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MAPPING THE EPIDEMIOLOGY OF CRIMEAN-CONGO HEMORRHAGIC FEVER ACROSS THE DURAND LINE (PAKISTAN & AFGHANISTAN INTERNATIONAL BORDER)

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Abstract

Background: *Owing to the zoonotic infectious nature of Crimean-Congo Hemorrhagic Fever (CCHF), increased outbreaks in the recent years, endemic in the area and limitations of the previous data, this study aims to update the spatial prevalence and to determine the risk factors associated with CCHF on both sides of the Durand line between Balochistan (Pakistan) and Afghanistan.*

Method: *A retrospective study was conducted to identify the CCHF cases occurred in Balochistan and in Afghanistan from 2012 to 2014. Chi-square and Pearson's correlation coefficient (r) statistic was used to determine the association between the variables and CCHF cases. The spatial distribution of CCHF cases was analyzed by the Geographic Information System (ArcGIS 10.2).*

Results: *There were 85 (out of 124) CCHF positive cases (75 cases from Balochistan and 10 cases from Afghanistan) confirmed with polymerase chain reaction (PCR) or enzyme-linked immunosorbent assay (ELISA). Dominantly, middle aged (18-40 years) individuals of rural areas particularly men (70 cases) were more affected by CCHF. The individuals who had contact with the animals [OR=9.05 (CI=3.79-21.61)], with history of tick bites (22 cases) [OR=4.19 (CI=1.17-14.98)] were higher at risk of attaining CCHF infection than the others. All the cases were reported in a dry climate (low rainfall of 0-18 mm) between the altitude of 1968-2623 meters above the sea level with a positive correlation (r = 0.85) to monthly average temperature while maximum appearing*

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in the peak summer months (May to August). The case fatality rate among the CCHF positive cases in Balochistan (Pakistan) was lower (17%) than in Afghanistan (30%). The cumulative yearly incidence of CCHF in 2013 and 2014, in Balochistan (Pakistan) was 0.36% and 0.32% respectively, while in Afghanistan it was 0.072% and 0.168%, respectively.

Conclusion: *The uncontrolled movements of people across the border, lack of awareness, cultural tendencies, and conventional agricultural and animal handling practices are important factors for the circulation of CCHFV in Balochistan and Afghanistan. An effective awareness program with active surveillance system with vector control efforts are urgently needed to avoid the damage.*

INTRODUCTION

Crimean Congo hemorrhagic fever (CCHF) caused by single stranded RNA virus Orthonairovirus of family Nairoviridae is a zoonotic viral disease with its distribution reported from Asia, Africa, Middle East and Eastern Europe (Adams et al., 2017; Aker et al., 2015; Khurshid et al., 2015; Sargianou et al., 2013; Xia et al., 2011; Yilmaz et al., 2009). The CCHF virus has three (small, medium and large) negative sense segments (Aker et al., 2015; Chinikar et al., 2013; Mostafavi et al., 2013), all encoding for specific proteins; with smaller segment for nucleocapsid protein, medium for glycoproteins and large segment encodes for viral RNA polymerase (Khurshid et al., 2015). Based on the geographical origin and phylogenetic analyses of small (S) segment CCHF has been divided into seven distinct groups with three groups for African region and two for European region while two for Asian region (Khurshid et al., 2015). Pakistan has the presence of Asia-I; including strains from Iran, Afghanistan, Pakistan and Middle East and Asia-II, having isolates from China, Kazakhstan, Pakistan and Uzbekistan (Khurshid et al., 2015).

Predominantly, CCHF is transmitted by ticks of genus Hyalomma, however, it can also be transmitted by contact with infected animal blood, body fluids or tissue and CCHF positive patients (Aker et al., 2015; Mostafavi et al., 2013; Sargianou et al., 2013; Xia et al., 2011; Yilmaz et al., 2009). The CCHF virus so far has been isolated from various animals including sheep, goats, cattle, hedgehogs, dogs, pigs, horses and donkeys (Dogan et al., 2009). The health effects of CCHF are wide-ranged and severe in humans with occurrence of chronic hemorrhages (Chinikar et al., 2013), headache, fever, nausea, dizziness, myalgia and multi-organ failure because of coagulopathy and hepatic impairment (Khurshid et al., 2015). The mortality rate in humans ranges from 2% to 80%, which varies from country to country depending on early diagnosis and management of disease (Leblebicioglu et al., 2015). The number of outbreaks of CCHF has notably increased since 2000 in many countries (Leblebicioglu et al., 2015). In Pakistan, the first CCHF case was reported in mid of 1970s in the Rawalpindi region (Khurshid et al., 2015). Since then sporadic cases has been reported in the country round the year (Jamil et al., 2005). On the other hand in Afghanistan previously the presence of CCHF has been reported in recent years with seroprevalence in humans as high as 75% in the western Afghanistan (Khurshid et al., 2015; Mustafa et al., 2011; Ölschläger et al., 2011). The Pakistani region bordered with Afghanistan in the western and northwestern borders is endemic because of the higher number of cases reported in comparison to other parts of country (Khurshid et al., 2015). Being in the close circuits, some similar situation is observed in the Sistan and Baluchistan province of Iran where CCHF is also considered as endemic (Izadi et al., 2004). Keeping in view the zoonotic infectious nature of CCHF and the increased outbreaks in the recent years, there is need to update the previous data regularly along with exploring the risk factors in order to avoid the greater damage. In addition previous data was limited by the reports from limited number of districts (Jamil et al., 2005; Khurshid et al., 2015; Mustafa et al., 2011; Ölschläger et al., 2011) from both Balochistan (Pakistan) and Afghanistan and also did not focused

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on the risk factors for CCHF in the local population. Given the widespread prevalence and endemic nature of CCHF, along with the limitations of previous data, this study aims to conduct spatial epidemiological investigations to update the prevalence and to determine the risk factors associated with CCHF on both sides of the Durand line between Pakistan and Afghanistan.

Materials and Methods

Study Design

A retrospective analysis was conducted by identifying the CCHF cases reported in all the 32 districts of Balochistan, Pakistan and four provinces of Southwestern Afghanistan. The data were collected from the hospitals in Balochistan province of Pakistan in the time period from 2012 to 2014. The cases which had the sign and symptoms related to the CCHF according to the case definition of Disease Early Warning System 2009 (DEWS) (Ministry of Health, National Institute of Health, & World Health Organization, 2009) and confirmed diagnosis with polymerase chain reaction (PCR) or enzyme-linked immunosorbent assay (ELISA) were included in the study. The cases from Afghanistan were collected from the hospitals across Balochistan (Pakistan) because of the regular attendance of the patients from Afghanistan. This is due to the long term continuous insurgency and lack of health facilitation in Afghanistan and further Balochistan being the nearest destination for treatment to the people of Afghanistan. From Afghanistan the cases were reported from Kandahar, Helmend, Rozgan and Herat provinces.

Study Area Description

The Balochistan province is in the south-western part of Pakistan. It is the largest province of the country in terms of area but is least populated among all the provinces. The overall population of Balochistan according to the recent census in 2017 is 12.3 million ("Top Story; Population shoots up by 47 percent since 1998," 2012). Balochistan is geographically divided into four distinct zones; plains, upper high lands, lower high lands and deserts. The upper highlands are 1,500 to 3,700 meters above the sea levels whereas lower high lands are 600 to 1200 meters above the sea levels. The climate is extreme both in winters and summers, while annual precipitation is 50-500 mm (Qiaser; WorldClim, 2017). Kandahar and Helmend provinces are located in the southern part of Afghanistan bordering with Balochistan province of Pakistan, while Herat is located in the western part of Afghanistan bordering with Iran and Turkmenistan (WorldClim, 2017). The climate in Afghanistan is arid to semi-arid with temperature fluctuation in day- and night-time. In summer, high temperature recorded is 50°C, while in the winter the temperature falls up-to -10 °C (Tünnermeier, 2005).

Spatial Analysis

Spatial distribution of CCHF in relation to altitude and monthly average temperature and rain fall are presented in special maps, designed with ArcGIS version 10.2 (Esri GIS company Redlands, California, USA). Maps for the region were obtained from the online global administrative areas (GADM) database version 2.8 (GADM, 2017) and climate data for temperature and precipitation was obtained from World Clim-Global Climate Data (WorldClim, 2017).

Statistical Analysis

The descriptive statistics of CCHF cases were carried out by determining the demographic data relating to the CCHF cases. This included the geographic distribution, age, sex, occupation/profession and history of tick bite. The Case fatality rate was calculated among the CCHF positive cases reported in Balochistan (Pakistan) and Afghanistan. The Chi-square test was used to estimate the differences between sex, locality, history of contact with animals, history of tick bite, contact with CCHF suspected cases, high risk professional groups and residence relative to the districts at the border areas of the two countries and CCHF cases. The odd ratio (OR) and 95% confidence interval (CI) were calculated to identify association between possible risk factors and CCHF cases by logistic regression analysis, while p-value <0.05 was considered as statistically significant. The cumulative incidence per one hundred thousand of population was calculated for 2013 and 2014. The total number of yearly cases taken as the event variable and 1998 census and estimated

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population in 2013 were taken as base variable for Balochistan and Afghanistan, respectively. A Scatterplot obtained by Pearson`s correlation statistic was used to see the strength of the linear relationship between the monthly CCHF cases and average monthly temperature. The data were analyzed using IBM SPSS Statistics Version .22 and Epi Info™ 7.

Results

From 2012 to 2014, 124 suspected CCHF cases (108 cases from Balochistan and 16 cases from Afghanistan) were reported in different hospitals of Balochistan. There were 85 CCHF positive cases (75 cases from Balochistan and 10 cases from Afghanistan) having CCHF specific clinical signs and confirmed laboratory diagnosis (Table 1). The mean age of the cases was 32.25 years (range 6-80 years) (Table 1). The distribution of CCHF cases with age was inverse U-shaped with low frequency in the age group ≤ 18 years (Table1), while high frequency was observed in the age group from 19 to 40 years. However, a decline was observed in the age group ≥ 41 years. In sex stratification, men were more vulnerable (70 cases) to CCHF as compared to women (15 cases). Livestock farmers and butchers were the high-risk professional groups. Comparatively the frequency of CCHF was higher in the rural areas than in urban areas. There were 22 cases who had the history of a tick bite, while five cases having history of nosocomial infection (Table1). The risk of attaining CCHF infection in the individuals who had contact with the animals was significantly higher [OR=9.05 (CI=3.79-21.61)] than the others (Table 2). The individuals who had tick bite were also significantly higher at risk of attaining CCHF compared to those with no tick bite [OR=4.19 (CI=1.17-14.98)], while those related to high-risk professional groups were 2 times higher at risk than those with low-risk professional groups (OR=2.65, CI=1.21-5.78, p-value=0.01). In contrast, here was no significant difference between CCHF cases and other risk factors such as sex, locality, contact with CCHF suspected cases and districts at the border areas. All the CCHF cases were reported between the altitudes from 657 to 2623 meters above the sea level both in Balochistan (Pakistan) and Afghanistan territory (Figure 1). Maximum number of CCHF cases was reported between the altitudes from 1968-2623 meters. Among districts, a higher number of CCHF cases was reported from; Quetta (33), Killa Abdullah (12), and Pishin (10) than in other districts in Balochistan Pakistan. While in Afghanistan, the CCHF cases were reported from; Kandahar (4), Rozgan (3), Herat (2) and Helmend (1) provinces (Table 3). There was a positive correlation ($r = 0.85$, $p \leq 0.001$) between CCHF cases and monthly average temperature (Table 4, Figure 1). The highest frequency of CCHF cases were reported in the peak summer months from May to August than in the other months (Figure 1). In Balochistan province, the frequency of CCHF cases was high in the average monthly temperature range of 17-24 °C (Figure 1). However, in Afghanistan on the other hand, the maximum number of CCHF cases was reported for a bit lower average monthly temperature range from 13 to 20 °C (Figure 1). The average rainfall in Balochistan in relation with CCHF positive cases was very low with 0-18 mm, therefore having dry climate (Figure 1). Similar situation was observed in Afghanistan having very low rainfall of 0-18 mm in the region with highest frequency of CCHF positive cases. The case fatality rate among the CCHF positive cases on Pakistani side of the border (Balochistan province) was 17%, while case fatality rate among the CCHF positive cases in Afghanistan was 30%. The cumulative yearly incidence of CCHF in 2013 and 2014, in Balochistan (Pakistan) was 0.36% and 0.32% respectively (per 100,000), while in Afghanistan it was 0.072% and 0.168%, respectively (per 100,000).

Discussion

We conducted this study to assess the risk factors associated with CCHF and an update on the severity of CCHF around the Durand line— in Balochistan on the Pakistani side and in four provinces of Afghanistan. Our results show that this infectious disease has been affecting the population in the area, particularly men. The most vulnerable people to CCHF were those having contact with animals, those having a history of tick bite, those in the middle age of their life, and having rural residence. The number of CCHF cases was mainly reported in the peak

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summer months and comparatively at a higher altitude with lesser rainfall. This disease was more

Table 1: Summary of CCHF Cases (2012-2014) in Balochistan (Pakistan) and Afghanistan

Category	Balochistan (Pakistan)	Afghanistan	Total
Total Suspected Cases	108	16	124
Total Confirmed CCHF Cases	75	10	85
Age (Mean)	32.25 years	-	-
Age Group (High Risk)	19 - 40 years	-	-
Age Group (Low Risk)	≤ 18 years, ≥ 41 years	-	-
Sex (Male)	70 cases	-	-
Sex (Female)	15 cases	-	-
Risk Group	Livestock farmers, butchers	-	-
History of Tick Bite	22 cases	-	-
History of Nosocomial Infection	5 cases	-	-

Table 2. Risk Factors Analysis of CCHF Cases

Variable	OR	95% CI	p-value
Sex	1.20	0.46-3.13	0.703
Locality	1.43	0.66-3.06	0.354
History of contact with animals	9.05	3.80-21.6	<0.01
History of tick bite	4.19	1.17-15.0	0.014
Contact with CCHF suspected cases	0.37	0.10-1.38	0.130
High risk professional group	2.65	1.21-5.80	0.017
District around the boarder	1.52	0.61-3.80	0.363

p-value obtained by logistic regression analysis; OR; Odds ratio, CI; Confidence interval

Table 3: Geographical Distribution of CCHF Cases

Region	Reported Cases	Altitude Range (m)
Balochistan (Pakistan)		
- Quetta	33 cases	1968-2623
- Killa Abdullah	12 cases	1968-2623
- Pishin	10 cases	1968-2623
Afghanistan		
- Kandahar	4 cases	657-2623
- Rozgan	3 cases	657-2623
- Herat	2 cases	657-2623
- Helmand	1 case	657-2623

Table 4: Environmental and Climatic Factors Associated with CCHF

Factor	Balochistan (Pakistan)	Afghanistan
Average Monthly Temperature (°C)	17-24 °C	13-20 °C
Average Rainfall (mm)	0-18 mm	0-18 mm
Seasonal Frequency of CCHF	Peak: May-August	Peak: May-August
Correlation with Temperature	r = 0.85 (p<0.001)	r = 0.85 (p<0.001)
Cumulative Yearly Incidence (2013)	0.36% (per 100,000)	0.072% (per 100,000)

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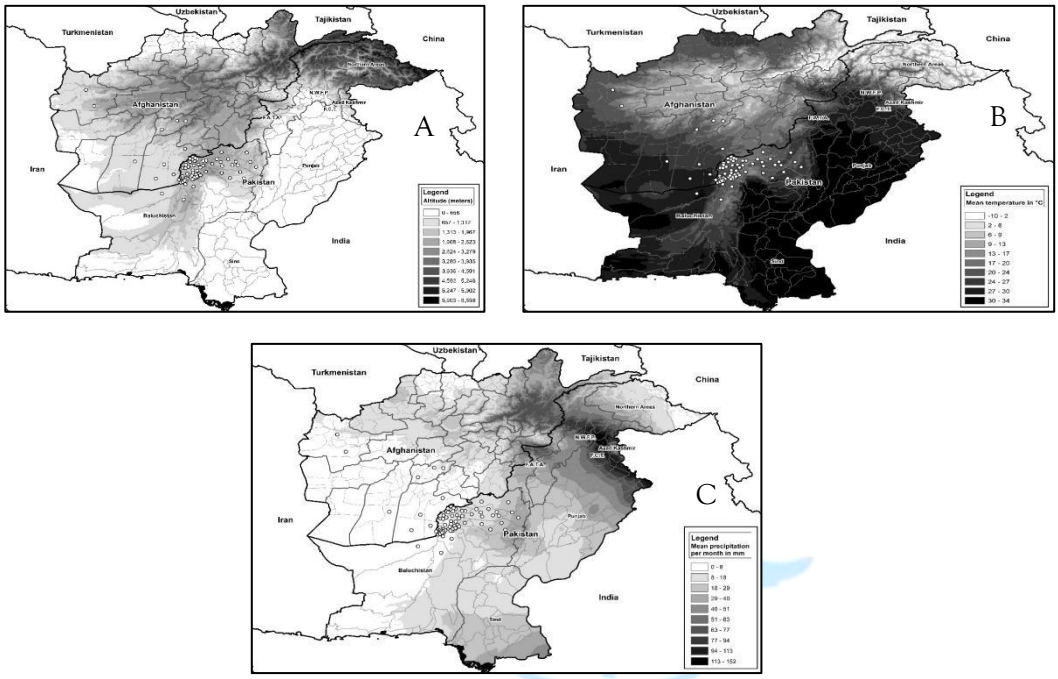
Cumulative Yearly Incidence (2014)	0.32% (per 100,000)	0.168% (per 100,000)

Figure 1: Spatial Distribution of CCHF Cases According to the Altitude (A), Average Monthly Temperature (°C) (B) and Average Monthly Rainfall (mm) in Balochistan (Pakistan) and in Afghanistan



fatal in Afghanistan than in Pakistan, although the incidence was higher in Pakistan. Causality of a vector borne disease is associated with the economics of the population, social trends, the trend of using livestock for livelihood in the rural areas, climatic conditions, health awareness and facilitation. The nature of CCHF as a highly infectious disease was making it vulnerable in our study region because of all these factors resulting in higher number of cases (85) than the cross sectional reports from Greece (7) and China (57), but lower than the longitudinal retrospective studies conducted in Turkey (1820) between 2002 and 2007 (Yilmaz et al., 2009), and Iran (255) from 1999 to 2004 (Alavi-Naini et al., 2006). However, our reported cases were in line with the results of previous study from Pakistan in which from different hospitals in Quetta, Balochistan reported 83 CCHF positive cases between 1997 and 2002 (Sheikh et al., 2005). Prevalence of CCHF has been reported from other regions in Pakistan, and although the results may be coinciding, but the junction of the three countries (Pakistan, Iran and Afghanistan) had been a hotspot for CCHF, while already CCHF has been endemic in neighboring countries including China, Kazakhstan, Tajikistan and United Arab Emirates(UAE) UAE (Khurshid et al., 2015). This can be depicted from the fact that the regions in Iran, bordering with Balochistan province of Pakistan and Afghanistan had also observed an uphill of the CCHF cases (433) in proceeding years from 2000 to 2007 (Mostafavi et al., 2013), while another study from Iran in region near Afghanistan and Pakistan, reported 65 out of 255 CCHF cases in Afghan nationals (Alavi-Naini et al., 2006). Similarly, in our study in the Balochistan province of Pakistan, the highest number of cases was reported from northern and western districts bordering Afghanistan and Iran. Similarly, on Afghanistan side the cases were reported in the south-eastern and western provinces of the country which are geographically connected with Balochistan province of Pakistan and Iran respectively. There are certain obvious explanations to this triad distribution in this region. First, both in Pakistan and Iran, a major junk of livestock has been imported (legally and illegally) from Afghanistan

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(Alam et al., 2013). This is also supported by the fact that Balochistan was/is a main source of animal skins and hides for the Leather industry of Pakistan, and also it serves as corridor for import of these raw materials from Afghanistan and Iran (Raziq, Younas, & Rehman, 2010b). Secondly, because of no border control and insurgency in Afghanistan and also by inherent tribal and cultural civilization, there has been free movement of humans (including seasonal nomadic migrants along with their animals) and also suspected patients in both the countries. So, unidentified CCHF positive humans are certainly one of the sources of importing CCHFV to Pakistan (Jamil et al., 2005; Khurshid et al., 2015). Finally, the dry climatic conditions defining more number of CCHF cases as we observed in our results— is the most important non-biological determinant due to sustainability of the tick population. An integrated approach is needed to work out health related efforts aimed to reduce the rate, ratio, severity, epidemic of a certain disease and also to look for the causal and associational relationship. Studying and sequentially reducing the risk factors may help in understanding the course and control of a disease. In line with other studies from Iran, Turkey, China and previous from Pakistan, in our results middle age individuals, male sex and rural residence were more vulnerable to CCHF. Similarly, livestock farmers, butchers and house wives were high risk professional groups. This is also in line with previous studies from Pakistan and around the world (Khurshid et al., 2015; Sargianou et al., 2013; Sheikh et al., 2005; Yilmaz et al., 2009). The distribution of CCHF cases in relation with these risk factors may exclusively be explained in cultural dimensions apart from general explanation and regional dispersion. First, in Pakistan and Afghanistan men in their active middle age are more involved in non-mechanized conventional animal dependent agricultural activities in remote rural areas, which increase their chances of contact with livestock animal and consequently disease vector. Secondly, there is division of labor among men and women in a family for rearing animals in our study region (Shafiq, 2008). Men are majorly responsible for out of home care due to cultural tendencies; for example grazing animals in wild, agricultural activities, animal trading and slaughtering (Ferdoos, 2007; Raziq, Younas, & Rehman, 2010a; Shafiq, 2008) but, women are supposed to take in home care along with animal husbandry practices if they have animals at their home (Shafiq, 2008). Therefore, this variably exposes and consequently makes them more susceptible to CCHFV. This aspect become worse because of the trend of keeping the animals at home, rather than a special animal farms, making both men and women susceptible for CCHF (Afzal, 2004; Leblebicioglu et al., 2015; Miller, 2011). Additionally, the chances of contracting animals with vector for CCHF or any other pathogen may be more high in public because of lack or implementation of regulations for animal rearing, slaughtering, breeding and health care (Leblebicioglu et al., 2015). In our study region, unaware of the lethal effects and lack of health safety measurements and cultural tendencies– people expose themselves very easily to the CCHF virus transmission through ticks. The habit of keeping the animals at home and then sleeping close to them at night during peak summer months expose them to the tick bite. Additionally, due to the general unhealthy and unhygienic practice of crushing and killing the ticks with hands (fingers) certainly expose them directly to CCHF virus. Therefore, as an important risk factor, in our study there were 22 (26%) cases having history of a tick bite. This is in contrast to a study from Turkey who had reported a higher percentage of history of tick bite (68.9%) among the CCHF cases involved in animal husbandry and farming, although the reasons were not the same like in our study (Yilmaz et al., 2009). Similarly, studies from China and Kazakhstan also conclude ticks as an important vector for the transmission of the CCHF infection (Nurmakhanov et al., 2015; Xia et al., 2011). The agricultural practices may vary among different countries but working in fields from developing to developed countries, it is certain that a person is always susceptible to the tick bite, in spite of adopting the precautionary measures. This is evident from the fact that although Turkey, China and Kazakhstan are economically stable countries with latest technology but still tick bite is an important risk factors for contracting the CCHF. This may be because of ticks contact from other sources in the agricultural practices for example crops and vegetation. Summer season is a pre-requisite for the life cycle of the ticks

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and transmission pathway (CDC, 2013). During the spring and summer season, the larvae and nymphs develop into the adult tick (Aslam et al., 2016). It is evident in our study where there was a positive correlation between monthly average temperature and CCHF cases and higher number of cases was reported in summer months starting from May to August than other. This is in accordance with previous study conducted in Pakistan, which shows peak incidence of CCHF cases from April to August (Khurshid et al., 2015), while in Turkish study the highest number of cases were reported from May to July (Sisman, 2013). Similarly, studies in Iran and Kazakhstan shows the same pattern of CCHF cases between mid to late spring and early summer and from April to June, respectively (Alavi-Naini et al., 2006; Nurmakhanov et al., 2015). However, a bi-annual surge of CCHF cases from March to May and then again from August to October in another study from Balochistan, Pakistan was observed (Sheikh et al., 2005). This bi-annual surge could be explained by the Muslim's annual religious festival of Eid-ul-Adha between March and May from 1997 to 2002 in the succeeding years. This succeeds 10 days earlier every year and people slaughter animals on the occasion as a religious belief with certainly higher chances of exposure to CCHF infection. CCHF can be transmitted from person-to-person contact. There were five cases having history of nosocomial infection. In previous studies, there were 5 cases from Balochistan, Pakistan (Sheikh et al., 2005), 3 cases from Turkey (Yilmaz et al., 2009) and 1 case from Iran (Chinikar et al., 2013), which acquired the CCHF infection nosocomially. In this aspect the healthcare workers are more at risk as they are in direct contact with CCHF patients during treatment. Therefore, it is important for the healthcare workers to follow the standard measures and isolation methods to get protection from contracting the disease. Early recognition of unintended effect is always the aim of health-related studies which may help in decreasing the case fatality rate. While lacking surveillance system for CCHS, the only reliance is on case based data regarding fatality. In our data on Pakistani side the fatality rate (17%) has slightly decreased in comparison to the previous study (20%) in 2011, along with a slight decline in the cumulative incidence in preceding years 2013 (0.36%) and 2014 (0.32 %) (Khurshid et al., 2015) but higher than (15%) a study published in 2007; a ten years observational study in Balochistan (15%). However, in Afghanistan the case fatality is still high (30%) with increase in cumulative incidence [2013 (0.072%), 2014 (0.168%)]. Case fatality rate of CCHF can be minimized if it is diagnosed at early stage with immediate treatment. However, in our study region; in Balochistan province of Pakistan and Afghanistan health facilities are usually poor. Furthermore, to the fact that in Balochistan, cases were reported from the province itself as well as from Afghanistan, which increased the burden on the limited health facilities. All suspected cases are referred to provincial headquarter for treatment and from there, samples from suspected patients are send to Karachi and Islamabad for laboratory confirmation, which takes a longer time to start the specific treatment if patient is positive for CCHF. Owing to the cruel social fact that patients which reports to the hospitals are usually already in chronic stage, therefore, it parallelly increase the case fatality rate. So, the case fatality rate certainly depends on the standardized health facilitation and social trends, as proven in the following studies. Turkey has better health facilitation and so as case fatality rate (5 %) (Yilmaz et al., 2009) in comparison to Pakistan (17%), Afghanistan (30%), Iran (14.8%) (Tabatabaei & Hassanzehi, 2014) and Kazakhstan (14.8%) (Nurmakhanov et al., 2015). The strength of this study is its focus on the area around the Durand line, which is considered an important hotspot for the endemicity of the CCHF. Further and importantly the correlation between the different variables and CCHF cases was determined to identify the influencing factors which contributed in disease distribution. This study had several limitations. Owing to the retrospective nature of the study, secondary data has been collected. We are restricted only to the information which has been registered by health officials of the respective hospitals. Secondly, the suspected cases reported to the hospital are usually in very critical conditions. Therefore, complete case history of patient is not obtained unintentionally by the hospital officials, as there is lack of hospital registry system across the country. Third, in most of the cases, the patients are not able to access the health facilities in Quetta because of

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long distances and lesser resources, therefore there may be underreporting of the disease. The limitation of this study does not allow us to generalize the results for whole region around the Durand line. But still with the current available data we had tried our best to determine the disease burden and the important risk factors responsible for the transmission of the disease.

Conclusion

The uncontrolled movements of people across the border, lack of awareness, cultural tendencies, and conventional agricultural and animal handling practices are important factors for the circulation of CCHFV in Balochistan and Afghanistan. We recommend that awareness among the high-risk professional groups should be promoted along with vector control efforts. In this aspect an effective surveillance system emphasizing on one health strategy should be implemented across the Durand Line. This study will be a vast contribution in awareness of vector agents of the region and will serve to instruct people regarding the risk and about what they can do to escape catching vector-borne diseases.

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