the infected newborns. They were also asked about the other arbovirus (DFV) resembles ZIKV which is endemic in the western region of KSA. They were inquired about the possibility of ZIKV transmission to

KSA, and if yes, they were asked about the reason. The questionnaire contained 2 questions asked about the other most dangerous emerging diseases present nowadays in the West-Africa (Ebola), and in the KSA (MERS).

Students' attitudes towards ZIKV were assessed by 10 statements. These statements were answered in a 3-point Likert-scale (the answers were either agree, no opinion and disagree). These statements included their opinions about the ability of the world's populations to control ZIKV epidemic, presence of suitable preventive and control measures, and if they have bad feelings towards ZIKV. They were asked also about their opinion towards learning more about each of ZIKV, emerging diseases in general and the Travel Epidemiology.

The face and content validity were determined by two experts. The internal consistency reliability of it was assessed with Cronbach's alpha and was found to be 82%.

Statistical analysis

Data analysis was done using the Statistical Package of Social Sciences (IBM SPSS Statistics 21, IBM Corporation, Armonk, NY, USA, 2014). A scoring system was done for determining the level of ZIKV knowledge. For each knowledge of the 25 questions, a score of "1" was put for the correct answer and "0" for the incorrect or unknown answers. The total knowledge score was calculated and it ranged from 0 to 25. Knowledge score was then categorized into: poor knowledge for answering less than half of the questions (<50% of total score), fair knowledge (50–66.6% of total score), and satisfactory (>66.6% of total score) [24]. Both descriptive and inferential statistics were done. Pearson's Chi Square test, Fisher's exact test Odds Ratio (OR), and 95% Confidence Interval (CI) were calculated. All p-values <0.05 were considered statistically significant.

Ethical statement

The study followed the ethical standards of the Helsinki Declaration. Approval was taken from the Unit of Biomedical Ethics of King Abdulaziz University Hospital (KAUH) with a Reference Num-

Table 1
Source of information about Zika virus among medical students in King Abdulaziz University, Jeddah.

Source of information	%
Facebook	56.1
Other internet sources	45.8
Mass media	42.0
Friends	31.5
What'sApp group	20.9
Conferences	3.1

N.B. Each question was separately asked.

ber of 32–15. Administrative approvals were taken. An informed written consent was taken from each participant recruited in the study.

Results

The total number of the participants enrolled in the study was 426 students; with a slight increase in the number more than minimal calculated sample size for the stratification purpose. The male to female ratio was 1:1.2, and their age ranged from 18 to 26 years, with a mean of 21.5 years (SD = 1.51).

Table 1 shows that the Facebook was commonest source of medical students' information about ZIKV. In addition, the other Internet sources, mass media, friends, What'sApp groups and conferences accounted for 45.8%, 31.5% and 20.9% and 3.1%, respectively.

It is apparent from the Table 2 that about one-half of the participants correctly recognized that mosquito bites (53.3%) and vertical route (50.5%) are among the modes of ZIKV transmission. On the other hand, smaller percentages of them knew that ZIKV can be transmitted through blood-borne (30.3%) and sexual (17.1%) transmission. Regarding the severity of symptoms, only 13.1% of the participants correctly recognized that adult ZIKV infection usually presents as a mild disease. Furthermore, about one-fifth of them knew the commonest symptoms of ZIKV. Microcephaly as the most dangerous complication of ZIKV among the infected newborns was

Table 2
Responses of medical students to the knowledge questions about Zika Virus, King Abdulaziz University, Jeddah.

Sentence	Correct answer		Incorrect answer	
	No.	%	No.	%
The first time of discovery (isolation) of ZIKV (1947)	35	8.2	391	91.8
The place of isolation of ZIKV for the first time (Africa)	70	16.4	356	83.6
The most affected world's region by Zika nowadays (Americas)	177	41.5	249	58.5
The type of Zika disease (Emerging disease)	155	36.4	271	63.6
The commonest route of transmission of ZIKV (mosquito bite)	227	53.3	199	46.7
The name of vector that transmits Zika (Aedes)	69	16.2	357	83.8
ZIKV can be transmitted by vertical route from mother to baby	215	50.5	211	49.5
Zika can be transmitted by blood-borne transmission	129	30.3	297	69.7
ZIKV can be transmitted by sexual route of transmission	73	17.1	253	82.9
ZIKV can not be transmitted through food	106	24.9	320	75.1
ZIKV can not be transmitted through airborne	147	34.5	279	65.5
Adult ZIKV is generally a mild disease	56	13.1	370	86.9
The most frequent symptoms of ZIKV (fever, conjunctivitis, arthralgia)	88	20.7	338	79.3
The usual incubation period of ZIKV (3–12 days)	18	4.2	408	95.8
The percentage of persons infected with ZIKV who are presented with clinical symptoms (20%)	34	8.0	392	92.0
The most dangerous complication of Zika among the infected newborns (microcephaly)	151	35.4	275	64.6
Laboratory confirmation of ZIKV done through blood sample	86	20.2	340	79.8
The most important method for prevention the spread of Zika disease in the communities (reduction of exposure to mosquito bite)	200	46.9	226	53.1
Unavailability of a licensed ZIKV vaccine at the time of the study	86	20.2	340	79.8
The most common treatment of ZIKV case (fluids)	34	8.0	392	92.0
An arbovirus disease resembles ZIKV and presents in Saudi Arabia (Dengue Fever Virus)	158	37.1	268	62.9
ZIKV can be transferred to Saudi Arabia (Yes)	338	79.3	88	20.7
The reason for possibility of transmission of Zika virus to Saudi Arabia (having same vector and the largest annual mass gathering)	139	32.6	287	67.4
The most dangerous emerging infectious disease found in West Africa (Ebola)	169	39.7	257	60.3
The most dangerous emerging infectious disease found in KSA nowadays (Corona)	240	56.3	186	43.7

Table 3
Relationship between personal and socio-economic characteristics and the level of knowledge about Zika virus among medical students in King Abdulaziz University.

Variables	Knowledge score				χ^2	p
	Poor (n = 330)		Fair & satisfactory (n = 96)			
	No.	%	No.	%		
Gender						
Male	146	76.0	46	24.0	0.41	0.50
Female	184	78.6	50	21.4		
Age						
<20	31	93.9	2	6.1	5.56	0.018
≥20	299	76.1	94	23.9		
Educational year						
Second year	82	90.1	9	9.9	15.05	0.005
Third year	71	79.8	18	20.2		
Fourth year	63	70	27	30		
Fifth year	51	78.5	14	21.5		
Six year	63	69.2	28	30.8		
Residency						
With family	290	78.2	81	21.8	1.71	0.426
University dorm	24	77.4	7	22.6		
Private dorm	16	66.7	8	33.3		
Father's education						
<University	84	75.7	27	24.3	0.275	0.600
University & +	246	78.1	69	21.9		
Mother's education						
<University	122	75.8	39	24.2	0.423	0.516
University & +	208	78.5	57	21.5		
Received training program about ZIKV						
Yes	224	70.2	95	29.8	38.19 ^a	0.000
No	106	99.1	1	0.9		

^a Fisher's exact test.

not recognized by about two-thirds of the participants. Similarly, four-fifths of them did not recognize that blood sample is needed for the laboratory viral isolation of ZIKV. The table also reveals that less than one-half of the respondents knew that reduction of exposure to mosquito bites is one of the important preventive measure for reducing Zika transmission in the endemic countries. A large proportion of the participants (79.3%) correctly identified that ZIKV could be transmitted to Saudi Arabia. However, only about one-third of them recognized the reasons behind such possibility (KSA contains the *Aedes vector* and hosts the largest annual mass gathering). A similar percentage recognized that DFV is another similar arbovirus endemic in the KSA. Furthermore, few students correctly recognized the unavailability of a licensed ZIKV vaccine, at the time of study. Similarly, a scattered percentage (8%) recognized that fluid replacement therapy is the most important treatment of ZIKV cases. The table also shows that 39.7% of the participants correctly identified that Ebola is the most dangerous emerging diseases found in the West Africa. While, 56.3% of them identified that MERS as the most dangerous one in the KSA.

Calculations and categorization of the ZIKV knowledge score revealed that 77.5%, 15.0%, and 7.5% of the participants obtained poor, fair, and satisfactory knowledge scores, respectively. Table 3 demonstrates that 93.9% of the younger participants (less than 20 years) obtained poor ZIKV knowledge score compared to only 76.1% among those aged 20 years and above. A statistical significance difference was present ($p < 0.05$). The table also reveals that the percentage of those obtained fair and satisfactory scores increased with increasing the educational year (except among in the fifth year). A highly statistical significant difference was present ($\chi^2 = 15.05$, $p < 0.01$). Participants who received training program about ZIKV obtained much higher percentage of fair and satisfactory knowledge scores compared to others, with a highly statistical significant difference ($p < 0.001$).

The attitudes of medical students towards ZIKV is presented in Table 4. About one-half of the participants agreed that ZIKV could add new burden on the healthcare system of the affected countries. A similar percentage agreed that: ZIKV could be easily transmitted to Saudi Arabia, the mass media may have an influence on its prevention, and that the world's populations can control ZIKV epidemic. About two-fifths of medical students agreed that they have bad feelings towards Zika disease, and a comparable percentage agreed that it will be dangerous to travel to Zika epidemic countries. Only 17.6% of them agreed that there are enough prevention and control measures for ZIKV. Most of the participants were interested in learning more about ZIKV, epidemiology of emerging diseases, and the "Travel Medicine".

Discussion

Up to the best of our knowledge, and by extensive literature search, this may be the first study conducted in Jeddah for assessing knowledge and attitudes of medical students towards ZIKV and similar emerging diseases. Our results showed that most of medical students had low level of knowledge about ZIKV. This finding agrees with the results of Gupta et al. who conducted a similar study among dental practitioners from India [21]. The cause behind such poor knowledge among the target populations from both countries may be because both KSA and India had no cases of ZIKV at the time of conduction of studies; as the threats of the ZIKV was concentrated mainly in Americas.

The Indian study showed that nearly two-fifths of their participants obtained their knowledge about ZIKV from the internet [21]. Similarly, the current study revealed that Facebook and other internet sources were the commonest source of participants' information. These findings indicate the importance of using such tools for spreading the health information and educational messages about ZIKV and other emerging diseases.

Table 4
Attitudes about Zika virus, emerging diseases and travel epidemiology among medical students in King Abdulaziz University.

Sentence	Agree		No opinion		Disagree	
I am confident that the world's population can control the ZIKV epidemic worldwide	206	48.4	185	43.4	35	8.2
I think that there are enough prevention and control measures for ZIKV	75	17.6	218	51.2	133	31.2
I have bad feelings towards ZIKV virus	162	38.0	190	44.6	74	17.4
I think that ZIKV can add new burden on healthcare system of the affected countries	235	55.2	167	39.2	24	5.6
I think that ZIKV can be transmitted to Saudi Arabia	228	53.5	162	38.0	36	8.5
I think that mass media coverage about ZIKV may have influence on its worldwide prevention	223	52.3	154	36.2	49	11.5
I am interested in learning more about ZIKV	316	74.2	91	21.4	19	4.5
I am interested to learn more about epidemiology of the new emerging diseases	284	66.7	105	24.6	37	8.7
I am interested in learning more about Travel Medicine	283	66.4	111	26.1	32	7.5
I think that it is dangerous to travel to the countries epidemic with ZIKV	161	37.8	189	44.4	76	17.8

About one-half of our participants correctly knew that mosquito bite is the commonest mode of ZIKV transmission, while only 4.2% knew its incubation period. Better results were reported from the Indian study [21]. The cause of this discrepancy between both studies may be because the Indian study was done among practitioners (with more knowledge) and not among medical students. However, much better knowledge was obtained from a study performed among attendees of Zika symposium in 4 cities of Colombia from June to July, 2015. After the symposium, all participants identified the correct answer regarding mosquito bite transmission of ZIKV, and almost all of them correctly identified the incubation period [23]. The cause behind such dissimilarities may be because the study of Colombia was done among participants who attended Zika symposium, or may be because the cities of Colombia are endemic in Dengue and Chikungunya fevers which resemble ZIKV, or due to the starting Zika epidemic in the Latin American countries at the time of conduction of their study. Another cross-sectional study done in Pereira and Cartagena cities of Colombia, 2016, showed that most of their respondents (97% and 92.5% in both cities) correctly identified the routes of ZIKV transmission [22]. The cause of their high level of knowledge may be due to extensive spread of ZIKV epidemic during 2016 in the most of the Latin American countries, including Colombia. In such countries, many educational programs were done about ZIKV and this results in increasing their knowledge about it.

Our results illustrated that only about one-fifths of the medical students correctly identified the symptoms of ZIKV and the corresponding rate from the Indian study was 40.4% [21]. On the other hand, the Colombian study [22] reported much better knowledge than the other 2 studies. These differences could be attributed to the same causes discussed before.

Congenital anomalies and GBS associated with ZIKV made the circumstances to become worse [8,29]. In the current study, only about one-third of the participants correctly identified that microcephaly is the most dangerous complication of ZIKV.

The recent Ebola virus outbreak in West Africa, the MERS in the Middle East, and the ongoing Zika virus outbreak in Americas are examples of emerging infectious pathogens that have provoked widespread fear, economic and social implications worldwide [30]. Only about two-fifths of our participants recognized that Ebola virus is the most dangerous current emerging disease in West Africa. A higher percentage of the participants knew that MERS is the most dangerous one in Saudi Arabia and this better percentage may be due to its presence in KSA. Such knowledge percentages indicate the importance of focusing on emerging disease epidemiology in the undergraduate and post-graduate medical curricula.

Some infectious agents, as sexually transmitted organisms, are recognized to be the etiologic agents of hematospermia. Recently, Zika arbovirus had been notified to be associated with hematospermia [31]. In the current study, only a small proportion of the medical students knew that ZIKV can be transmitted via sexual route.

There is no licensed vaccine nor specific treatment for prevention and control of ZIKV epidemic, until now, and the four phases

clinical trial started only in the second half of 2016 [32]. The time taken for vaccine may be prolonged, so implementation of a coordinated, multi-pronged, multilateral and comprehensive public health education about Zika virus is very important [15]. Concerning students' attitude, less than one-fifth of our participants agreed that there is enough prevention and control measures for ZIKV nowadays. Furthermore, almost half of the students believed that the world's populations can control the Zika epidemic worldwide.

The spiky spread of ZIKV throughout Americas [7], especially in Brazil, poses phobia for travelling to these countries and some travel restriction was put especially for pregnant females [4,26]. In our study, more than one-third of the participants believed that it will dangerous to travel to the countries where ZIKV is circulating.

Most of the contributors in our study were interested in learning more about ZIKV, emerging disease epidemiology and Travel Medicine. These findings require medical educators and officials to develop and deeply introduce such important subjects into the medical curricula.

Conclusion

Medical students had a limited knowledge about ZIKV, but they had good attitudes towards learning more about it. Their knowledge was mainly gained from the Facebook and other internet sources. Younger medical students and those enrolled in the second-year obtained lower level of knowledge score compared to others. On the other hand, those who attended training programs about ZIKV had significantly better ZIKV knowledge compared to others. A high percentage of the participants identified that ZIKV can spread to Saudi Arabia, while a smaller percentage knew the causes behind this. Regarding the attitudes, most of the participants agreed that there are no adequate measures for preventing ZIKV. Multifaceted approaches are needed to increase awareness of medical students about ZIKV and other emerging diseases. These approaches can be extended to include also the medical practitioners and the community in general. Development of interactive courses on emerging diseases and travel epidemiology is needed for undergraduate medical curricula. Facilitation of medical students' volunteer working in preparedness of important emerging diseases with Ministry of Health and other volunteering bodies is required. Similar studies about ZIKV, and other emerging diseases are recommended to be done among medical practitioners and other target populations. Furthermore, the findings of the current study point out the need for creating international and national programs for addressing the important emerging public health concerns of the nations, especially in the emergence of ZIKV and its complications as microcephaly, GBS and other complications.

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Competing interests

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