The experience of China with the Disease Surveillance Point system (DSPs) and validation studies to evaluate the completeness of death registration

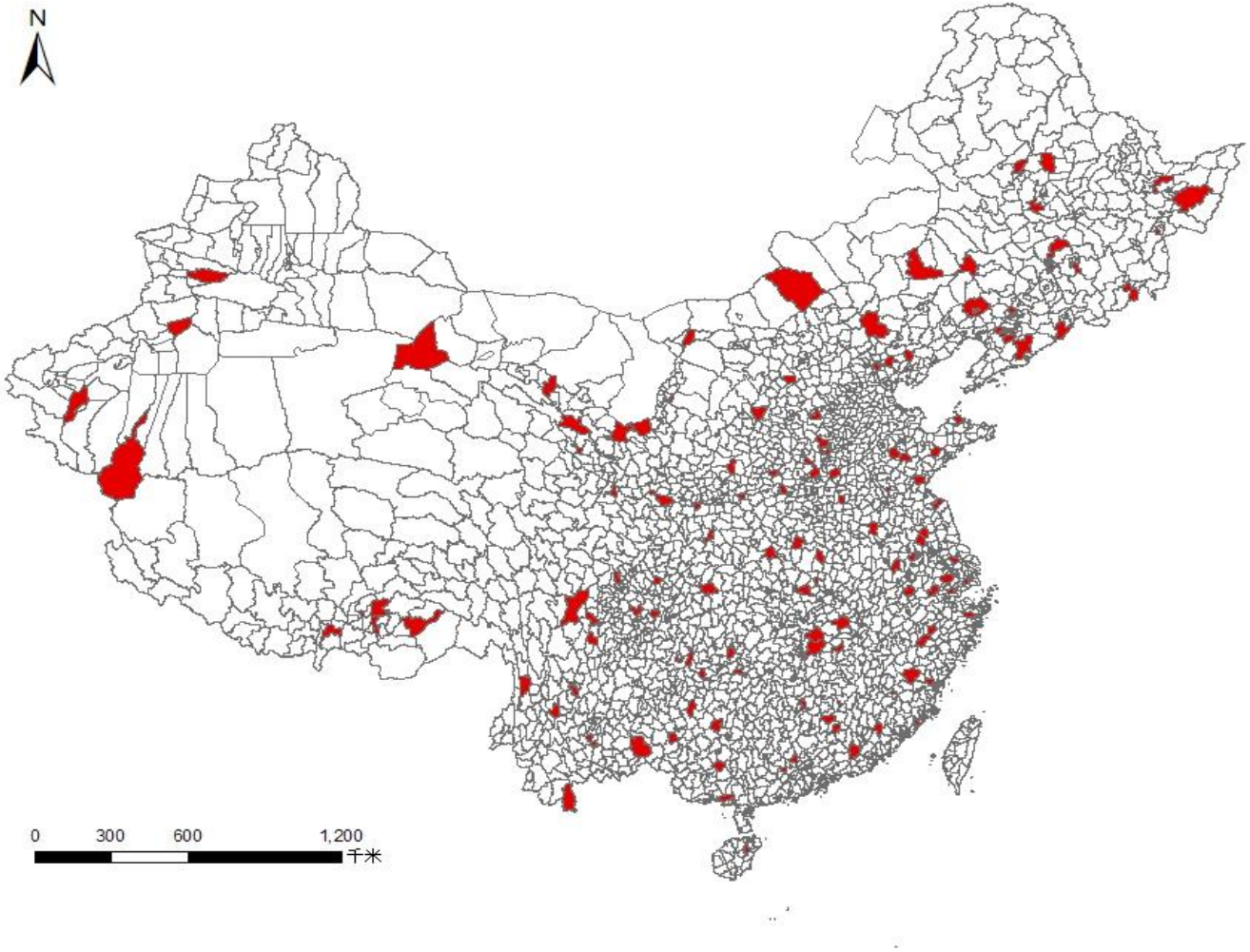
Maigeng Zhou, Peng Yin

National Center for Chronic and Noncommunicable Disease Control and Prevention, Chinese Center for Disease Control and Prevention

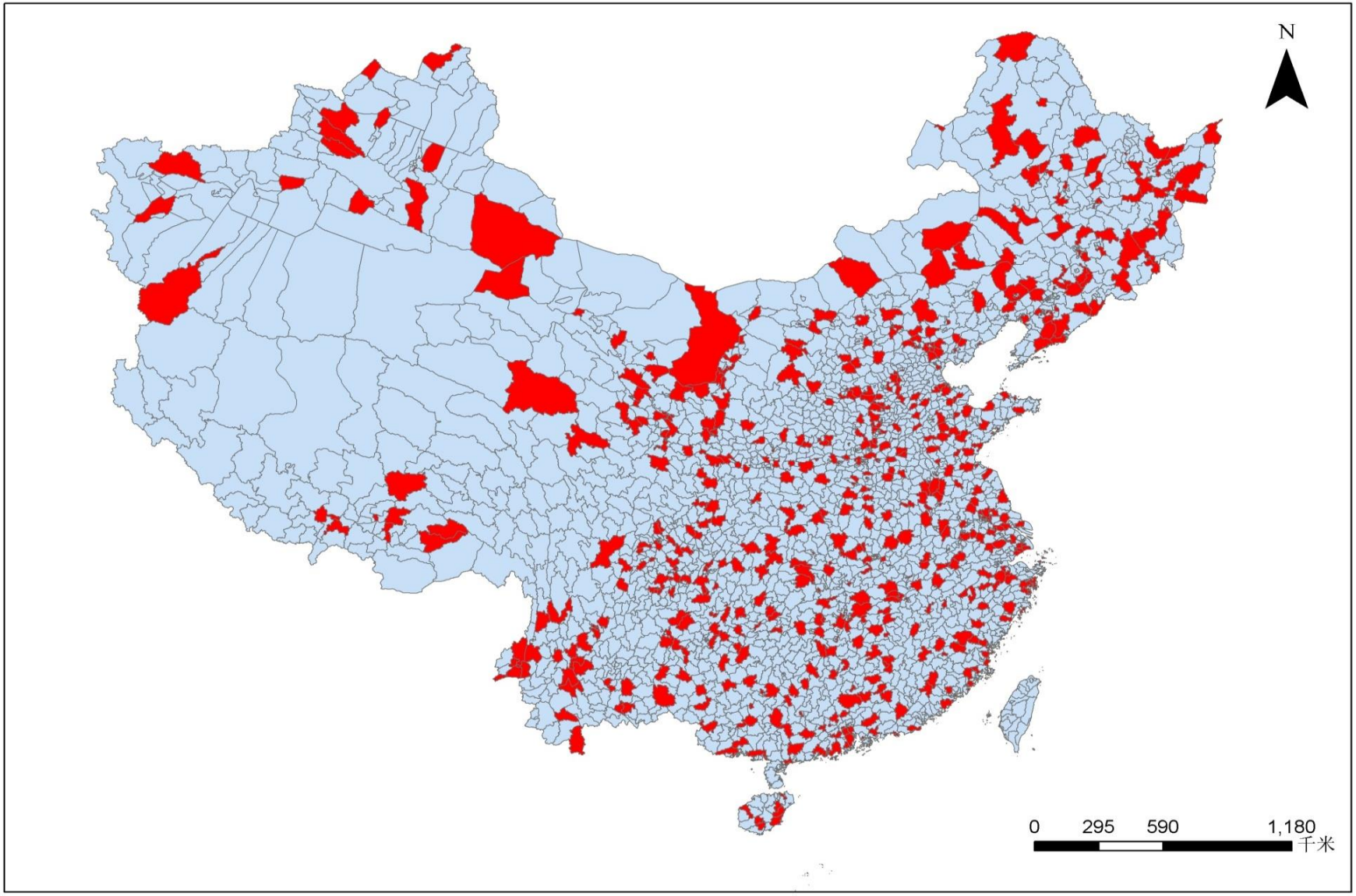
Development of DSPs

1978	Founded. Pilot of Dongcheng district and Tong county in Beijing.
1989	71 points of 29 provinces involved. Big cities and wealthy rural areas , by volunteering.
1990	Expanded to 145 points, 31 provinces. 10 million population. Multi stage stratified cluster sampling and probability proportionate to population size sampling.
2004	Expanded to 161 pionts (full population coverage), 31 provinces. 73 million population Multi stage stratified cluster sampling and probability proportionate to population size sampling, national representativeness.
2013	Expanded to 605 surveillance points, 31 provinces. 323.8 million population (24.3%). Stratification adjustment, national and sub-national representativeness.

Distribution of DSPs (161 sites)



Distribution of DSPs (605 sites)



Development of DSPs

- In 2013, the National Health and Family Planning Commission (NHFPC, previously MOH) combined the DSPs and the vital registration system (hosted by previously MOH) to create an integrated national mortality surveillance system (NMSs).
- The goals were to integrate and rationalize the health resources expended on these systems and to accelerate the development of a complete vital registration and mortality surveillance system covering the entire population of China.

Policy & practice

An integrated national mortality surveillance system for death registration and mortality surveillance, China

Shiwei Liu,[a] Xiaoling Wu,[b] Alan D Lopez,[c] Lijun Wang,[a] Yue Cai,[b] Andrew Page,[d] Peng Yin,[a] Yunning Liu,[a] Yichong Li,[a] Jiangmei Liu,[a] Jinling You[a] & Maigeng Zhou[a]

Abstract In China, sample-based mortality surveillance systems, such as the Chinese Center for Disease Control and Prevention's disease surveillance points system and the Ministry of Health's vital registration system, have been used for decades to provide nationally representative data on health status for health-care decision-making and performance evaluation. However, neither system provided representative mortality and cause-of-death data at the provincial level to inform regional health service needs and policy priorities. Moreover, the systems overlapped to a considerable extent, thereby entailing a duplication of effort. In 2013, the Chinese Government combined these two systems into an integrated national mortality surveillance system to provide a provincially representative picture of total and cause-specific mortality and to accelerate the development of a comprehensive vital registration and mortality surveillance system for the whole country. This new system increased the surveillance population from 6 to 24% of the Chinese population. The number of surveillance points, each of which covered a district or county, increased from 161 to 605. To ensure representativeness at the provincial level, the 605 surveillance points were selected to cover China's 31 provinces using an iterative method involving multistage stratification that took into account the sociodemographic characteristics of the population. This paper describes the development and operation of the new national mortality surveillance system, which is expected to yield representative provincial estimates of mortality in China for the first time.

Abstracts in عربي, 中文, Français, Русский and Español at the end of each article.

Workflow of DSPs

Deaths in hospital

Diagnosis

Fill in death certificate

Collect certificates, check and coding

Report online

CDC

Re-check and coding

Verify and correct

Statistic analysis

Data utilization and publication

Deaths outside hospital

Verbal autopsy（ICD-10）

Determine the underlying CoD

Collect, check and coding

Report online

CDC

Re-check and coding

Verify and correct

Statistic analysis

Data utilization and publication

Death cases reporting in China during 2004-2015

Year	reported number of deaths	Number of counties	Reporting rate	Garbage code rate	Crude mortality rate in DSPs	Mortality rate released by National statistics Bureau	Infant mortality rate in DSPs	Infant Mortality rate released by National statistics Bureau
2004	437,430	2422	82.58	20.05	6.08	6.42	11.32	21.5
2005	702,296	2295	78.25	24.68	6.08	6.51	11.32	19.0
2006	937,995	2308	79.45	22.13	5.25	6.81	9.31	17.2
2007	1,399,764	2385	81.63	14.07	5.60	6.93	9.02	15.3
2008	2,212,693	2593	84.16	7.06	5.75	7.06	8.00	14.9
2009	2,479,811	2615	84.74	5.82	5.83	7.08	6.06	13.8
2010	2,943,629	2695	87.33	5.56	5.75	7.11	5.51	13.1
2011	3,400,136	2695	87.33	5.10	5.76	7.14	5.82	12.1
2012	3,991,660	2818	91.08	6.26	5.96	7.15	6.32	10.3
2013	4,927,460	2903	93.6	5.96	5.60	7.16	4.70	9.5
2014	5,599,933	2900	93.4	3.70	5.87	7.16	4.80	8.9
2015	6,096,558	2916	93.6	3.58	5.84	-	4.80	

Under-reporting survey

- conducted every 3 years since 2009 in all 161 DSPs.
- Independent sampled survey, funded by central government.
- Cover deaths occurred during the past 3 year.
  - -2009: 2006-2008
  - -2012: 2009-2011
  - -2015: 2012-2014

Under-reporting survey: design

- Conducted in all 161 DSPs from July to October in 2012.
- Within each DSP, three townships (in rural areas) or streets (in urban areas) were first selected as candidate field.
- One township/street was finally chosen as the field site if its economic level was similar to the DSP's average and the population size was in the middle level among all the townships/streets in the DSP.

- Covered deaths occurring from January 1, 2009 to December 31, 2011
- All the residents in the selected township/street were included as the survey population.

Data collection process

- A list of decedents from the focal time period was created for each resident group (the smallest administrative unit) within all villages/communities in the selected townships/streets by recall of the resident group leaders.
- The initial list was checked and complemented by data from public security departments, civil affairs departments, family planning departments, and maternal and child health departments.
- Interviewers in each village/community surveyed each family which experienced a death to verify and revise relevant information on the death records.

常住人口资料


常住人口资料调查表
*发生地区
|--羊坊店街道
上一级
下一级
增加村人口记录
(当发生地区选至具体乡镇后，该按钮才可使用)
序号
村名
2009年年末人口
2010年年末人口
2011年年末人口
操作
男性
女性
男性
女性
男性
女性
1
...请选择...
删除
根据发生地区的选择而变化
*合 计
*年内出生数
*报告地区
---国家---
上一级
下一级
报告单位
-----请选择-----
报告日期
2012-05-29
报告人
softdev
*填表日期
2012-05-29
*填表人
保存
返回

录入调查表

调查表格信息

*报告地区	北京市市辖区东城区	报告单位:北京市东城区疾病预防控制中心	
*调查地区	北京市市辖区东城区东华门街道		
*村	韶九社区		
录入人	软件开发组		
录入日期	2012-05-03		
*填表人	test		
*填表日期	2012-05-03		

增加个案

序号	*编号	*死者姓名	*性别	*死亡年龄	*死亡日期	*家属联系电话	*死亡原因	*ICD10	根本死因	*身份证号码	*婚姻状况	*文化程度	*职业	*死亡地点	*生前最高诊断单位	*生前最高诊断依据	*调查结局	操作
1	1	test1	男	77	2012-05-01	1111111	高血压	I10 选择 清空	特发性(原发性)	111111111111111	已婚	不详	专业技术人员	医院病房	县区级医院	病理	现场补充病例	删除
2	2	test2	女	78	2012-05-01	11111111	糖尿病	E10 选择 清空	胰岛素依赖型糖尿	2222222222222222	已婚	文盲或半文盲	企业管理者	医院病房	省级医院	尸检	失访	删除

更新 返回

调查表格信息

*报告地区	北京市市辖区东城区	报告单位:北京市东城区疾病预防控制中心	
*调查地区	北京市市辖区东城区东华门街道		
*村	韶九社区		
录入人	软件开发组		
录入日期	2012-05-03		
*填表人	test		
*填表日期	2012-05-03		

序号	*编号	*死者姓名	*性别	*死亡年龄	*死亡日期	*家属联系电话	*死亡原因	*ICD10	根本死因	*身份证号码	*婚姻状况	*文化程度	*职业	*死亡地点	*生前最高诊断单位	*生前最高诊断依据	*调查结局	是否漏报(非漏报卡片填写CARD_ID)
1	1	test1	男	77	2012-05-01	1111111	高血压	I10	特发性(原发性)	111111111111111	已婚	不详	专业技术人员	医院病房	县区级医院	病理	现场补充病例	匹配
2	2	test2	女	78	2012-05-01	11111111	糖尿病	E10	胰岛素依赖型糖尿	2222222222222222	已婚	文盲或半文盲	企业管理者	医院病房	省级医院	尸检	失访	匹配

更新 返回

Training

- China CDC organized a central training for all provincial level CDC staffs
- provincial CDC organized training for related staffs at county/district level CDC.
- The County/district CDC organized training for interviewers from all the selected townships/streets.
- Interviewers include county/district CDC staffs, township/street community health center doctors and village doctors who are familiar with the routine death cause surveillance.

Under-reporting survey is an independent data collection procedure

- initial list of deceased cases (including in-hospital and out-of-hospital deaths) from all resident groups were required for each township/village.
- The documents from other related departments were also required.
- Emphasized during all training sessions at all levels.
- An important content for supervision.

Variable matching

- Cases included in both systems were identified as a match when national ID matched.
- If the national ID was missing, cases with the same name, gender and age (within three years) were used to identify a match.
- After an initial computer matching process, all mismatched cases were checked and verified by a further manual checking in the DSP level.

Method

- Propensity score weighting method
  -based on logistic regression

- CMR

Propensity score method

- Model estimation

-logistic regression to the sociodemographic variables to predict the probability a respondent was included in the routine surveillance in the sampled under-reporting survey site.

- Weighted estimates for deaths cases

-The probability of being reported for each observation(pi) was based on the logistic regression model of the field survey data. Weights for each case were calculated as wi=1/pi. The weighted number of deaths from 2009 to 2011 (Ts) was:

$$T_s = \sum_{i=1}^{N_s} w_i$$

Where Ns is the total number of death cases from the DSP 2009–2011 surveillance.

- Under-reporting rate $= (T_s - N_s) * 100\%/T_s$

Uncertainty calculation

$$p \pm Z_{0.05/2}\sqrt{\frac{p(1-p)}{n}}$$

Where p is the under-reporting rate, $Z_{0.05/2}$ is 1.96，n is the total number of deaths in the under-reporting survey.

For example, in calculating the 95%CI for east region in 2009 using CMR, where p=0.102，$Z_{0.05/2}$ =1.96，n=12026，using the fomula above, the 95%CI is 10.2% (9.7%, 10.18%)

Table 3 Test of goodness for fit of under-reporting field survey data and DSP dataset

Variable	Proportions in DSP dataset (Pi)	Proportions in under-reporting survey dataset (Si)	(Si-Pi)^2/Pi	χ^2	P
Age					
0-5	0.6	1.3	0.817	0.312	>0.05
6-14	0.8	0.5	0.113		
15-44	8.1	8.0	0.001		
45-64	22.5	22.8	0.004		
65+	67.3	66.9	0.003		
Cause of death					
Cancer	23.8	24.1	0.004	1.239	>0.05
Cardiovascular disease	43.9	42.4	0.051		
Respiratory disease	9.0	11.1	0.490		
Nervous system disease	1.4	1.3	0.007		
Digestive system disease	2.4	2.3	0.004		
Urinary system disease	1.3	1.2	0.008		
Congenital anomalies	0.4	0.4	0.000		
Injury	8.2	9.0	0.078		
Infectious diseases	3.2	3.5	0.028		
Pregnancy, childbirth and the puerperium	0.5	0.6	0.020		
Other disease	5.9	4.1	0.549		
Highest level of hospital where disease was diagnosed					
Provincial level	14.2	12.6	0.180	1.876	>0.05
City level	28.0	25.8	0.173		
County level	34.2	40. 5	1.124		
Township level	13.1	12.3	0.049		
Village level	3.9	3.8	0.003		
Other	5.7	4. 5	0.257		
No treatment	1.0	0.7	0.090		
Diagnostic criteria					
Symptoms + physio-biochemistry	55.8	57.6	0.058	0.360	>0.05
Pathology	7.9	6.9	0.127		
Symptoms/signs	25.1	25.6	0.010		
Autopsy	0.6	0.6	0.000		
Surgery	1.7	1.4	0.053		
Inference	7.8	6.9	0.104		

	Crude	Propensity score	CMR
Geographic region			
East	9.9	10.1(8.6,11.3)	9.9(9.6,10.2)
Central	11.0	11.2(9.6,12. 7)	11.0(10.7,11.3)
West	18.4	18.8(16.5,21.0)	18.4(18.0,18.9)
Sex			
Male	12.4	12.8(11.0,14.4)	12.4(12.3,12.8)
Female	12.9	13.2(11.4,14.7)	12.9(12.5,13.2)
Rural/urban			
Urban	10.7	11.3(9.6,12.8)	10.7(10.4,11.0)
Rural	14.1	13.9 (12.1,15.6)	14.1(13.8,14.3)
Age(years)			
0-5	19.6	23.6 (16.1,35.1)	19.6(17.3,21.7)
6-14	19.0	16.4 (13.1,20.0)	19.0(16.3,21.6)
15-44	14.1	14.8(12. 5,16.9)	14.1(13.3,14.8)
45-64	12.6	12.8 (11.2,14.2)	12.6(12.1,13.0)
65+	12.2	12.5(10.9,13.7)	12.2 (12.0,12. 5)
Total	12.6	12.6	12.9

Propensity score method

- used outcome (under-reporting rate) as dependent variable and other related factors as independent variables to build the models.
- took account of all the covariants which may affect both the under-reporting group and reported group and integrated the information of several major covariates into one propensity score variable.
- should include all the variables which potentially related to the outcome variable.

Advantages of PS

- represents the influence of multiple covariates for under-reporting.
- reduces the dimension of covariates and calculated under-reporting rate of each group based on the scores.
- In a large sample of cases, individuals between the groups could be adjusted using propensity score, making the distribution of covariates between the groups equivalent to achieve a post-randomization.

Strengths and limitations

Strengths：

-independent of routine surveillance.

-If the sample representativeness is good and the survey data quality is high, it can be used to estimate under-reporting rate very quickly and adjust the overall death rate.

Limitations:

-It is always not easy to have good representative for sampled survey and the data quality for large-scale field survey is not consistently high.

-It needs manpower, money and resources and not easy to administer.

Next steps

-under-reporting rate for the 2015 under-reporting survey (605 DSPs)

-sub-national under-reporting rate

-linkage with other data sources

Thank you!

Prof. Maigeng Zhou: maigengzhou@126.com

Dr. Peng Yin: yinpengcdc@163.com