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The Influence of Migration on the Burden of and Response to Infectious Disease Threats in China

A Theoretically Informed Review

Joseph D. Tucker, Chun Hao, Xia Zou, Guiye Lv, Megan McLaughlin, Xiaoming Li and Li Ling

Migration and Health in China
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UNRISD, Palais des Nations, 1211 Geneva 10, Switzerland; Tel: +41 (0)22 9173020; Fax: +41 (0)22 9170650; info@unrisd.org; www.unrisd.org

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Sun Yat-sen Center for Migrant Health Policy, Sun Yat-sen University, #74, Zhongshan Road II, Guangzhou City 510080, P.R. China; Tel: +86 20 8733 5524; Fax: +86 20 8733 5524; cmhp@mail.sysu.edu.cn; http://cmhp.sysu.edu.cn/

Introduction to Working Papers on Migration and Health in China

This paper is part of a series of outputs from the research project on Migration and Health in China.

China is confronted by major challenges posed by the massive population movement over the past three decades. In 2009, approximately 230 million rural inhabitants moved temporarily or permanently to cities in search of employment and better livelihoods. Such large-scale mobility has huge implications for the pattern and transmission of diseases; for China's health care system and related policies; and for health of the Chinese population in both receiving and sending areas. The health and social issues associated with population movement on such an unprecedented scale have been inadequately addressed by public policy and largely neglected by researchers. Based on interdisciplinary research across the health, social science and policy fields, this project constitutes a major effort to fill research and policy gaps. Collectively, the papers and commentaries in this series aim to provide a comprehensive assessment of the health and public policy implications of rural to urban migration in China, to inform policy and to identify future research directions.

This project is a collaboration between UNRISD and the Center for Migrant Health Policy, Sun Yat-sen University, Guangzhou, China, and funded by the China Medical Board.

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Working Papers on Migration and Health in China

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Contents

Abstract

Massive rural-to-urban migration in China may influence infectious disease spread, but the same powerful social forces that reliably promote migration can also be used to design more effective health systems. We systematically reviewed eight databases to identify research studies focused on migrant infectious disease epidemiology and control policies. Grounded in Zimmerman et al.'s migration-health framework, we examined the sequential phases of rural-to-urban migration (pre-departure, travel, destination, interception, and return) in terms of their influence on infectious disease epidemiology and control policies. The migration process has a profound impact on the distribution of airborne, blood-borne, sexually transmitted, and mosquito-borne infectious diseases in addition to influencing potential control strategies. The spread of vaccine preventable diseases in China underscores the need for more responsive vaccination systems among migrants. Scaling up successful pilot migrant infectious disease control policies and new programmes are urgently needed in order to achieve health equity for Chinese migrants.

Acknowledgements

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Authors

Joseph D. Tucker, MD (University of North Carolina Project-China, Guangzhou, China; University of North Carolina at Chapel Hill, Chapel Hill, United States; Sun Yat-sen University Center for Migrant Health Policy, Guangzhou, China)
Chun Hao, PhD (Sun Yat-sen Center for Migrant Health Policy, Guangzhou, China)
Xia Zou, MPH (Faculty of Medical Statistics and Epidemiology, School of Public Health, Sun Yat-sen University, Guangzhou, China; Sun Yat-sen University Center for Migrant Health Policy, Guangzhou, China)
Guiye Lv, MPH (Faculty of Medical Statistics and Epidemiology, School of Public Health, Sun Yat-sen University, Guangzhou, China; Sun Yat-sen University Center for Migrant Health Policy, Guangzhou, China)
Megan McLaughlin, MPH (University of North Carolina Project-China, Guangzhou, China; Sun Yat-sen University Center for Migrant Health Policy, Guangzhou, China)
Xiaoming Li, PhD (Prevention Research Center, Wayne State University School of Medicine, Detroit, United States; Sun Yat-sen University Center for Migrant Health Policy, Guangzhou, China)
Li Ling, PhD (Faculty of Medical Statistics and Epidemiology, School of Public Health, Sun Yat-sen University, Guangzhou, China; Sun Yat-sen University Center for Migrant Health Policy, Guangzhou, China)

Correspondence to Dr. Joseph D. Tucker (jdtucker@med.unc.edu) or Dr. Li Ling (lingli@mail.sysu.edu.cn).

Introduction

Infectious diseases remain a major public health threat in China, but their spatial distribution across China is uneven.[1,2] The persistence of infectious diseases in rural regions, evolving rural health systems and massive movement of migrants from rural to urban areas make rural infectious diseases relevant on national[2] and international scales.[3, 4] Migrants' periodic return from urban destinations to rural origins also carries substantial public health implications.[5] While migrants in China are often considered a high-risk group for many infections,[2] the underlying mechanisms linking the migration process and infectious disease spread are unclear.

Understanding migrant infectious disease epidemiology is fundamental for designing responsive control policies. China provides a unique opportunity to examine the relationship between migration and infectious disease control policies for several reasons. First, China's 225 million migrants, alongside an increasingly detailed understanding of their movements,[6] create opportunities to examine the relationship between migration and infectious diseases on a large scale. Second, the China public health system has the capacity to rapidly implement new infectious disease control policies,[7] substantially narrowing the gap between evidence and implementation. Finally, health reform in China provides a strong financial and organizational impetus to achieve health equity among migrant populations.[8] The main purpose of this systematic review is to determine how the migration process influences infectious disease epidemiology and control responses in China.

Methods

While migration is a complex social phenomenon that encompasses many types of movement and resettlement, this review focuses on rural-to-urban migrants (referred to as "migrants" in the review) in China. One of the primary drivers for this massive rural-to-urban migration has been the search for better employment in urban regions, but there are many other reasons underpinning rural-to-urban migration.[9,10] This review has two main components: 1) a systematic review of the burden and distribution of infectious diseases among migrants; 2) a policy-focused review considering how the migration process can enhance disease control efforts.

The first component includes notifiable infectious diseases in China associated with the greatest mortality in 2010 and transmitted via respiratory droplets, blood, sex or mosquitoes (Table 1).[11] In addition, some non-notifiable infections associated with a substantial burden of disease (human papillomavirus, influenza) are also discussed. Zoonotic and fecal-oral infections are not discussed in depth because their mechanism of transmission is not directly related to the migration process.

This analysis uses a migration phase-specific theoretical framework to inform analysis.[12] Developed by Zimmerman et al., this theoretical framework was created as a tool to improve policies related to migration and health. This framework focuses on five sequential phases of the migration process that may influence infectious disease transmission and require policy attention: pre-departure, travel, destination, interception and return (figure 1). These phases are separate stages that many migrants will iteratively move through in their lives, and these transitions characterize the migration process in action. From a health policy perspective, analyzing migration and health at multiple phases will be the most effective for creating responsive control policies. The second component of this paper moves through each of the five phases to describe ongoing and potential strategies to control infectious diseases that

incorporate our understanding of rural-to-urban migration in China. Through using this framework, we are able to draw broader portraits that connect the *migration process*, not simply migrant individuals, to explain risk and tailor effective control programmes.

Search strategy and selection criteria

The systematic review search strategy for the first component of the review (burden of disease) retrospectively analysed studies that included a quantitative measure of the burden of one of the selected infectious diseases among migrants in China. The review of published work was done in several phases, with PRISMA guidelines. Potentially relevant articles were selected from four English databases (Pubmed, EMBASE, Ovid and PsycInfo) and four Chinese databases (CNKI, Wanfang, CBM and VIP). Search terms included "China" AND ("migrant" OR "peasant worker" OR "migrant worker" OR "rural to urban" OR "work personnel" OR "peasant laborer" OR "mobile population" OR "floating population") and one or more terms corresponding to the identified infectious disease. Only papers that identified migrant infectious disease epidemiology were included. The search algorithm was restricted to articles published in any language before 20 November 2012.

Abstracts were checked for relevance and had to meet the following criteria to be included: individual participants were entirely or partly (with disaggregation) rural-to-urban migrants; biomarker specimens were taken from Chinese residents and tested for an infectious disease; and sufficient detail was provided regarding test methodology, specificity, and sensitivity. All full-text articles meeting eligibility criteria were independently analysed by two reviewers before final inclusion. Data from selected full text research manuscripts were recorded.

Results

The migrant infectious disease burden of disease search identified 368 citations (figure 2). These research studies included airborne, blood-borne, sexually transmitted, and mosquito-borne infections.

Airborne infectious diseases

Airborne infections are generally transmitted by inhalation of respiratory droplets containing a pathogen, providing an opportunity for a local epidemic to travel along established routes of human movement. Several airborne pathogens have expanded along migration routes in recent years, which calls for a further investigation of the travel phase of migration. Higher burden of vaccine-preventable diseases in pre-departure areas as well as barriers to accessing health services at destinations further exacerbate these travel-specific risks. Tuberculosis, SARS and influenza are all airborne infectious diseases that demonstrate the close link between the travel phase of migration and airborne infectious disease transmission.

Tuberculosis is primarily a migrant disease in middle and high-income nations[13] and so it is not surprising that widespread movement within China may expand local TB transmission. In 2010 there were 429,812 smear-positive pulmonary tuberculosis cases in China, with migrants accounting for 7·0% (29,924).[14] There are at least two separate mechanisms that likely underpin this relationship: the rural-to-urban migration of individuals from higher prevalence western and central provinces to lower prevalence eastern regions (higher pre-departure burden);[15] and the cramped living conditions of migrant populations resulting in increased risk of acquisition (travel and destination conditions).[16] But beyond biomedical explanations alone there are also specific aspects of social and cultural practices among Chinese migrants that predispose them to tuberculosis. Both micro-level variations in cultural

beliefs about illness and macro-level political and environmental influences can increase tuberculosis risk.[17] Non-permanent residents in urban areas and those who travel have been found to have a higher risk of multi-drug resistant tuberculosis in China.[18-20] Returning migrants can also bring back urban-acquired TB infection to their home village.[21] Tuberculosis epidemiology in China demonstrates how travel and destination phases can accelerate onward transmission.

SARS is another key airborne infection, with high transmission rates and high mortality.[22] Epidemiological studies of SARS found that migrant labourers comprised a substantial portion of all cases reported.[23] A spatial analysis of SARS cases in mainland China found that locations with national highways or inter-provincial freeways showed the highest risk of SARS, adjusting for population density and medical capacity.[24] These same highways are the main arteries used by rural-to-urban migrants, revealing how travel-specific phases of migration could enhance SARS transmission. In addition to these biomedical data, anthropologists have described how the marginalized position of some migrants and their inadequate access to medical services further made them susceptible to SARS infection.[25]

Influenza was associated with 652 deaths in China during 2009 and has clear public health importance. The particular ecology of south China is uniquely well-suited to influenza interspecies transmission, creating conditions that are frequently associated with the emergence of new influenza strains. Although the existing epidemiological data do not suggest that rural-to-urban migrants are at a greater risk for influenza compared to their urban counterparts, the travel phase of migration could be critical in accelerating a local influenza epidemic into a regional, national and international one.[3, 4] Close contact on long train rides (over 40 hours) has been implicated in the spread of H1N1 influenza in China.[26] Proximity to airports and highways have also been associated with the disease.[27] Influenza vaccination coverage rates are lower in rural areas,[28, 29] increasing its risk in the pre-departure phase for rural-to-urban migrants.

Measles is a vaccine-preventable airborne virus that is highly contagious and associated with poor outcomes in immunocompromised individuals. Measles vaccine is recommended for all children in China.[30] However, measles remains an important airborne disease more common among migrants. In 2010 the World Health Organization reported that China had a total of 44,597 confirmed measles cases.[31] Migrant children have been at the forefront of China's measles epidemic, likely related to their lower rates of receiving the measles vaccine[32] (higher pre-departure burden) and their greater reliance on unlicensed private physicians[33] (inadequate destination services). Differential access to high-quality preventive medical services at urban migrant destinations likely contributes to this trend. Many migrants are either not registered or have a temporary residence permit that does not confer the full health care service benefits entitled to local urban residents.[9, 34]

Blood-borne infectious diseases

Blood-borne infections such as hepatitis B virus (HBV) and hepatitis C virus (HCV) are more common among subsets of migrants.[35, 36] Much of this transmission reflects blood donation in central rural China during the mid-1990s alongside incomplete HBV vaccination coverage in the same regions, creating a higher pre-departure burden of disease. Migration of these individuals to urban China has created new public health needs. Since China's HIV epidemic

is predominantly sexually transmitted,[37] we will cover HIV in the sexually transmitted infection section. This section explores hepatitis B virus (HBV) and hepatitis C virus (HCV).

HBV is a vaccine preventable disease that causes cirrhosis and liver failure. Among the 350 million individuals infected with HBV worldwide, approximately one-third are in China.[38] The majority of cases of chronic HBV are related to perinatal transmission or early childhood transmission in China.[39] Chinese health authorities recommended vaccinating all infants in 1992, and widespread implementation of HBV vaccination started around 2002.[30] However, rural areas have been slower to implement the Expanded Program on Immunization compared to urban areas, resulting in low HBV vaccination coverage rates in rural areas (pre-departure phase).[40] At the destination phase, migrants may not be eligible for routine free HBV vaccines compared to urban resident counterparts.[41] As a result of these two trends, low rates of HBV vaccination among young migrants in Beijing and Shanghai have been reported.[32, 42]

Hepatitis C virus is another blood-borne pathogen that is more common in central China. The prevalence of HCV in China is 10 times greater than the United States, thought to be related to increased injection drug use[43] and professional blood donation.[44] One large study of HCV in Guangdong Province found a higher prevalence among migrants.[36] Harm-reduction programmes such as needle exchanges and methadone clinics can protect injection drug users from HCV infection to some extent.[45] However, migrants are generally not eligible for these programmes [46] and may be more difficult to retain over time.[47] Since there is no HCV vaccine, prevention is critical.

Sexually transmitted infections (STI)

Sexually transmitted diseases are often more common among subsets of migrants. Away from their spouses or the influence of extended family structures, rural-to-urban migrants may have greater risk of having multiple sex partners, unprotected and/or commercial sex.[48] Higher prevalence of several STIs, including syphilis, HIV and HPV have been noted among migrants in China.[49-53]

Syphilis is a bacterial STI that can be easily cured with penicillin. China has a resurgent syphilis epidemic, and the disease has become the most commonly reported infectious disease in many urban regions of China.[54] Migrant women in Shanghai have higher rates of stillbirth attributable to syphilis compared to local women. The context of delayed prenatal care among migrant populations likely explains some portion of syphilis-attributable stillbirths. Universal first-trimester syphilis screening and treatment could nearly eradicate syphilis among pregnant women and their offspring, but operationalizing this is challenging in the Chinese context.

HIV is the leading cause of infectious disease death over the past three years in China (table 1). There are an estimated 780,000 people living with HIV in China, with approximately 48,000 newly infected in 2011.[55] According to national HIV data from the National Center for AIDS Control and Prevention, migrants accounted for 12.7 per cent of all HIV cases in 2007 and 20.8 per cent of all HIV cases in 2010[50-52] (figure 3). A systematic review of 54 Chinese studies found that over half of HIV cases in urban areas were rural-to-urban migrants.[56] There are several potential explanations for this trend, including HIV-infected individuals seeking better health care in urban regions, worse stigma in rural areas and the ability to start a new identity at the destination. No empirical research has evaluated these

explanations, but the lack of rural health services to serve HIV-infected individuals has been noted before.

The HIV prevalence of migrants is lower than other traditional most-at-risk populations (MARPs, e.g., men who have sex with men, female sex workers and intravenous drug users) in China, although a large share of MARPs are also migrants.[37] Migrants in China are a heterogeneous group that includes individuals at a higher and lower risk of HIV infection. Among studies of China migrants between 2000 and 2010, the HIV prevalence ranged from 0% to 1.5 per cent in 10 separate provinces.[57-81] A higher HIV prevalence was noted among migrants in regions that have greater intravenous drug use, such as Yunnan Province.[76-78] The highest HIV prevalence (1.5 per cent) among migrants was reported in Nanning, Guangxi Province.[79] The China Center for Disease Control and Prevention estimated that the prevalence of HIV among migrants in 2009 was 0.08 per cent%.[1] Owing to China's large migrant population, its comparatively low prevalence still represents a substantial portion of the Chinese HIV burden.

Although HIV prevalence is low among migrants, persistent high risk sexual behaviours suggest the potential for onward transmission. One study found that 20 per cent of migrants workers had engaged in commercial sex.[63] Studies of migrant sexual behaviour have shown low rates of condom use[83, 84]— approximately 6-10 per cent of migrants always use condom with their stable sexual partners.[80, 81, 85] This increased sexual risk could have implications for their rural wives/girlfriends after returning home. The return phase of STI epidemics in China has not been well explored.

Human papillomavirus virus (HPV) is a sexually transmitted vaccine-preventable cause of cervical cancer.[86] Last year there were 75,434 cervical cancer cases in China and 33,914 deaths attributable to cervical cancer.[87] Approximately 12 per cent of women in China are estimated to have HPV infection.[87] Rural areas have a higher burden of invasive cervical cancer. Migrant women in Hong Kong have been found to have a higher risk of invasive HPV infection compared to their local counterparts.[53] Although HPV vaccination has been implemented in many regions globally, China has not implemented widespread HPV vaccination.[88] Migrants may have more risky sex at destinations,[48] expanding the HPV and STI epidemics.

Mosquito-borne infections

Several major mosquito-borne infections, including Japanese encephalitis and malaria, are more common in pre-departure migrants. A study of malaria in Jiangsu Province China found that 25 per cent of cases were from rural-to-urban migrants and 26 per cent were from overseas Chinese visiting Africa.[89] Returning Chinese migrant workers from Africa have brought back *P. falciparum* infections.[90, 91] Migrants who have lower vaccination rates have a higher chance of contracting Japanese encephalitis (JE), [91] a mosquito-borne viral infection that is vaccine preventable. In the context of JE control, incomplete vaccination in pre-departure regions leads to an increased burden of disease among migrants. . This low vaccination rate is complicated by barriers to accessing preventive services at destinations, similar to other infectious diseases discussed. Migration of Chinese within Southeast Asia and Africa also create opportunities to acquire malaria infections during their journeys.[92]

Migration Phase-Specific Infectious Disease Control Policy Interventions

Examining the burden and distribution of infectious diseases as they relate to the migration process sheds new light on creating more responsive infectious disease surveillance, monitoring and control systems. This section explores how each of the five phases of the migration process (pre-departure, travel, destination, interception and return) has already been leveraged or could be leveraged to improve migrant health (figure 4).

First, the pre-departure phase is a critical driver and potential entry point for migrant health policy reform. Although health reform across China has contributed to decreases in infectious diseases, there are still large inequalities in the burden of disease and control infrastructure.[93] Specific pre-departure phase trends such as higher rural burden of disease (especially with tuberculosis and blood-borne diseases), insufficient rural vaccination rates (measles, JE virus, HPV), and limited rural health systems capacity converge to increase the risk of these infectious diseases among migrants. In order to confront the higher burden of HBV in pre-departure regions, enhanced school-based HBV vaccination in specific rural areas has been piloted.[94] The high rate of school attendance across China makes such efforts wide-reaching in their potential scope. Routine HBV screening at rural blood banks has also been instituted, reaching an older subset of the population.[95] Expanding school-based and blood bank-based pilots that have been successful for HBV to other preventable infectious diseases (JE virus, HPV, measles) would be a potentially useful control strategy. Unfortunately these types of programmes would not apply to HCV infection for which there is no vaccine available.

Following the pre-departure phase, the travel phase incorporates the period after leaving the pre-departure location and prior to arrival. Within the Chinese context, these transit periods are often spent in buses or trains and may take hours to days.[10] The transit phase is especially important in the context of airborne infectious diseases such as SARS and influenza. The short incubation period of influenza (1-4 days)[26] increases the importance of timely surveillance and monitoring systems at key travel points. China now requires an identity card or passport for all train travellers, increasing the feasibility of more extensive epidemiological investigations of the spread of influenza and other airborne infectious diseases in train settings. The nationwide electronic China Information System for Disease Control and Prevention (CISDCP) also helps to accelerate disease reporting about cases in transit.[96] At the same time, routine influenza surveillance in China still heavily relies on passive hospital-based case reporting[97] instead of exploiting the train stations and other hubs of human movement. There have been small pilots during influenza outbreaks that focused on more extensive temperature monitoring at schools.[98] Such community-based monitoring could be expanded to train or bus stations. The high volume of travel at most stations creates substantial logistical challenges for widespread surveillance efforts, but selective monitoring at such sites may be more feasible.[99] The transit phase is a critical period for understanding and responding to airborne infectious diseases among migrant populations in China.

Destination-phase migrant infectious diseases control policy interventions also show great promise. In the Chinese context, migrant destinations are often urban areas.[10] Destination-phase programmes in this context include vaccination programmes targeting migrant children and disease-specific programmes for adult migrants. Focusing on destination-phase interventions carries the advantage of leveraging existing urban public health and medical infrastructure. Responding to measles, the Chinese public health infrastructure launched a widespread immunization campaign in 2010. Immunization programmes targeting migrant

preschool children were found to be particularly effective.[100] These measles immunization campaigns were packaged as part of a supplementary immunization activity that included vaccines for polio, diphtheria-pertussis-tetanus, meningococcus, and Japanese encephalitis virus.[100] In the field of tuberculosis control, China has instituted free sputum smears and four-drug therapy for migrants, although these programmes do not cover inpatient hospital bills and other out-of-pocket costs that may prevent access.[101]

Disease-specific destination interventions have also been used for HIV surveillance and control responses. Until recently, HIV prevention efforts in China paid little attention to the migrant population. National HIV sentinel monitoring have not included migrants the last two years[51] and current HIV prevention programmes are estimated to reach less than 1 per cent of the migrant population.[102] There have been few HIV-related interventions targeting migrants in China.[103, 104] Most of these HIV migrant interventions have focused on increasing HIV awareness instead of behaviour change. Furthermore, most of these interventions have been small pilots[93, 103, 105] and not theoretically grounded. More research is needed to develop effective and feasible behavioural interventions that target migrants.

Finally, interventions for destination-phase infectious disease control have begun to focus on the prevention and control of other STIs. HIV control has special priority, and other STI control campaigns receive fewer resources and devoted programmes.[54] STI control interventions have been piloted for migrant women in South China[53, 102, 106] and need to be scaled up, as do successful pilot programmes for migrants, accompanied by cost-effectiveness studies. Utilizing the destination-specific phase represents a feasible component to enhance health systems for migrants in China.

In addition to vaccination and disease-specific destination-phase programmes, structural health systems issues in urban areas could be effective in alleviating the destination-phase burden of infectious diseases. Lack of insurance among migrants is a major problem that leads to delayed diagnoses and other complications associated with late presentation. Migrant health insurance schemes have already been developed in many regions of China. [107, 108] For example, Shanghai migrant workers have access to the Shanghai Migrant Worker Hospitalization Insurance and the New Rural Cooperative Medical System.[108] Translating these new programmes into efficient and comprehensive plans will take time, but is critical for destination-phase infectious disease control efforts. Other structural interventions such as stigma-reduction campaigns for health care providers could be useful to promote health-seeking behaviours and establish trusting physician-patient relationships.

The interception phase refers to situations of detention or interim residence, chiefly among forced migrants.[12] China's enormous rural-to-urban migration has underpinned much of the rapid economic growth during the past 30 years, so there are relatively few instances in which rural-to-urban migration is forced. The detention of female migrant sex workers in China likely serves to increase social suffering and may exacerbate STI risk. Female sex workers in China are often fined, detained or placed in "re-education through labour camps." [109] Women who are detained for selling sex are not processed through courts, but rather dealt with through the administrative detention system. Individual police make decisions about how to enforce regulations against women selling sex. Although the interception phase does not appear to be a useful strategy in China, the larger ethical and social context of internal migration is important for ensuring migrant health.

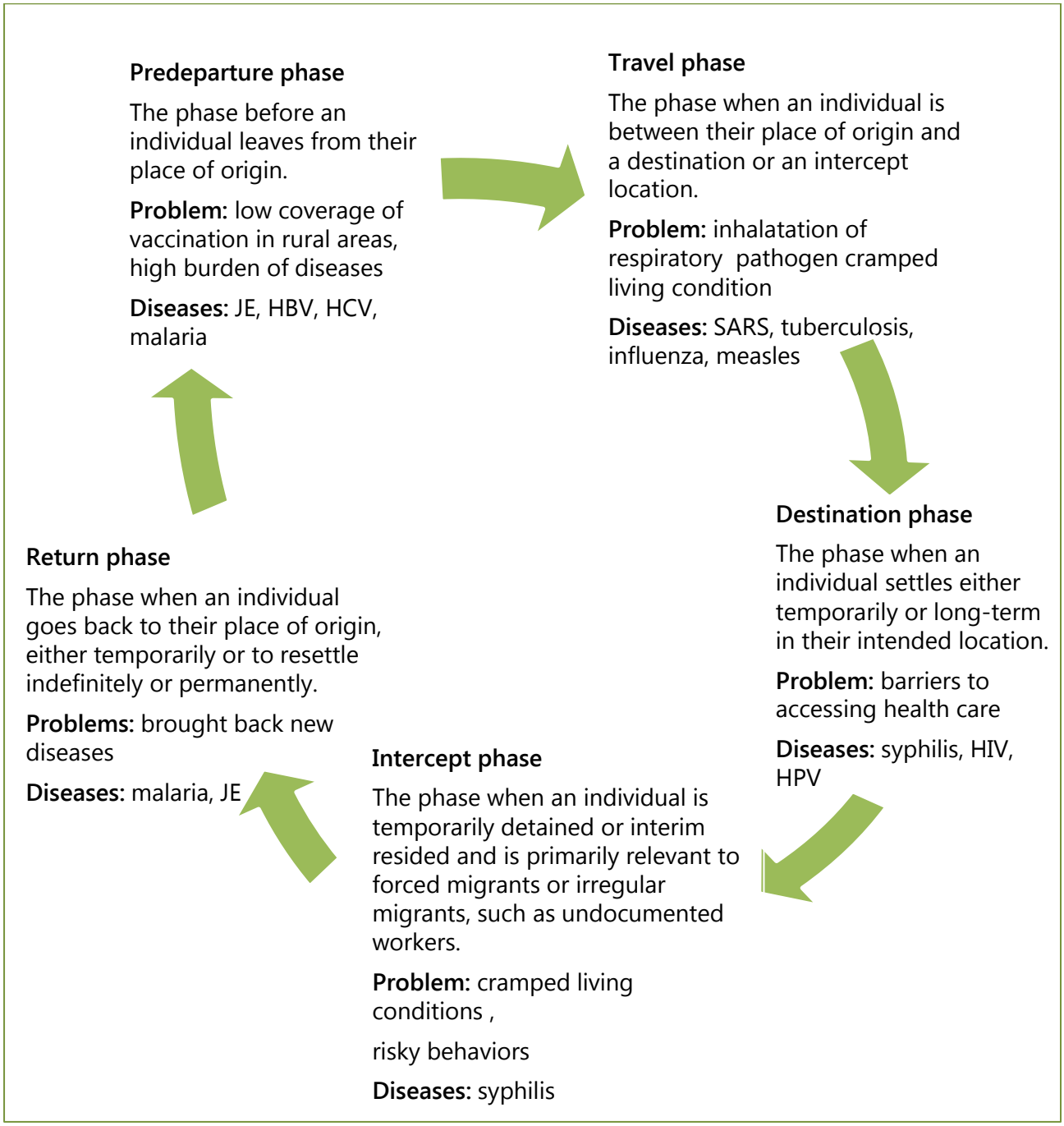
Finally, the return phase refers to when migrants return to their place of origin, either temporarily or permanently. This phase can represent an opportunity for an infectious disease acquired in the urban destination to be spread among individuals in origin locations. There is less research undertaken in many migrant origin communities in China, limiting the extent to which we understand how migrant behaviours influence their origin communities. A higher prevalence of STIs has been reported in rural parts of China that do not usually have increased STI risk,[110] raising the possibility that migrants have returned with untreated STIs. Research has also suggested that migrants returning to their rural origins may have persistently risky sexual behaviours.[111] New models for tuberculosis detection and treatment that encompass the return phase have been developed in China. A 60-county pilot provided free tuberculosis services to all individuals, regardless of migration status. Records of individuals who moved during their course of therapy were moved with them.[112] Between 2006 and 2008 this new system screened approximately 23 million migrants for tuberculosis and had over 90 per cent cure rates. This pilot has since been gradually expanded nationwide, accounting for the relationship between migration and tuberculosis spread.[112] The availability of health systems, records and providers at both destinations and origins was critical. Migrants who have to pay for hospital expenses out of pocket in urban areas may return to rural locations for less expensive health services. Several pilot schemes for expanded migrant health insurance have been effective, warranting scale-up and further implementation research.

Conclusion

Our analysis of migration and infectious diseases in China highlights several important lessons for the development of migrant health policy. The dynamic nature of China's population has laid the foundation for the expansion of many infectious diseases, but the same powerful social forces that promoted migration could also be used to generate more effective and sustainable surveillance and interventions. The spread of vaccine preventable diseases (measles, hepatitis B virus and HPV) in China underscores the need for more robust vaccination systems for rural residents and urban migrants. The need for integration of disease control mechanisms across borders is another priority, with promising pilots from tuberculosis control efforts showing how this could be achieved. One cross-cutting theme was inadequate health care access and suboptimal health insurance coverage, contributing to seeking care at unlicensed physicians or other informal settings. Effective pilot programmes need to be scaled up and new programmes will be needed in order to achieve health equity among Chinese migrants.

Figures

Figure 1 **: Impact of migration phases on infectious disease spread**



JE=Japanese encephalitis. HBV=hepatitis B virus. HCV=hepatitis C virus. SARS= severe acute respiratory syndrome. HIV=human immunodeficiency virus. HPV= human papillomavirus.

***Figure 2*: Schematic outlining systematic review of migrant infectious disease burden**

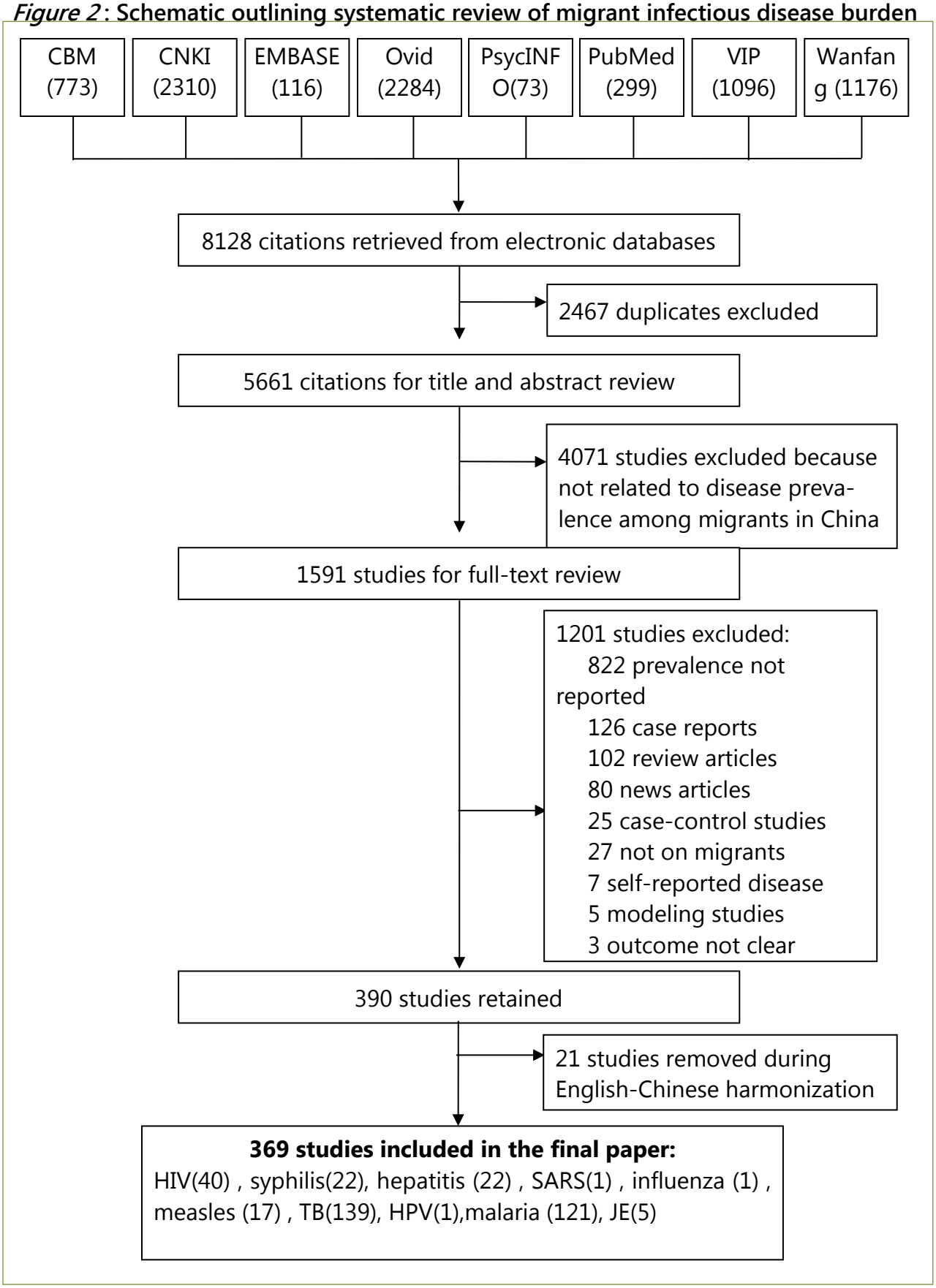


***Figure 3*: Proportion of migrants among reported HIV cases in China, January 2007 - June 2010**[1]

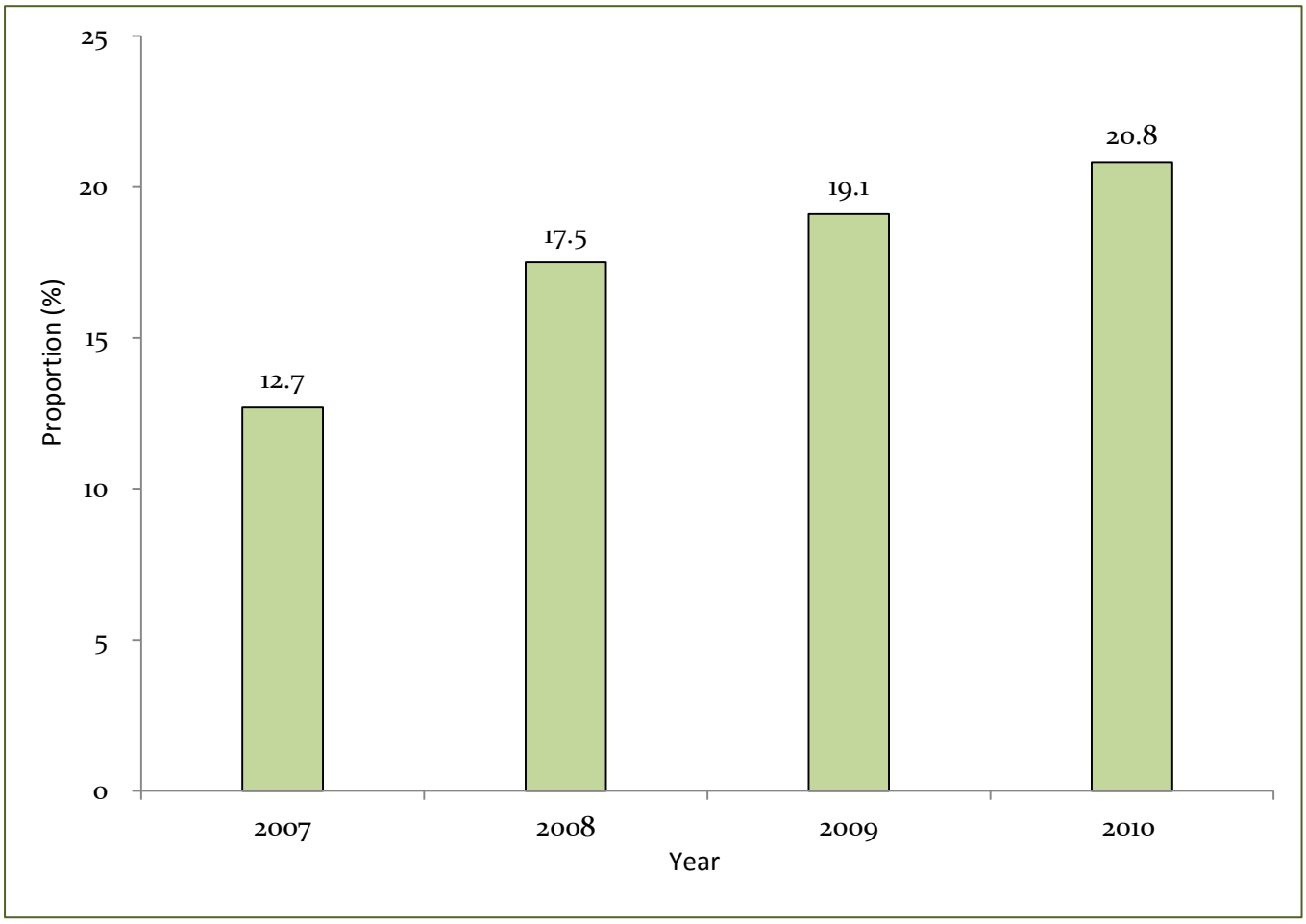
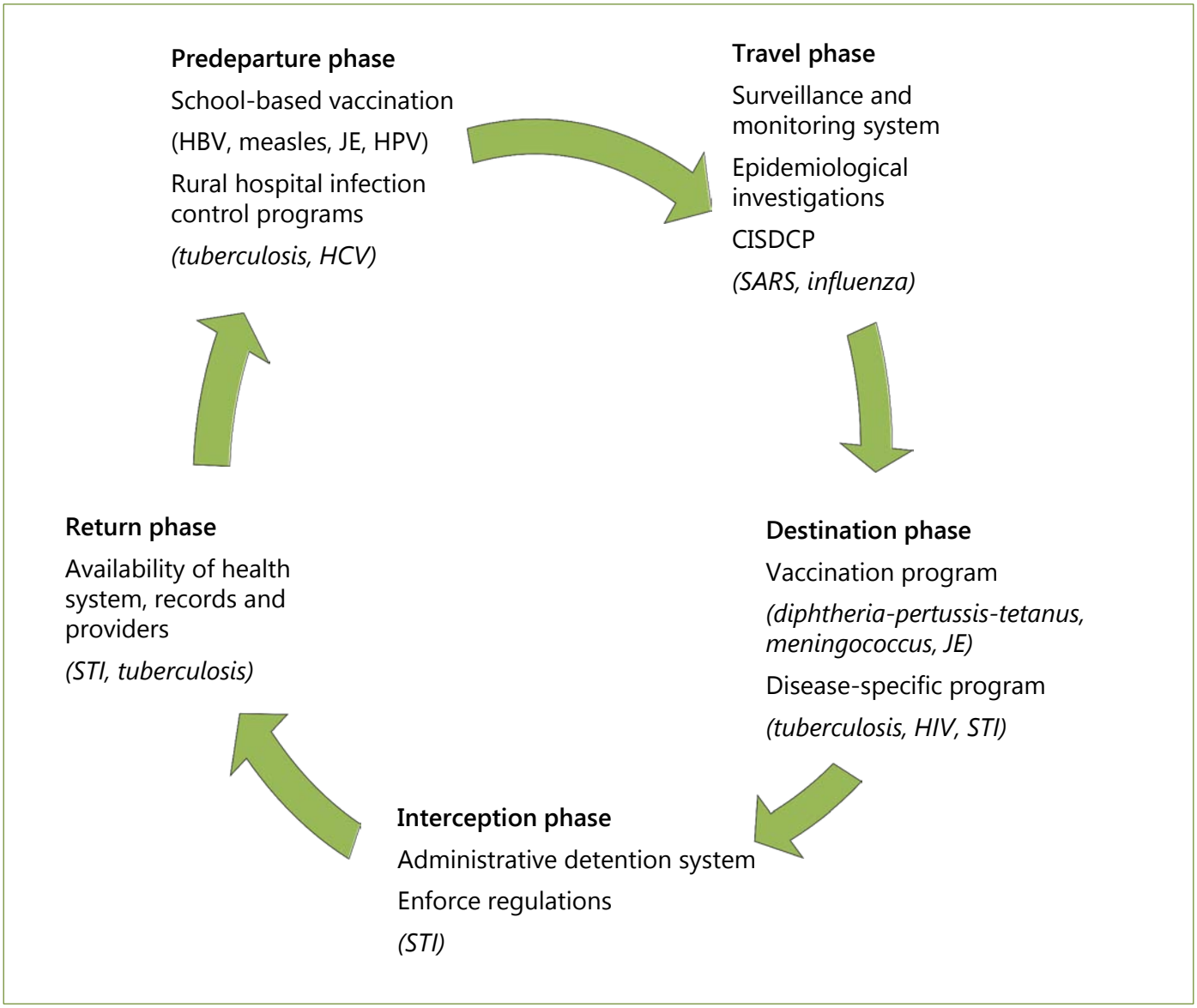


***Figure 4*: Migration phase-specific infectious diseases control policy interventions**



HBV=hepatitis B virus. JE=Japanese encephalitis. HPV= human papillomavirus. HCV=hepatitis C virus. CISDCP= China Information System for Disease Control and Prevention. SARS= severe acute respiratory syndrome. HIV=human immunodeficiency virus. STI= sexually transmitted infections

Table 1: **Infectious diseases associated with highest mortality between 2004 and 2010 in China (Data from Ministry of Health of the People's Republic of China)**

Year	No. of cases of mortality (in decreasing order)									
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**
2004	Rabies	Tuberculosis	Viral hepatitis	AIDS	Tetanus	Hemorrhagic fever	JE	Meningococcal disease	BDIA	Other
	2651	1435	1059	741	300	254	200	165	141	75
2005	Tuberculosis	Rabies	AIDS	Viral hepatitis	Tetanus	Hemorrhagic fever	JE	Meningococcal disease	BDIA	Syphilis
	6713	2545	1316	1208	306	271	214	206	137	74
2006	Tuberculosis	Rabies	Viral hepatitis	AIDS	JE	Tetanus	Hemorrhagic fever	Meningococcal disease	BDIA	Other
	3339	3215	1352	1331	463	263	173	156	111	91
2007	AIDS	Tuberculosis	Rabies	Viral hepatitis	JE	Tetanus	Hemorrhagic fever	Meningococcal disease	BDIA	Other
	3904	3669	3300	1122	227	207	145	124	71	68
2008	AIDS	Tuberculosis	Rabies	Viral hepatitis	Tetanus	JE	HFMD	Meningococcal disease	Hemorrhagic fever	Measles
	5389	2802	2373	1049	191	142	126	110	103	102
2009	AIDS	Tuberculosis	Rabies	Viral hepatitis	H1N1	HFMD	JE	Tetanus	Hemorrhagic fever	Meningococcal disease
	6596	3783	2131	1018	652	353	172	137	104	73
2010	AIDS	Tuberculosis	Rabies	HFMD	Viral hepatitis	H1N1	Hemorrhagic fever	JE	Tetanus	Syphilis
	7743	3000	2014	905	884	147	118	92	86	69
2011	AIDS	Tuberculosis	Rabies	Viral hepatitis	HFMD	Hemorrhagic fever	Syphilis	H1N1	JE	Tetanus
	9224	2840	1879	830	509	119	75	75	63	52

AIDS=acquired immunodeficiency syndrome. JE=Japanese encephalitis. BDIA=bacillary dysentery and intestinal amebiasis. HFMD=hand-foot-mouth disease. H1N1=influenza A virus subtype H1N.

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