

Letter to the Editor

## Introducing a model for communicable diseases surveillance: Cell phone surveillance (CPS)

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**Abstract.** *Background and goal:* Surveillance systems for communicable diseases are primarily passive in most countries, including Iran. Laboratory-based surveillance and use of cell phone surveillance may be a useful method.

*Material and method:* We established a new model for gathering data directly from district laboratories to regional laboratories and from them to national manager of public health laboratories by using cell phone. We assessed the coverage of Mobile and Cell phone in the laboratory Technicians, and Directors of Public Health in 27 universities in Iran by a simple data collection form to evaluate the feasibility of this method. And then this method was piloted for the last Cholera out break in Iran in 2005.

*Result:* From data of 27 universities with 184 cities, we gathered 769 data health directors' mobile, total mobile penetrating rate, SMS users, and SMS penetrating rate was 57.9%, 77.1%, and 44.6% between Directors in Medical Universities of Iran and 54.5%, 54.9% and 29.9% in Directors of Laboratory. In the Cholera epidemic in Iran in summer 2005, CDC of MOH registered near 900 cases of cholera from 70000 rectal soap's exam in whole of country. The median reporting interval was under one day.

*Conclusion:* Although the advent of the cell phone will probably change the way in which surveillance is delivered by health system, further studies are warranted to evaluate this method for laboratory based surveillance of lethal infections.

**Key words:** Communicable Diseases, Cell Phone Surveillance, Iran

### Introduction

Surveillance systems for communicable diseases are primarily passive in most countries, including Iran. Each Health Centers, Hospitals or Clinics report all cases of communicable diseases in one day of month according to a data collection form. Telephone-based health information service is used only for some epidemic diseases such as Cholera, Meningitis, Measles, Poliomyelitis, Tetanus, and etc [11]. The passive reporting system is not efficient and also not exact [22]. Existing reporting systems may identify outbreaks, but the incidence rates are far from accurate for example; 8110 new smear positive pulmonary TB had been registered by using this system in 2002 [33] but WHO estimated DOTS Case Detection rate was 60% in Iran in 2002 [44]. The median reporting interval (the time from the onset of disease to transmission of the case report to the Centers for Disease Control and Prevention) was at least 2 months (range, 1–6 months) [55]. Efforts to improve surveillance of communicable diseases had been started in Iran, one of these efforts is labora-

tory-based reporting and the use of currently available computer telecommunication systems, which had been developed as a pilot study in Isfahan province in 2004 [66].

Information technology is the new aspect in strengthening of surveillance and monitoring of diseases. One of the simplest, available, and mobile method is cell phone and some facility same as Short Message Services (SMS) by this device. Cell Phone Surveillance (CPS) is user-friendly, rapid, cheap and effective. In this paper we introduce this method for countries with limited resources such as Iran according to existing Health network.

### Material and methods

In this study, a new model for communicable disease surveillance is introduced. The data are gathered directly from district laboratories to regional laboratories and from them to national manager of public health laboratories using cell phone as the reporting medium.

**Table 1.** List of communicable diseases which had Surveillance in Iran

Diseases		
Anthrax	Hydatic cyst	Pertousis (Whooping Cough)
Brucellosis	Kalazar	Poliomyelitis
CCHF	Leishmaniosis	Rabies
Cholera	Leprosy	Syphilis
Conjunctivitis	Malaria	SARS
Diphtheria	Measles	TB
German Measles	Meningitis	Tetanus
Gonorrhoea	Nosocomial Infection	Toxoplasmosis
Hepatitis (A, B, C, D, E, Non A Non B)	Paratyphoid fever	Trachoma
HIV/AIDS	Pediculus	Typhoid fever

**Table 2.** List of communicable diseases which had phone surveillance in Iran

Diseases	
Anthrax	Neonatal tetanus
Botulism	Poliomyelitis
Cholera	Rubella
Diphtheria	Typhus
Measles	Yersinia
Meningitis	Yellow fever

**Table 3.** Minimum data collection form for CPS reporting

Data from microbiologists in district levels to director in regional laboratories	Data from director in regional laboratories to national director of public health laboratories
First Name, Last Name, Father Name, Sex, Age, City, Province, Date: dd/mm/yy Diagnosis,	Sex, Age, City, Province, Date: dd/mm/yy Diagnosis,

In this model if microbiologists in district levels find a positive case of communicable diseases which are in the list for CPS (Table 1, 2) they report it to his/her director in regional laboratories by SMS. The minimum data for collecting and reporting are showed in Table 3. The director of the regional laboratory collects all data from districts levels and after analyzing, they send information to director of public health laboratories at the national level. The national levels do the data processing, even in some cases quality control will be done by reference laboratory. After that they disseminate the information to health workers and field epidemiologist and laboratories in

whole of country as a feedback and to public health authorities and policy makers as a feed forward by SMS too. We assessed the coverage of Mobile and



**Figure 1.** The map of Iran and its provinces.

**Table 4.** Mobile and SMS Penetration rate among public health directors and lab technicians directors in health network of Iran (last updated December 2005)

Medical Universities	City	Total personals (Public Health Directors and Lab Technicians Directors)			Lab Technicians Directors		
		N	Mobile N (%)	SMS N (%)	N	Mobile N (%)	SMS N (%)
Ardabil	9	32	20 (62.5)	15 (46.9)	10	3 (30)	1 (100)
Babol	1	10	10 (100)	2 (20.0)	1	1 (100)	0 (0)
Birjand	6	34	12 (35.3)	6 (17.6)	6	3 (50)	0 (0)
Boshehr	9	40	28 (70.0)	21 (52.5)	10	4 (40)	0 (0)
Fars	17	94	47 (50.0)	36 (38.3)	18	7 (38.9)	6 (33.3)
Gilan	15	51	37 (72.5)	19 (37.3)	17	12 (70.6)	4 (23.5)
Golestan	11	42	32 (76.2)	32 (76.2)	12	8 (66.7)	8 (66.7)
Gonabad	1	4	2 (50.0)	0 (0.0)	1	0 (0)	0 (0)
Hamadan	8	27	14 (51.8)	8 (29.6)	9	7 (77.8)	1 (11.1)
Hormozgan	9	31	26 (83.9)	16 (51.6)	10	7 (70)	3 (30)
Ilam	6	21	20 (95.2)	12 (57.1)	5	5 (100)	2 (40)
Isfahan	21	84	56 (66.7)	36 (42.9)	21	11 (52.4)	7 (33.3)
Jahroom	1	7	6 (85.7)	6 (85.7)	1	1 (100)	1 (100)
Kashan	1	4	2 (50.0)	2 (50.0)	1	0 (0)	0 (0)
Kerman	13	39	27(69.2)	27 (69.2)	13	6 (46.2)	6 (46.2)
Kordesstan	9	53	23 (43.4)	13 (24.5)	8	3 (37.5)	1 (12.5)
North Khorasan	6	22	1 (4.5)	0 (0.0)	7	0 (0)	0 (0)
Qom	1	8	3 (37.5)	1 (12.5)	1	0 (0)	0 (0)
Rafsanjan	1	4	4 (100)	4 (100)	1	1 (100)	1 (100)
Sabzevar	1	3	1 (33.3)	1 (33.3)	1	0 (0)	0 (0)
Semnan	4	17	12 (70.6)	9 (52.9)	3	3 (100)	2 (100)
Shahrood	1	5	5 (100)	2 (40.0)	1	1 (100)	0 (0)
Tehran (South)	3	18	16 (88.9)	13 (72.2)	3	3 (100)	2 (66.7)
Tehran (East)	6	22	17 (77.3)	16 (72.7)	7	5 (71.4)	5 (71.4)
Yazd	10	44	31 (70.5)	21 (47.7)	11	7 (63.6)	3 (27.3)
Zahaden	7	28	18 (64.3)	9 (32.1)	1	1 (100)	0 (0)
Zanjan	7	25	16 (64.0)	16 (64.0)	8	3 (37.5)	3 (37.5)
Total	184						
	769		445 (57.9)	343 (44.6)	187	102(54.5)	49 (29.9)

Cell phone in the laboratory Technicians, and Directors of Public Health in 27 universities in Iran by a simple data collection form for mobile and SMS penetrating rates to evaluate the feasibility of this method for laboratory based surveillance.

As a pilot study, we examine the efficacy of CPS for reporting the cases in the last epidemic of Cholera in Iran from July to September 2005. Then we designed the algorithm of CPS. This algorithm is shown in Figure 1.

## Results

Health and medical cares are provided by Health Network in Iran. Managements of this network are done by Medical universities. There are 40 medical universities in Iran. Each university covers some cities. From data of 27 universities with 184 cities, we gathered 769 mobile data of health directors. 184 centers participate in the surveillance. Total mobile penetrating rate, SMS users, and SMS penetrating rate was 57.9%, 77.1 %, and 44.6% between Directors in Medical Universities of Iran and 54.5%,

54.9% and 29.9 % in Directors of Laboratory. Table 4 shows the details of this coverage in the universities (provinces) and in Figure 2 shows the provinces in Iran.

### *Cholera epidemic in Iran, summer 2005*

From the beginning of the Cholera epidemic in Iran from 17 April 2005 to 30 October 2005, CDC of MOH registered 1,240 cases of cholera from over 70,000 rectal soap's exam in whole of country [77]. From first days of this outbreak in Iran, we collected data from laboratories by SMS and compare it by routine ways of reporting system and surveillance:

This way seems to be fast and cheaper than traditional way, as well as having a grate rate of reliability. By using of SMS method we were informed about 1 day up to 10 days sooner (based on region) comparing with routine way. The median reporting interval (the time from the onset of disease to transmission of the case report to the Centers for Disease Control and Prevention) was under one day (range, few hours to one day). Unfortunately we didn't com-

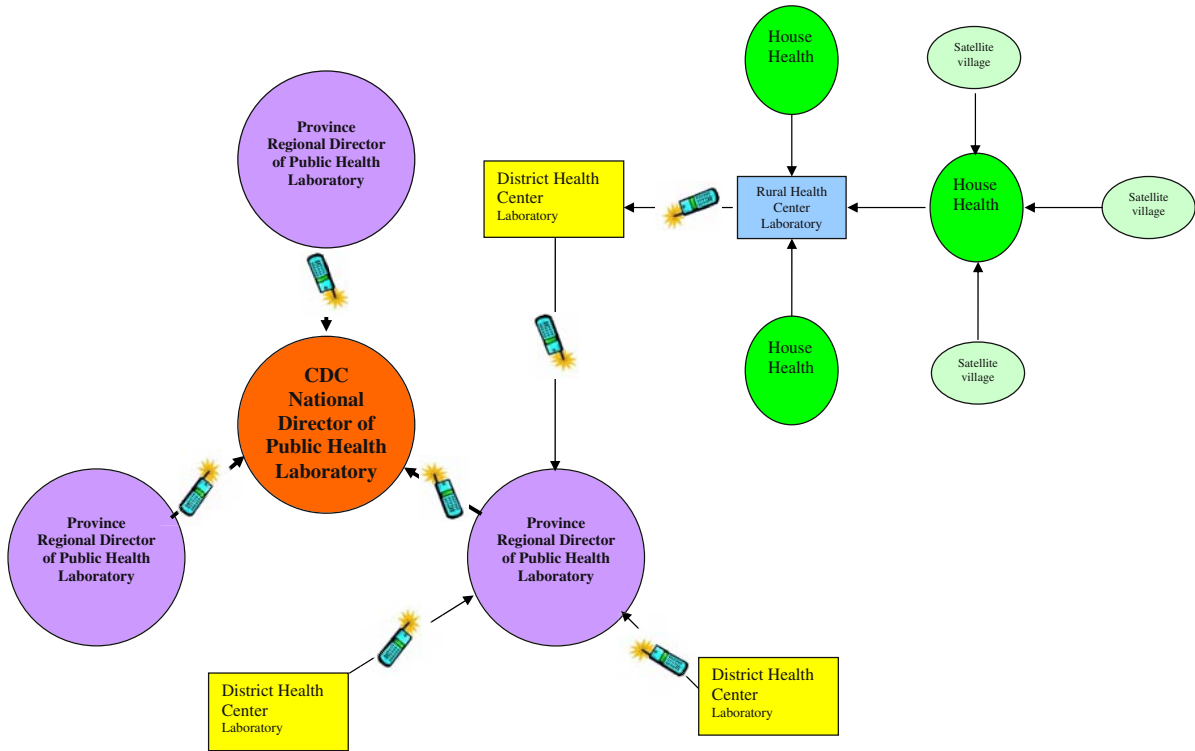


Figure 2. A model of CPS in Iran according to health network.

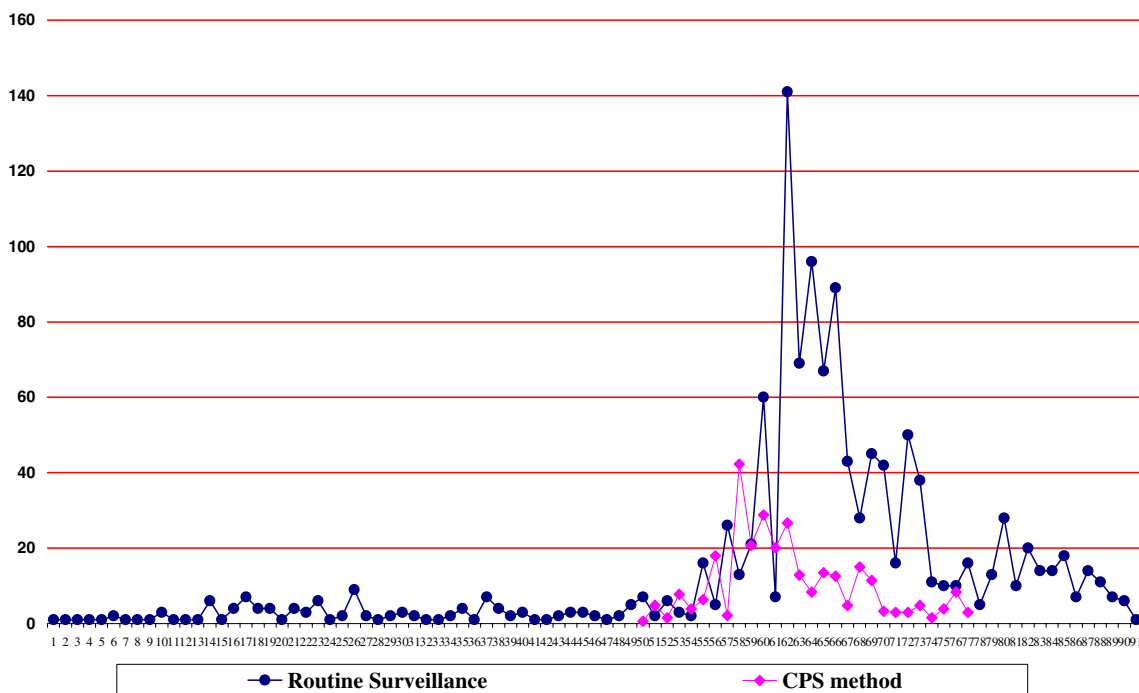


Chart 1. Epidemic curve of Cholera outbreak in Iran, two methods of surveillance is compared.

pare case to case for their reporting time, therefore there are no statistically comparing the mean reporting interval between routine surveillance and SMS method. But some of them were compared such as: One of the private laboratories which are not covered by routine surveillance system reported five cases to us by SMS. A reported case from Kurdistan

province by SMS method was reported after one week by routine surveillance. These methods are compared in Chart 1. The outbreak was defined by CPS method sooner than routine surveillance, because the low penetration rate of SMS between lab technician, the number of cases which reported by CPS were lower than routine method.

## Discussion

SMS penetrating rate among Directors of Laboratory Technicians is very low (29.9%). But according to the Public affair of Iranian Telecommunication's report [88], there are over 7 million users in the end of September 2005 and the mobile penetration rate is 10.5%, International Roaming Telecommunication had been provided between Iran and 43 countries. SMS users are 1.65 millions. According to 4<sup>th</sup> development goal, it will increase up to 36 million mobile until 2009.

There are many reports about the efficacy of telecommunication with mobile for diseases management and controls. The feasibility of remote management of extremity wound by using a mobile camera phone to transfer clinical images and online communication, teleconsultations were carried out on 60 patients between January and August 2003 for 82 extremity wounds presented to the emergency room between residents and consultant plastic surgeons. The preliminary results of this study showed that the camera phone is valuable and bears potential for remote management of the extremity wound [99]. To evaluate the accessibility and use of new communication technologies in a population of patients with type 1 diabetes mellitus. Patients with type 1 diabetes mellitus attending the Diabetes Clinic of the Hospital de Sabadell, Sabadell, Spain, in a 6-month period were asked to answer a structured questionnaire about education level, Internet accessibility, use of health-related Web sites, and mobile-phone ownership and use. They concluded the impact of new communication technologies might be jeopardized by the low rate of access and utilization of the Internet for health-related purposes. Because of their high rate of ownership and use, mobile phones show promise as a tool in health care communication technologies [1010].

Real-time syndrome surveillance was introduced in Ontario, Canada, in 2004. The purpose of this method was integrating a telephone-based health information service and emergency department triage with a first-line real-time, 24-h a day syndrome surveillance system. This automated system could be beneficial in detecting a bioterrorist threat as well as in detecting and monitoring disease outbreaks such as influenza, Norwalk, West Nile virus, Escherichia coli 0157 or severe acute respiratory syndrome [1111].

Another paper introduces Automatic Collision Notification (ACN) as a new invehicle-equipment which detects a severe vehicle crash and alarms via cellular phone the EMS automatically. Simultaneously the exact accident location was transmitted (GPS). Official data of the European Community predict a 15% reduction of road traffic fatalities with ACN [1212].

CPS that is proposed would be a province-wide integrated early warning system for cholera, meningitis,

influenza, Escherichia coli 0157 or severe acute respiratory syndrome. As an international health subject this network can connect to other countries and we can make an international network. When the outbreak is caused in Iran, our neighbors same as Turkey or Iraq can prepare themselves for prevention. Therefore we recommend this model to be substituted the traditional model of surveillance for these communicable diseases.

Use of wireless technology in health has been evaluated mainly as a telemedicine tool before [1313, 1414]. We are not aware of any study exploring the role of SMS as reminders or as strong tools. There is a need to explore the role of present and future mobile-phone technologies in diseases surveillance. However, these technologies may be powerful enough to support the surveillance of some lethal diseases.

Although the advent of the cell phone will probably change the way in which surveillance is delivered by health system, further studies are warranted to evaluate this method for laboratory based surveillance of lethal infections. Because of their high rate of ownership and use, mobile phones show promise as a tool in health system communication technologies. However the rapid proliferation of cell phones, and now we have an opportunity to use these natural disasters to beef up surveillance by using the cell phone network.

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