

# HIV-1 and STDs in a rapidly transforming China – challenges to disease prevention

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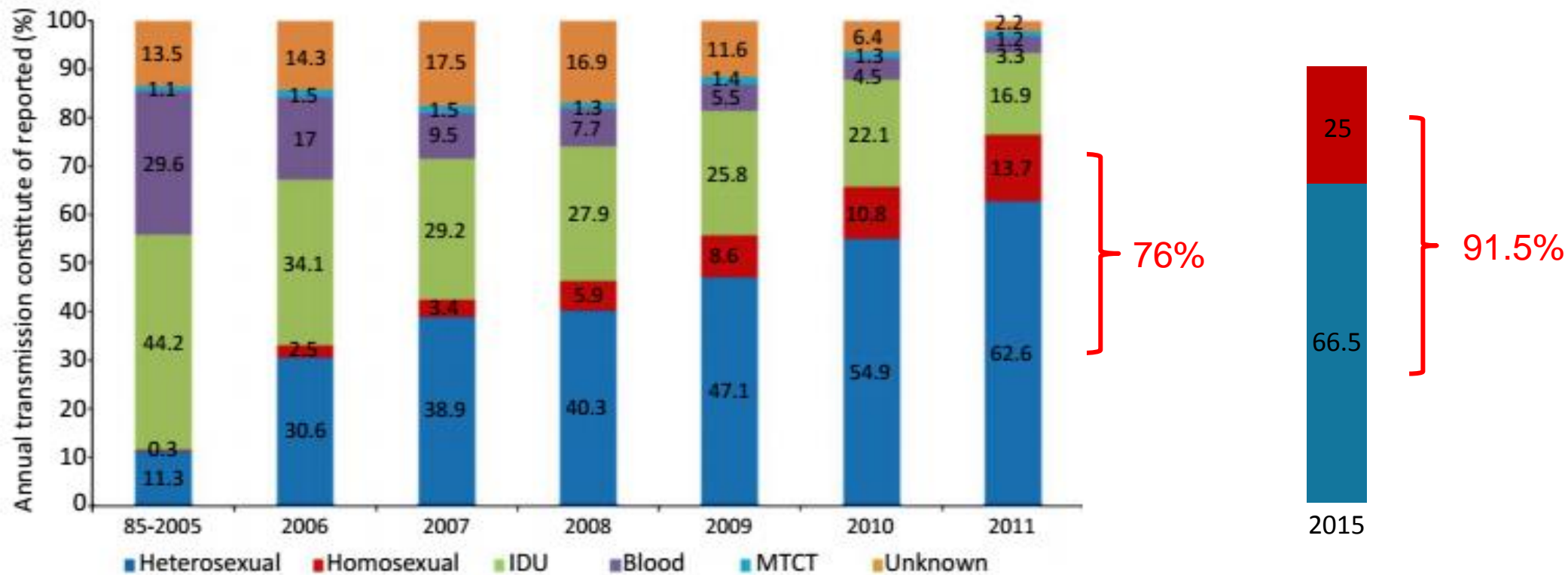
**Exploring Commonalities in Global Health Research**

**University of Southampton**

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# Sexual transmission of HIV-1 has become the major route



# Some characteristics of new infections

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- ◆ China, as a whole, remains a low prevalent country. However, there are a number of high prevalent regions. Yunnan, Guangxi and Sichuan provinces together account for 45% of the infection.
- ◆ In 70% provinces sexual transmission accounted for more than 90% of the infected
- ◆ From 2011 to 2015, new infection in college and school students increased 35% annually, among them 82% are MSM, gender ratio: 11:1. By 2015, 15-24 year old account for 15% of the infected population
- ◆ New infections among old people also increased dramatically
- ◆ HIV transmission in China is characterized by multiple transmission routes and low prevalence, which poses big challenges to disease control and public health policy implementation
- ◆ 50% infected individuals are unaware of their infections

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# **A health promotion logic model to review progress in HIV prevention in China**

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- ◆ Infected individuals who receive ART increased from 25% in 2005 to 87% in 2013, and death rate decreased from 17.9% to 6.6% for the same period.
- ◆ 2013-2014: new infection increased by 14.8% (104000 new cases); ART increased by 21.2% (85000 new cases), as compared to 2013.

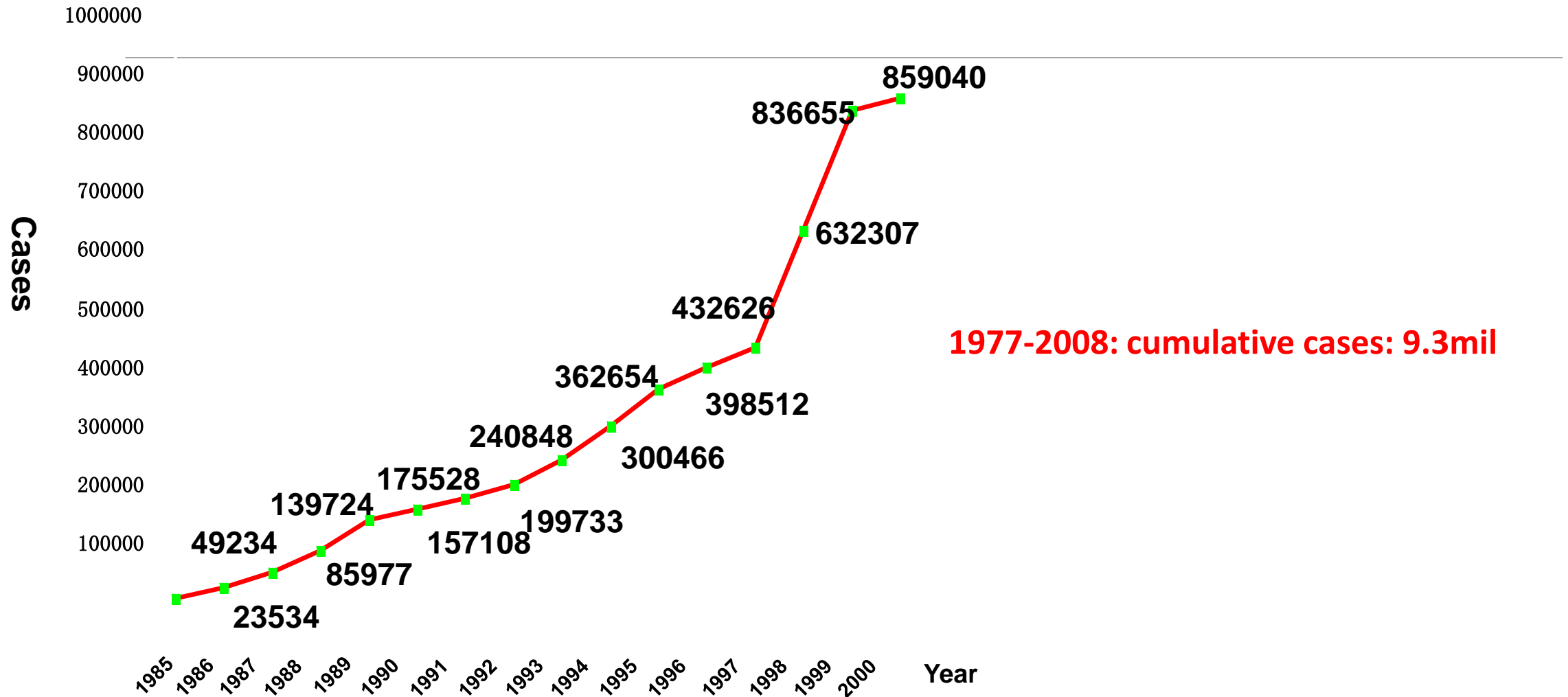
# Traditional sexually transmitted infections are also on the rise.....

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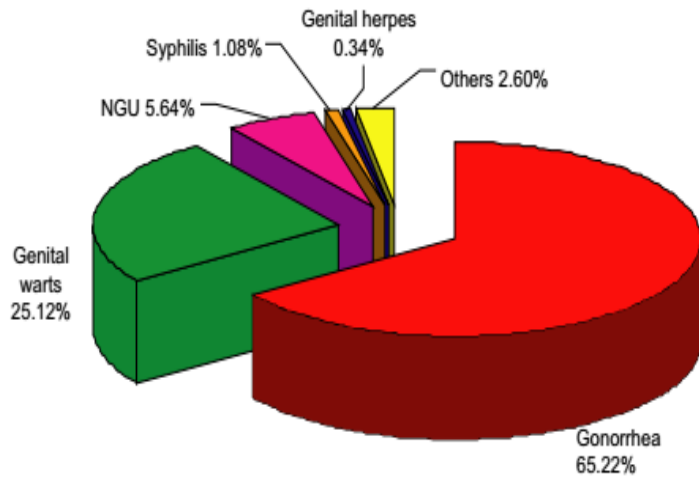
STIs/STDs are reported and recorded based on the state guidelines:

- Traditional STDs, such as syphilis and gonorrhea, were almost completely eliminated before the open door policy, but came back since the economical reform
- In early 1980s, STDs started re-appearing, initially in cities at southern coastal region and then spread to other parts of the country
- Since some STDs are not mandatorily required for reporting, the actual cases are likely significantly higher

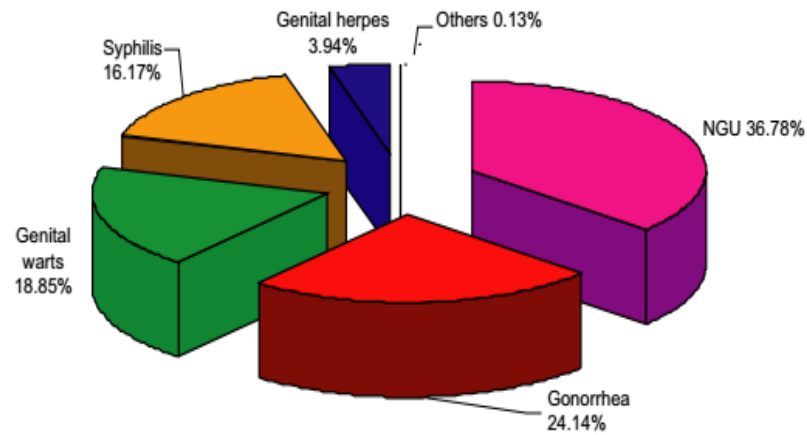
# Annual Reported STDs in China, 1985-2000



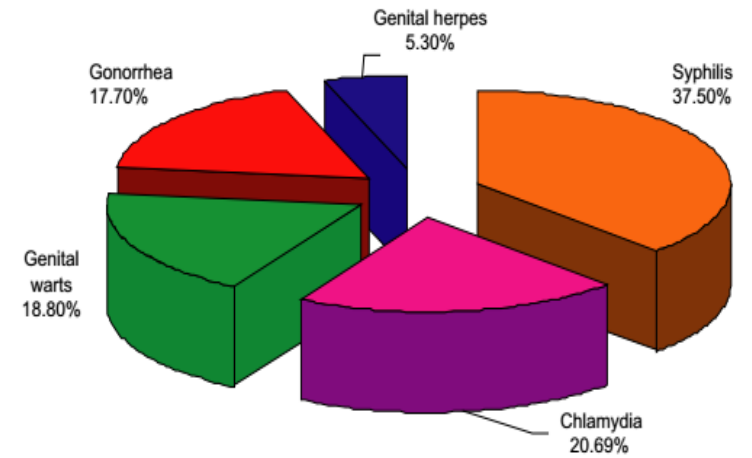
# Composition of STIs also changed



Ratio of STIs in China in 1991

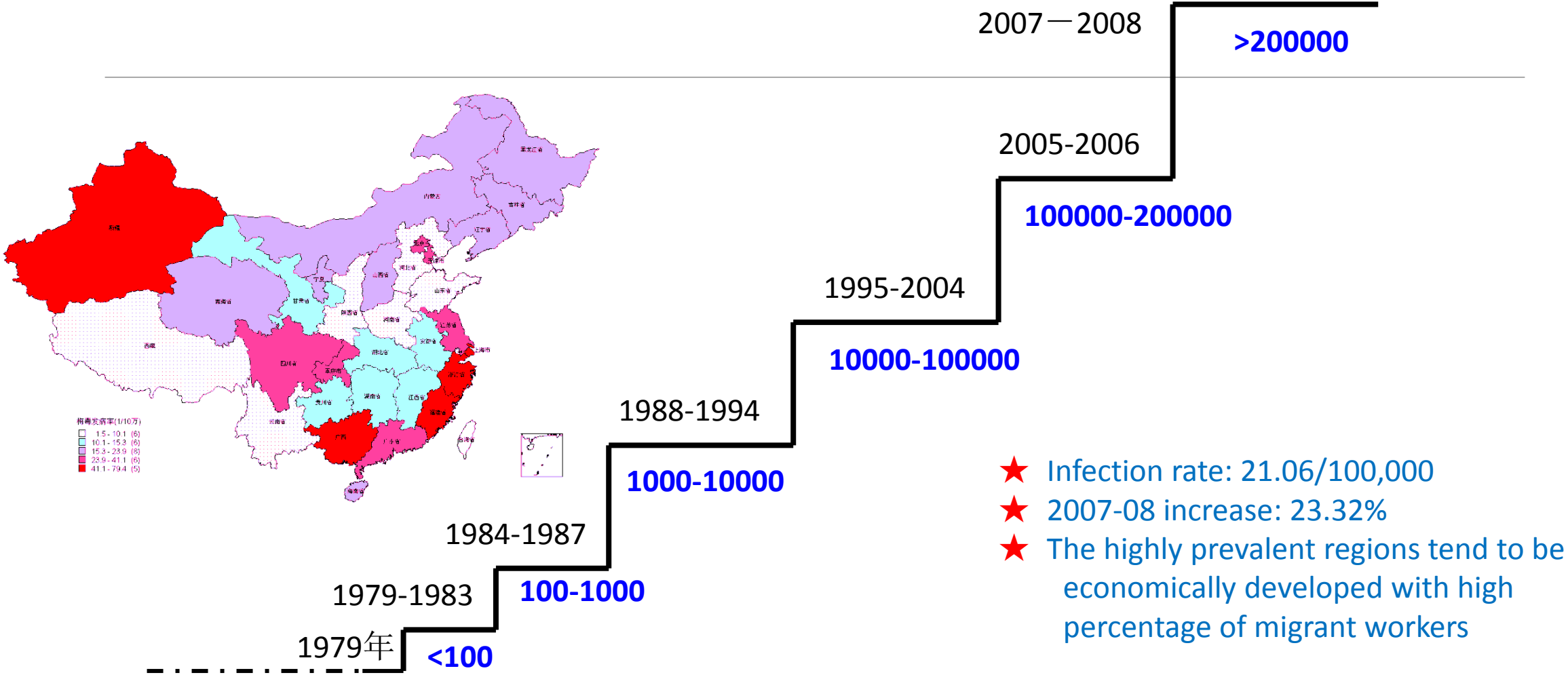


Ratio of STIs in China in 2005



Ratio of STIs in China in 2008

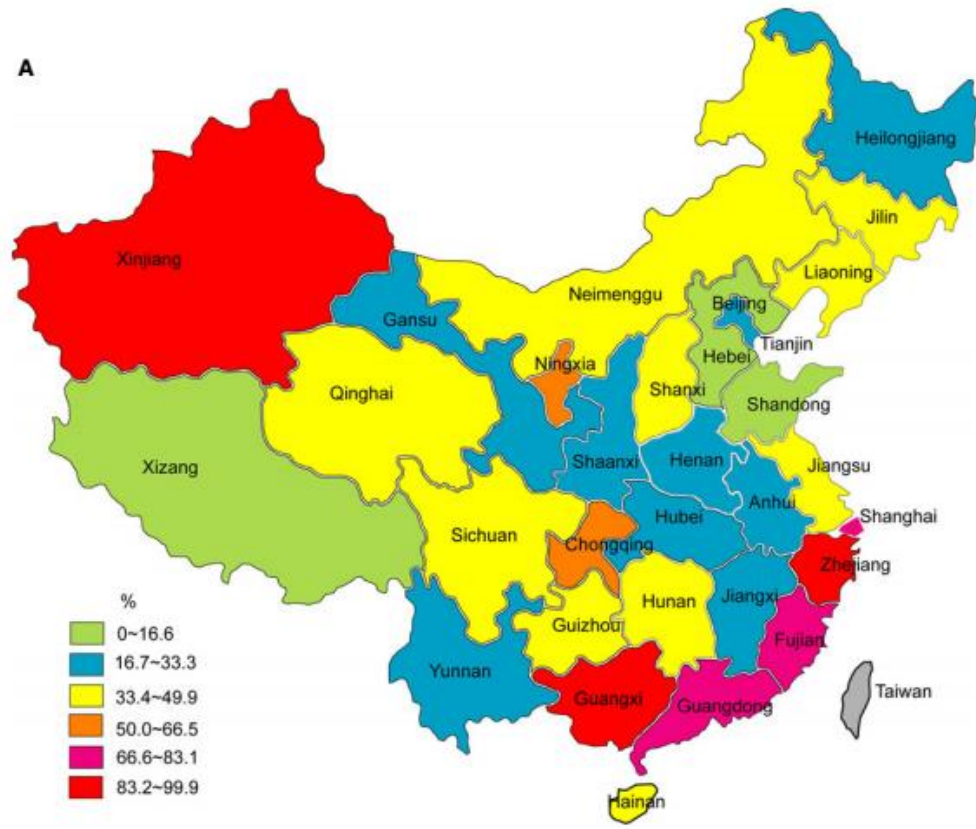
# Example: Reported cases of syphilis



- ★ Infection rate: 21.06/100,000
- ★ 2007-08 increase: 23.32%
- ★ The highly prevalent regions tend to be economically developed with high percentage of migrant workers



# The HIV-1 and Syphilis prevalence have significant geographic overlaps



# Demography of syphilis sero-positivity

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**MSM: Range: 10.6%-18.7%, Mean: 14.56%**

**FSW: Range: 4.95% - 17.8%, Mean: 12.49%**

- Mid cost FSW: 4.0% - 8.8%
- Low end FSW: 32.2% - 33.1%

**IVD: Range: 5.01% - 11.17%, Mean: 6.81%**

**FSW client: Range: 2.99% - 5.79%, Mean: 3.04%**

**Pre-marrige check: Range: 0.31% - 1.43%, Mean: 0.66%**

**Pregnant women: Range: 0.29% - 0.6%, Mean: 0.45%**

# FSW at various locations and their risks of infections

Location	Syphilis infection		HIV-1 infection	
	No of people	%	No of people	%
A	2179	3.4	2183	0.05
B	2808	5.6	2797	0.18
C	1295	12.8	1302	1.08
Total	6282	6.3	6282	0.32
$\chi^2$		P<0.001		P<0.001

**A** : Karaoke、 Disco、 Teahouse、 star-rated hotel

**B** : hair salon、 massage parlor、 beauty salon、 foot massage、 roadside guesthouse, etc.

**C** : roadside call girl、 rental apartment、

# The economic migrants are of particular concerns with respect to HIV and STDs



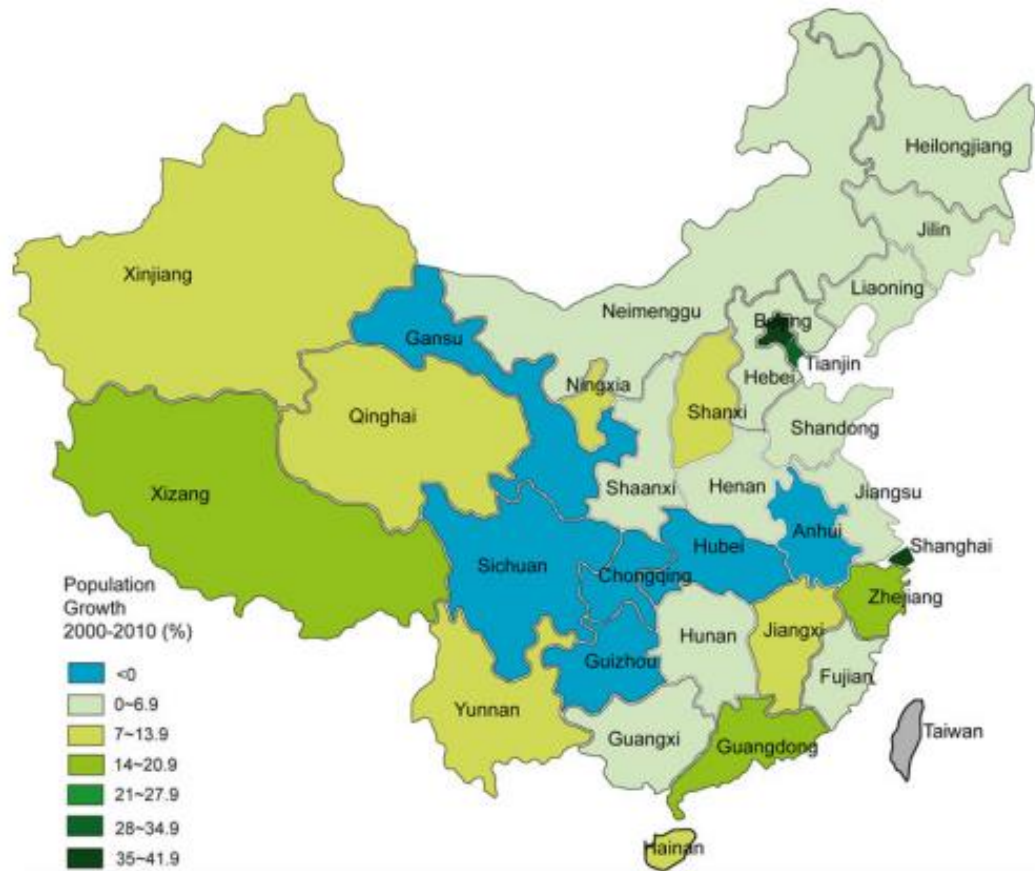
NB: The thickness of the arrows indicates the strength of the flows. Source: NBSC, 1997.

2009 data showed that there were 211m migrant population, 16.5% of the total population; mean age 27.3yr old;

78.7% of the migrants were from countryside with agriculture “Hu Kou”(registered residence) and poorly educated (<20% have any skill training);

# Population changes during 2000-2010

A

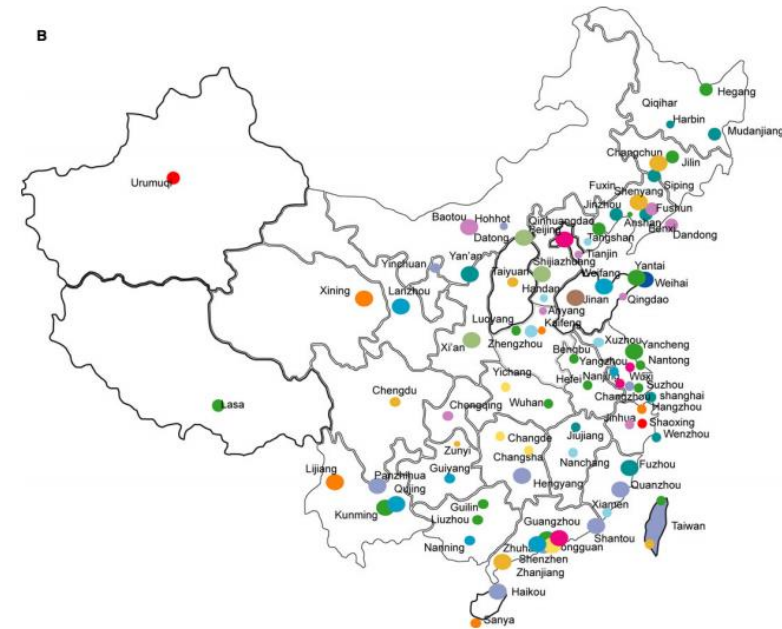


The coastal regions have the highest growth

The central regions have negative growth

Most of the population growth concentrates at the economically developed provinces

B



# Migrant population constitutes a significant portion in many cities

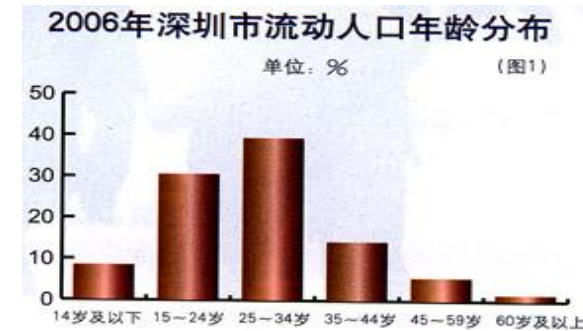
表1 我国2003年流动人口在50万人以上的26个城市名单(按流动人口总数排列) 万人

城市名称	总人口	户籍人口	流动人口
东莞	599.41	158.96	440.45
深圳	557.41	150.93	406.48
北京	1407.00	1079.22	327.79
上海	1434.90	1141.89	292.96
广州	865.12	588.26	276.86
佛山	550.86	344.24	206.62
杭州	535.51	393.19	142.32
温州	271.32	134.65	136.67
武汉	896.19	781.19	115.00
中山	240.38	137.86	102.52
南京	591.77	489.76	102.01
宁波	300.18	206.91	93.27
苏州	306.71	216.87	89.84
天津	848.39	758.78	89.61
无锡	302.20	219.60	82.60
厦门	214.06	141.76	72.30
湛江	144.25	74.75	69.50
沈阳	504.20	440.60	63.60
西安	573.78	510.26	63.52
成都	514.96	452.57	62.39
常州	274.65	213.41	61.24
济南	394.30	334.80	59.50
青岛	305.84	246.77	59.07
大连	329.93	274.78	55.15
昆明	263.56	210.81	52.75
重庆	1060.70	1010.12	50.61

>70%

Most of the floating population are sexually active young adults

20-40%



★ Henan Province: by 2014, total infections: 63940; in 2014, HIV-1 through heterosexual transmission: 2958, among which 70% was identified in agriculture workers (migrant workers);

★ Before 2010, new infections in Henan had been decreasing for several years. But from 2010, new infections have kept increasing, mainly due to the increase in sexual transmission.



# Impact of migrant population

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- ◆ Population mobility tears down traditional social fabrics
  - ◆ Migrants impact on social and cultural life in certain cities
  - ◆ Migrants are often at disadvantageous position with respect to social benefits associated with “Hu Kou”, the household registration
  - ◆ Less educated migrants are often at financial disadvantages since they tend to work for construction, manufacture, service and entertainment industries
- 
- In recent years, the trend shows that the migrant population is getting younger, with more and more 80s and 90s generations
  - These generations are better educated, more internet savvy, more actively socially connected and are often open minded. However, they tend to be unaware of risks associated with sexual interactions.





# Internet use took off around 2008



图 1 中国 IPv6 地址数量



# Our Concept of China's MSM and Internet

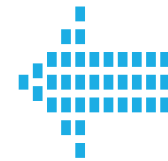
Gay online community



Social network: information stream and contact



Behaviors behind the network



Traditional survey by questionair



Impacts on transmission

# An example: BF99, China's largest gay online community

What can we draw out from the open-access data from China's largest gay online community ?

## User information

排序: 最新注册 显示: 每页10条

列表显示 双列显示 照片显示 上一页 下一页

如何才能在搜索列表前面?  
1. 有照片的会员。  
2. 通过认证的会员。  
3. 个人资料完整的会员。  
4. 录制自己真实视频的会员。

年龄: 20 - 59  
个性特点: 不限  
地区: 不限  
城市: 不限  
身高: 140cm - 不限  
体重: 40kg - 70 kg

开始搜索

## Info stream between community members

基本资料 详细资料 私人秘密 照片(3) 大头帖(0) 评论(45)

四川成都市锦江区  
型男飞行日记 的同志交友资料 离线

BF99指数 65分

>> 网友对此用户的所有评论 >> 点这里对此用户进行评论 <<

男人歌 于 2011-12-20 10:03:49 的评论  
对长 下面那些亵渎你的人可不少啊 又来看看 哈哈。

钵匪 于 2011-12-19 20:57:43 的评论  
笑得这样阳光的人, 会幸福的!

xintiao1122 于 2011-12-18 10:53:16 的评论  
o(∩\_∩)o唉 我是服装控 -- 还是正装的男的好看

风自由 于 2011-12-17 22:21:54 的评论  
好娘的爷们

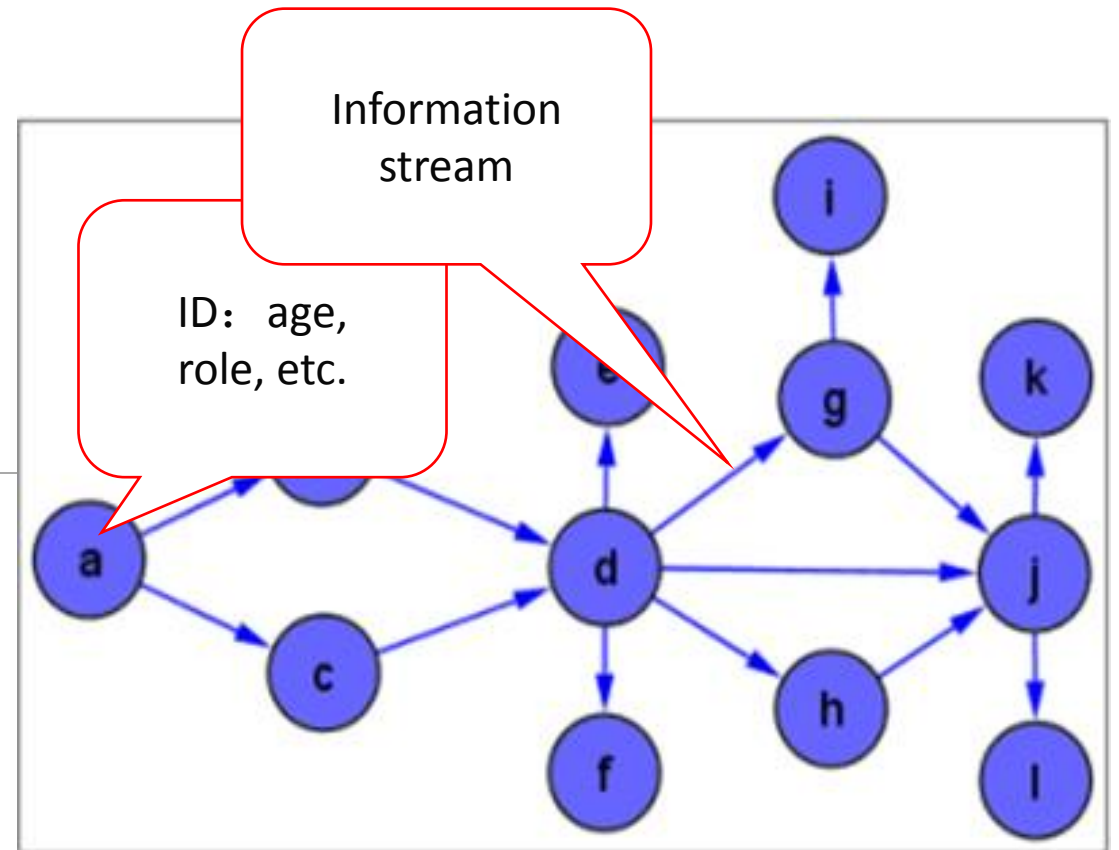
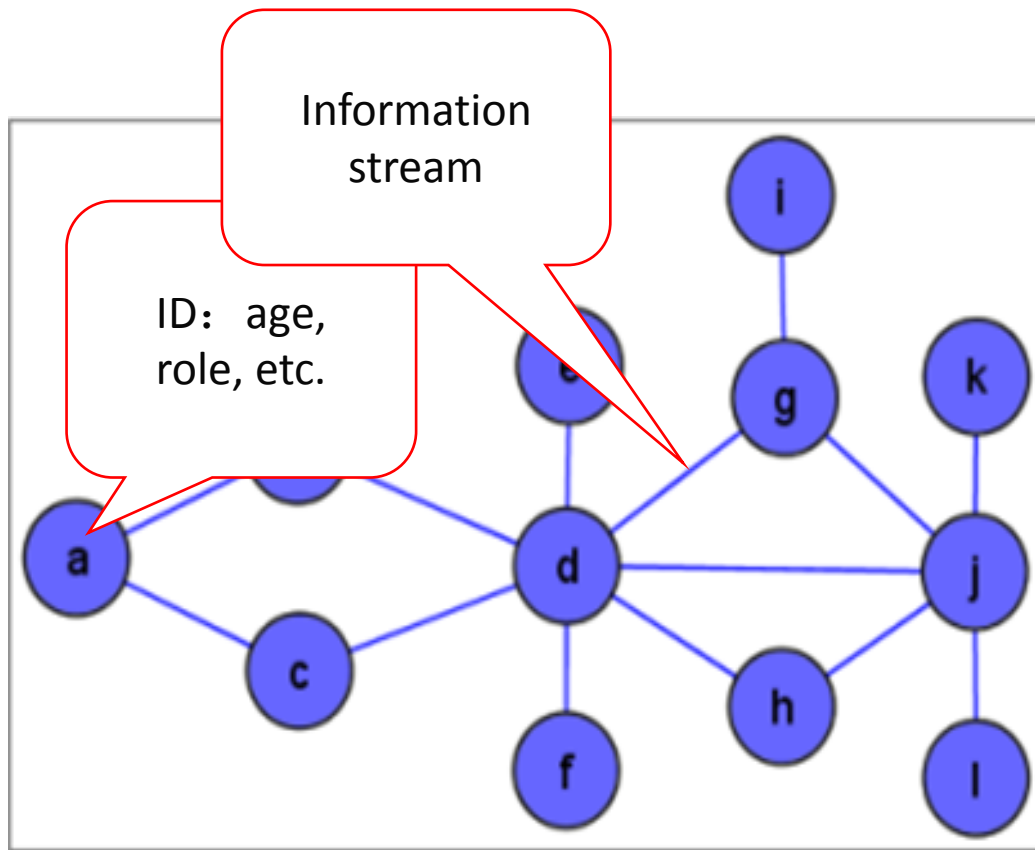
微笑着 于 2011-12-17 21:12:57 的评论  
成熟, 迷人的笑容, 迷死人不用本啊。。。哈哈啊。。

生活的真谛 于 2011-12-16 21:05:31 的评论  
应该不是空少 我不好看 我觉得你也一般 都有眼带了

爵士音乐 于 2011-12-16 16:56:17 的评论

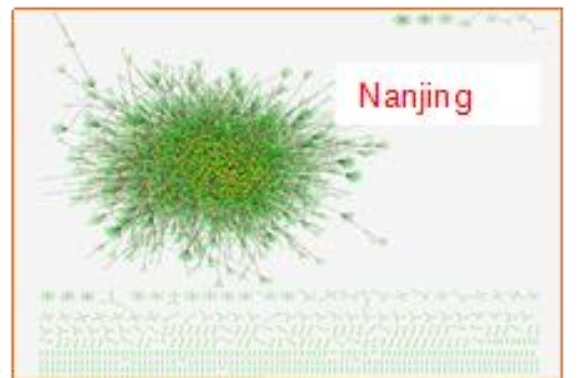
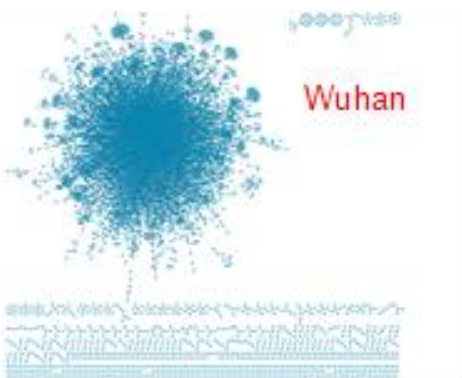
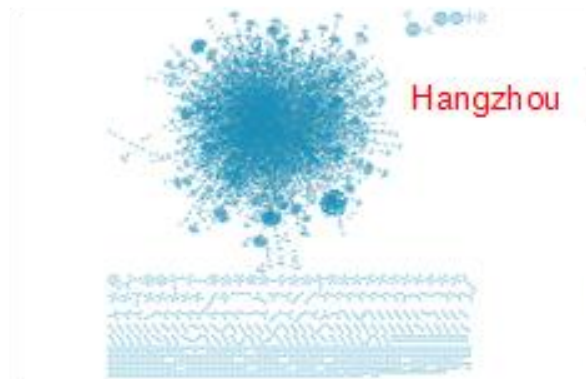
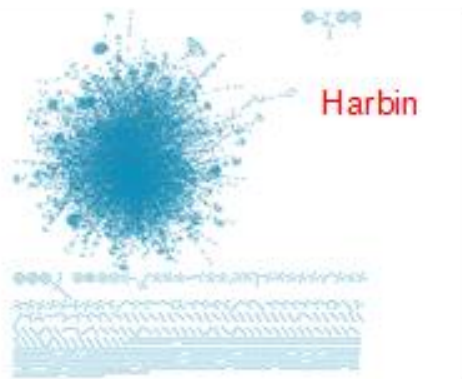
送朵鲜花 砸个鸡蛋  
发送短信  
鲜花 5朵  
鸡蛋 2个  
总点击 5957  
月点击 5957  
周点击 819  
日点击 177  
资料登记时间: 2011-12-20 22:22:25

# A network based on member properties and comment information between BF99 community members



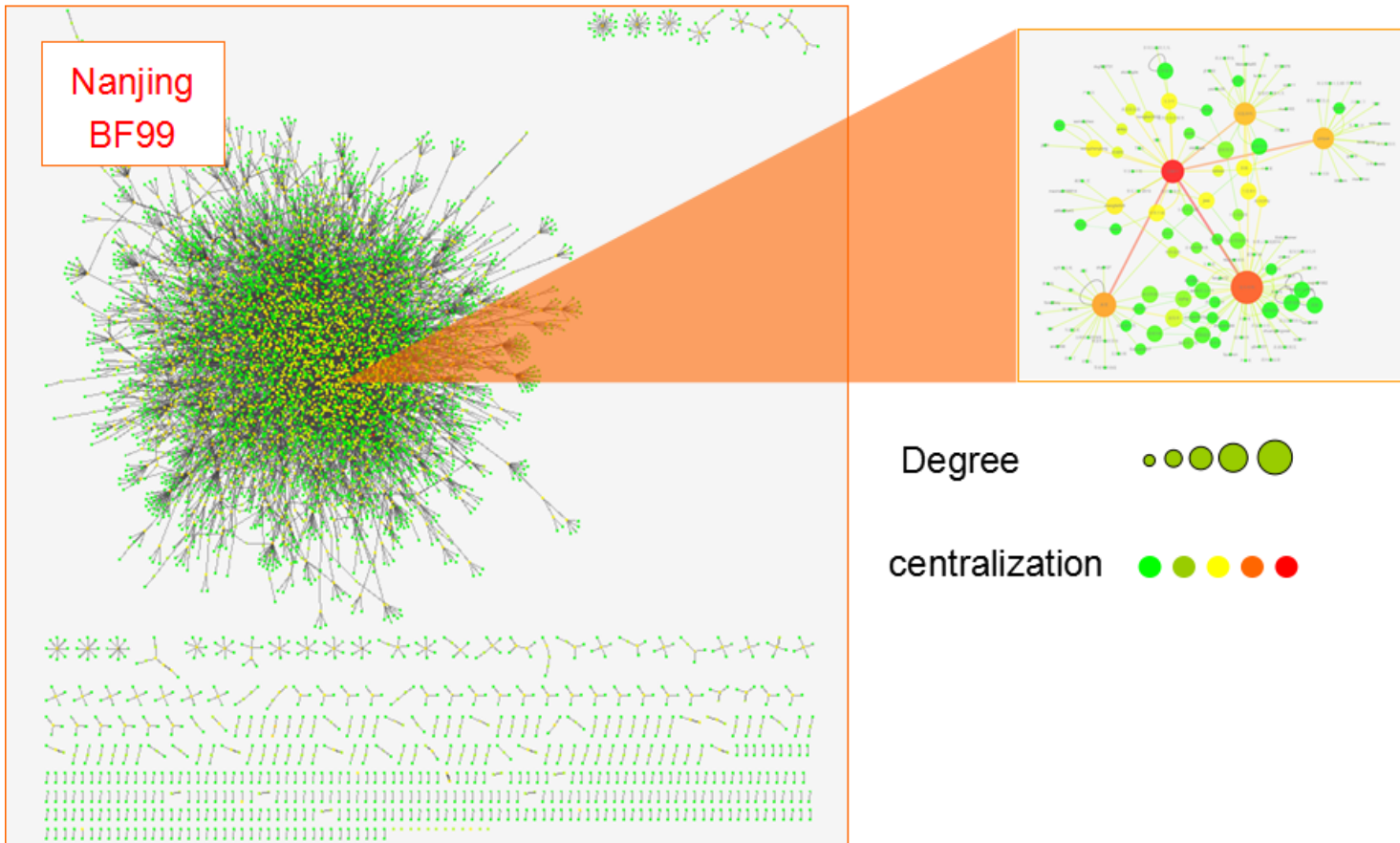
# BF99 network of eight large cities

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# Information network of Nanjing BF99 community

## Network of Nanjing BF99 Community



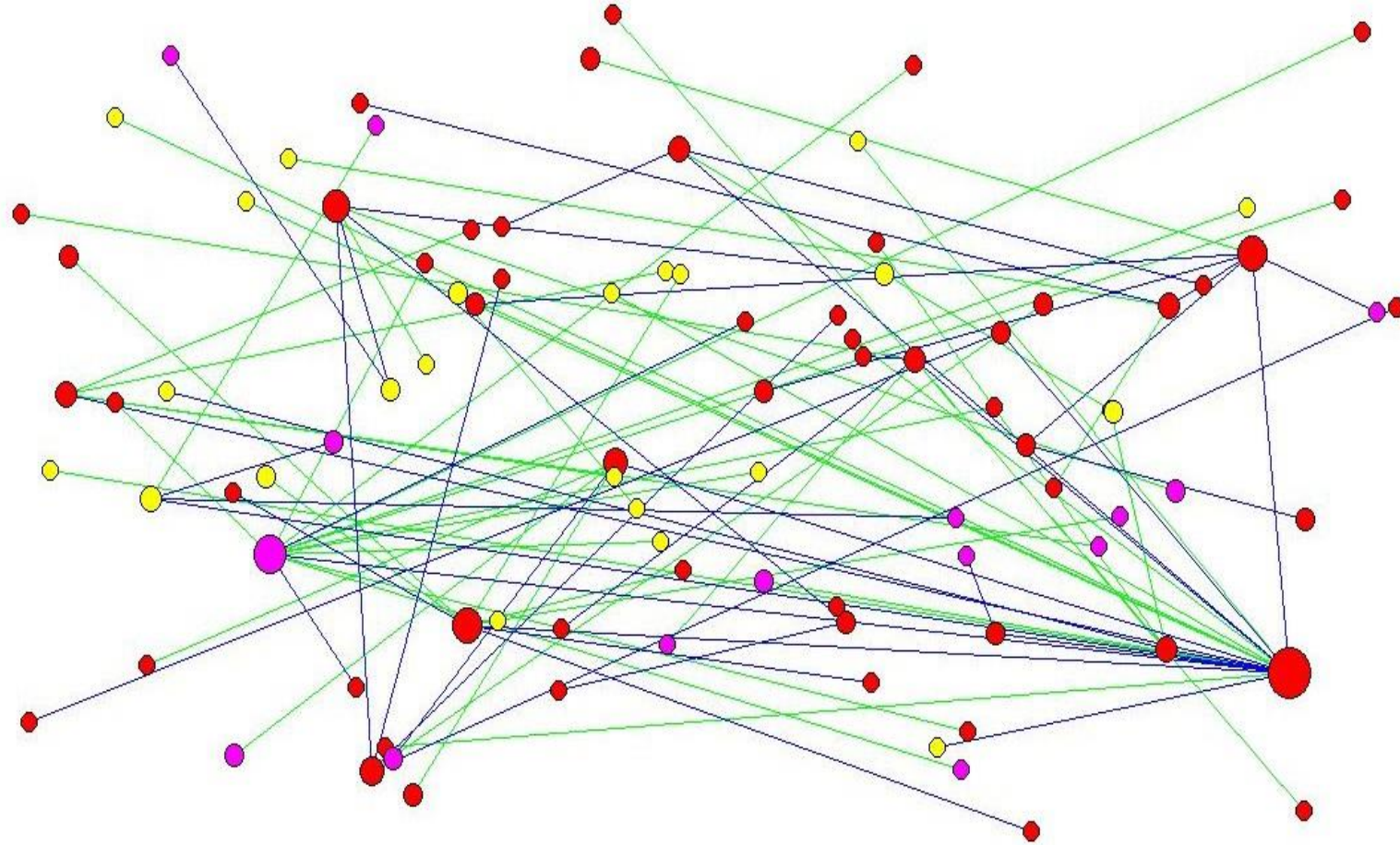
Betweenness centralization:

$$g(v) = \sum_{s \neq v \neq t} \frac{\sigma_{st}(v)}{\sigma_{st}}$$

where  $\sigma_{st}$  is the total number of shortest paths from node  $s$  to node  $t$  and  $\sigma_{st}(v)$  is the number of those paths that pass through  $v$ .



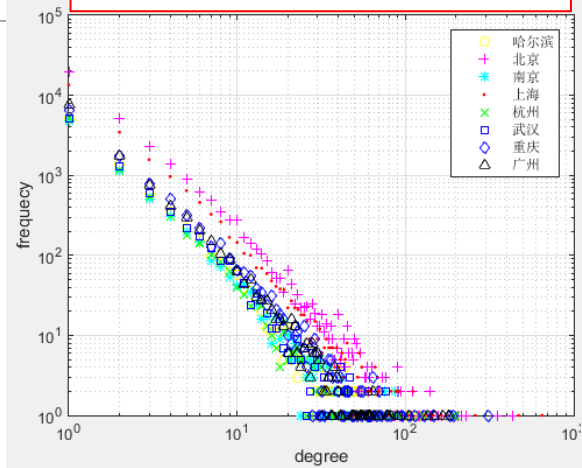
# A 100 sampling group from *BF99*: based on roles (0,1, 1/0)



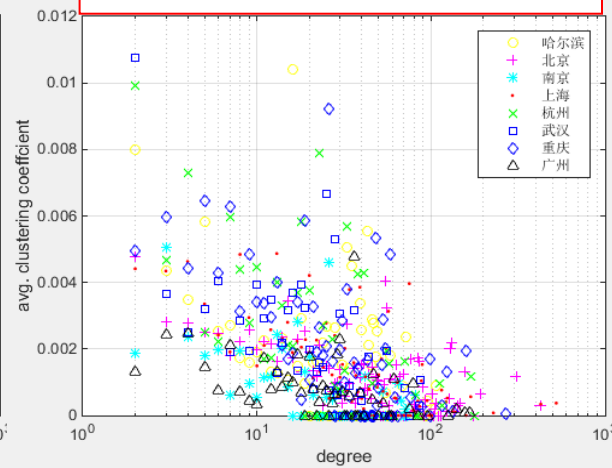


# Statistics analysis of node's complex network parameters

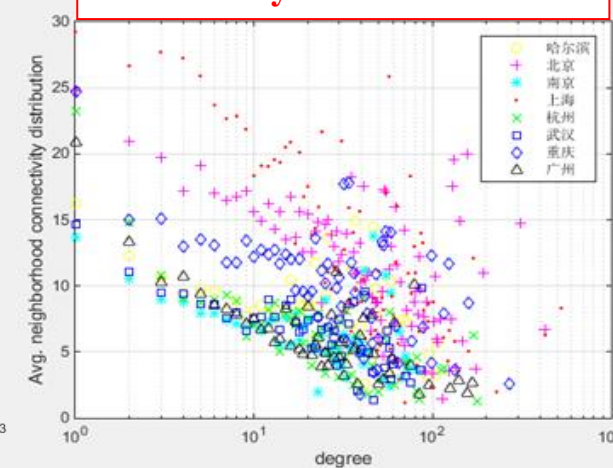
## Degree of Distribution



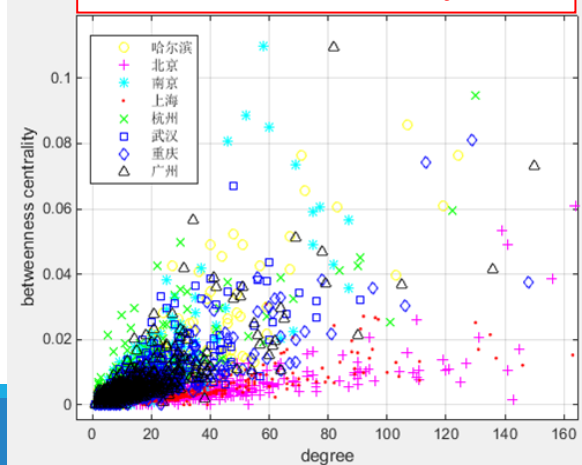
## Average clustering coefficient distribution



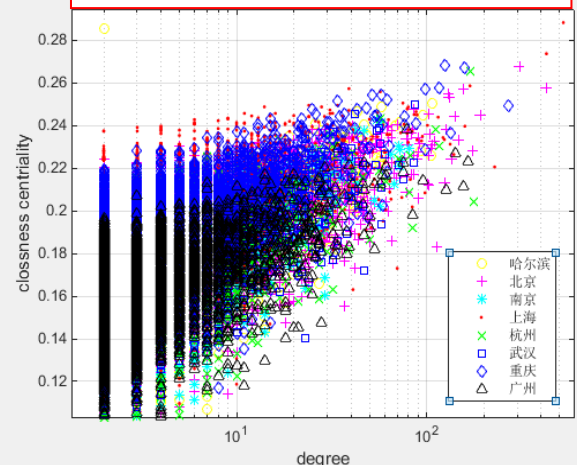
## Average neighborhood connectivity distribution



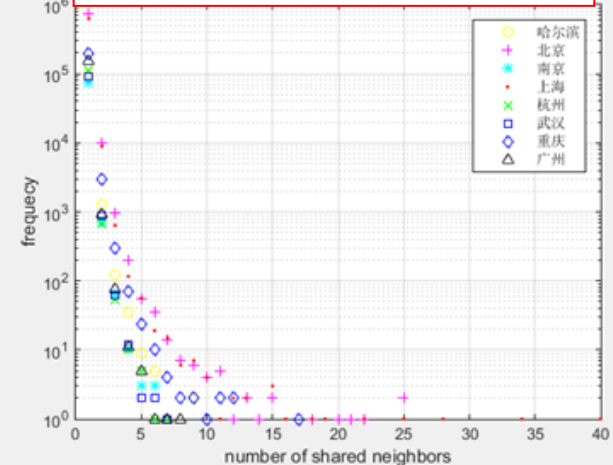
## Betweenness centrality



## Closeness centrality



## Number of shared neighbours



# Observations and questions

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- ★ Internet MSM chatrooms provide a convenient and anonymous venue for contact
- ★ Individuals using internet chatrooms have broader and more contacts than those who do not use the chatrooms
- ★ Individuals using internet chatrooms have much longer distance contacts

## **Big questions:**

- Does increased chatroom contact lead to physical and sexual contacts ?
- Does broader chatroom contact lead to more sexual partners ?
- What are the impacts of increased and broader contact on the disease transmission ?

# Challenges to disease control and intervention

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- ◆ HIV continues to spread, mainly through sexual transmission, regardless of increasing investment and policy implementation of intervention;
- ◆ Traditional STDs have emerged as one of the major public health concerns, both as diseases and as risk factors for HIV; Some of the pathogens are known to have significant overlap in the affected population;
- ◆ Huge mobile population that may facilitate HIV and other STDs spreading;
- ◆ Weakening of traditional social fabrics, increasing diversification of social cultures and open attitudes towards sexuality require new approaches for intervention;
- ◆ Inadequate public health infrastructure and approach to identify, monitor, and intervene;
- ◆ Insufficient healthcare coverage, social welfare, particularly for people at low income sector, to receive medical service.

# Multi-purpose Prevention Technologies (MPT)

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Women worldwide confront two frequently concurrent reproductive health challenges: the need for contraception and for protection from sexually transmitted infections.

While conception and infection share the same anatomical site and mode of transmission, there are no reproductive health technologies that *simultaneously address that reality*.

Relevant available technologies are either contraceptive or anti-infective, are limited in number, and require different modes of administration and management. These “single-indication” technologies do not fully respond to what is a substantial reproductive health need intimately linked to pivotal events in many women’s lives.

## Sexually transmitted infections (STIs) further compound these burdens

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The World Health Organization estimates that 448 million new cases of the curable STIs (trichomoniasis, chlamydia, gonorrhea, and syphilis) occur annually in adults aged 15–49 years.

Cases of the major incurable viral diseases—genital herpes (HSV-2), human papillomavirus (HPV), and HIV-1—account for an even greater burden of both morbidity and mortality. The estimated number of people aging 15–49 years living with HSV-2 worldwide in 2003 was 536 million, with overall prevalence higher in women than in men.

Approx. 500,000 women are diagnosed with cervical cancer, mainly attributable to HPV infection.

There were 2.7m new HIV infections in 2010, and women account for over half.

# Key attributes of MPTs

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MPTs are some of the most innovative health products under development to simultaneously prevent unintended pregnancy and/or sexually transmitted infections including HIV. MPTs enable women to better protect themselves by delivering a broader spectrum of protection at one time.

## MPTs

- Provide protection simultaneously against two or more indications by a single delivery of agent/agent or agent/device
- Are regional specific
- Can be delivered in various forms

The Initiative for Multipurpose Prevention Technologies for Reproductive Health (IMPT) was founded in 2009 as a global coalition of multidisciplinary and multinational stakeholders, scientists, policy-makers, advocates, donors, and product developers

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## **The activities of the Initiative and its colleagues focus in three areas:**

- (1) defining an integrated MPT product pipeline and scientific agenda, as guidance for donors, product developers, regulators, and advocates about MPT scientific priorities and needs;
- (2) exploring the associated regulatory pathways and anticipated needs around delivery of and access to such products;
- (3) designing and implementing a strategy for communication, advocacy, and outreach to raise global awareness around MPTs as a prospective public health product.

# The increase of sexually transmitted infections calls for simultaneous preventive intervention for more effectively containing HIV epidemics in China

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# Thank You

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**Otto Reinhoff**

