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Real Life Experience of Emergency Management in the Response to Sars-Cov-2 Emerging Epidemic

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Abstract

The ongoing outbreak of SARS-CoV-2 infection was first identified in Wuhan, China at the late of 2019. Following the acceleration of the novel coronavirus spreading, person-person transmissions in family residences, hospitals and other public environments have led to a major public hazard in China. Currently, the SARS-CoV-2 outbreak has been further developed into a public health emergency of international concern. In response to an occurring pandemic, hospitals need an emergency strategy and plan to manage their space, staff, and other essential resources, therefore, to provide optimum care to patients involved. In addition, infection prevention measures urgently need to be implemented to reduce in-hospital transmission and avoid the occurrence of virus super-spreading. For hospitals without capacity to manage severe patients, a referral network is often needed. We present our successful field experience regarding hospital emergency management and local hospitals network model in response to SARS-CoV-2 emerging epidemic.

Keywords: Emergency plan; hospital management; PPE; COVID-19

Introduction

The epidemic transmission tendency of the SARS-CoV-2 outbreak that started in Wuhan, China, is a rapidly evolving and fast changing situation in the world. This is the first pandemic caused by a novel corona virus [1]. The novel coronavirus SARS-CoV-2, named COVID-19 by the World Health Organization (WHO), is closely related to SARS and MERS [2]. The disease has been rapidly spreading globally and positive cases have been already diagnosed in more than 187 Countries, areas or territories [3,4]. The international spread of the virus has unsurprisingly recalled memories of the 2003 severe acute respiratory syndrome (SARS) outbreak world wide and raised concerns regarding preparedness and management by hospitals in response to

the current SARS-CoV-2 pandemic [5-7].

Hospitals and other healthcare facilities play a critical role in national and local responses to emergencies, as well as the SARS-CoV-2 outbreaks [8]. The influx of SARS-CoV-2 patients not only created a burden for existing medical resources but also increased the chance of in-hospital infection to visitors, patients and medical staff [9-11]. Therefore, emergency management strategy and implementation in the response to SARS-CoV-2 emerging epidemic is imperative.

Based on our first hand experience, it is prudent for a local hospital to follow these general principles to prevent virus infection and spreading: Timely development of an

appropriate emergency plan to response to infection; initiate appropriate protocols and procedures to protect patients and staff from infection; have adequate staff, actions and resources to execute diagnosis, control and treatment of SARS-CoV-2 patients; timely identification and isolation of patients known or suspected to be positive SARS-CoV-2; require the proper use of PPEs (masks, gowns and gloves) by medical staff and close contacts during the management of these patients; protect vital areas in hospital from contamination from SARS-CoV-2 [12,13].

Moreover, the propensity of novel corona viruses to spread in medical centers indicated the needs for networking health care facilities to be on standby to identify potential cases. An active hospital network that is coordinated to transfer and centralize the management of SARS-CoV-2 patients would decrease the exposure of network hospitals to SARS-CoV-2 [14]. These general principles could place hospitals in an advantageous situation to manage with the SARS-CoV-2. However, the differences in medical capacity, resources, conditions and practices from various hospital settings may contribute to either an effective control of virus transmission or a disaster of super-spreading of the virus intra-hospital and make it a virus hub [14,15]. So far, few reports have described detailed hospital emergency plans and managements in response to the SARS-CoV-2 outbreak. In this study, we present our real life experiences in a general hospital located in the central plains of China in response to the SARS-CoV-2 pandemic.

Methods

The study model is Shangqiu First People’s Hospital located in Shangqiu city in the East of Henan Province, a most populous province in the central plains of China. The city governs 2 districts, 1 technology developing zone, 1 County-level city and 6 counties with a general population of 9.3 million. Shangqiu First People’s Hospital is the biggest medical center in the city and suburb area. The hospital has 2043 beds with an annual outpatient visit of 1.8 million (2019 data). The outpatient clinic has been always crowded with a high tendency of cross contamination given more than 5000 patients come daily to seek medical consultation and treatment on average in limited outpatient clinic space. Shangqiu First People’s Hospital has immediately initiated an emergency plan when person to person transmission of SARS-CoV-2 was officially identified in China on Jan 20, 2020 [16]. 5 core teams were initiated, which includes coordinating team, medical expert team, infection control and report team, logistic team and food service team.

The hospital is segregated into three zones: clean zone, potentially contaminated zone and contaminated zone in

the clinic and inpatient ward respectively. The contaminated zone in clinic contains exam rooms, offices, pharmacy, lab, radiology suites, bathroom, waste room and observation room (single person dorm with attached restroom). Certain floors in the inpatient ward were dedicated to admission of potential positive patients. Separated Observation wards and isolation wards were re-furnished for the management of those suspected and confirmed SARS-CoV-2 patients. Three pathway channels were established to maintain the setup of the three zones, which include medical staff channel, patient channel and bio-waste channel. Medical staff enter from the clean zone, change clothes and wear PPEs according to the detailed instructions (Table 1) ; go to the potentially polluted zone where they clean hands, wear caps and masks, put on isolation suits and change into special shoes; after that they enter the contaminated zone (Figures 1-3). Patients enter from a separate patient channel to the contaminated zone. Medical wastes were

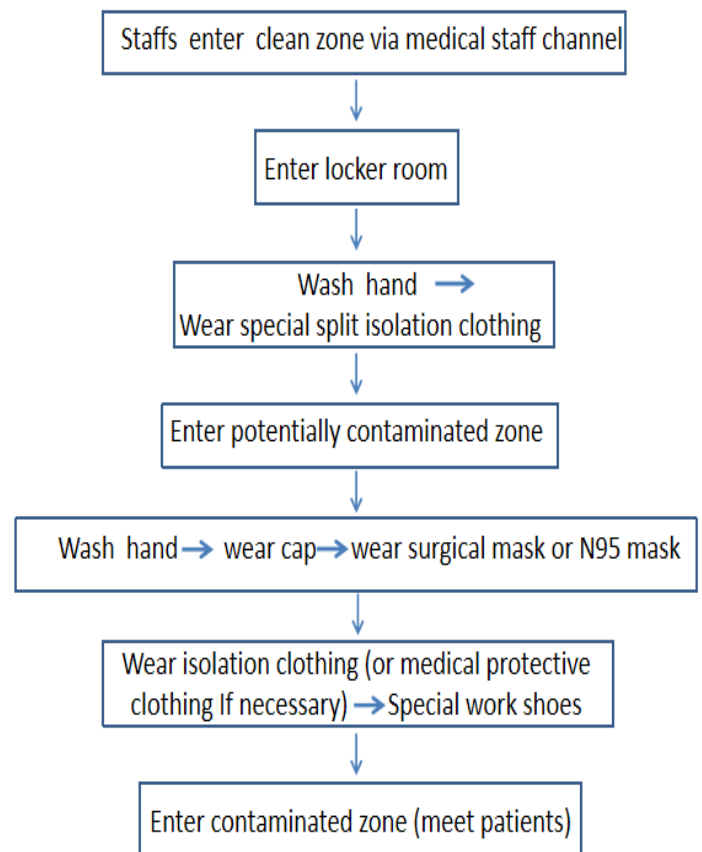


Figure 1: Procedure for fever clinic staff to proper wear PPE.

collected from the bio-waste channel. Thus, each zone is maintained effectively.

Any patient who was suspected to have symptomatic or asymptomatic presentation of SARS-CoV-2 was screened in 2 hours. These patients are dedicated to a consolidated/

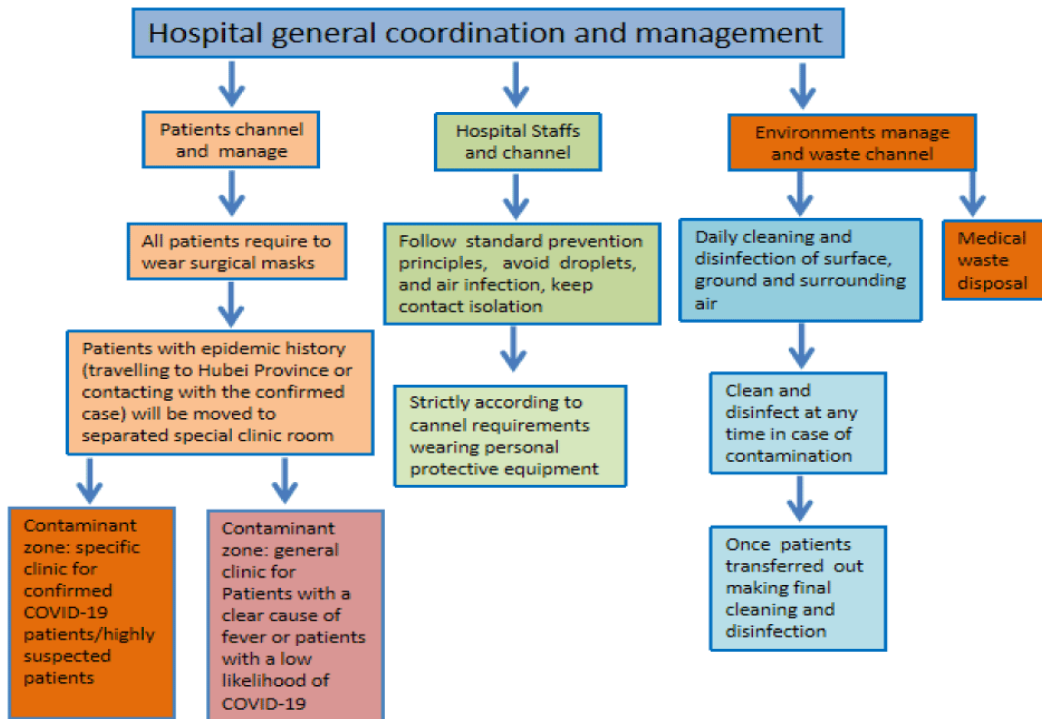


Figure 2: Fever clinic SARS-CoV-2 infection prevention and control process.

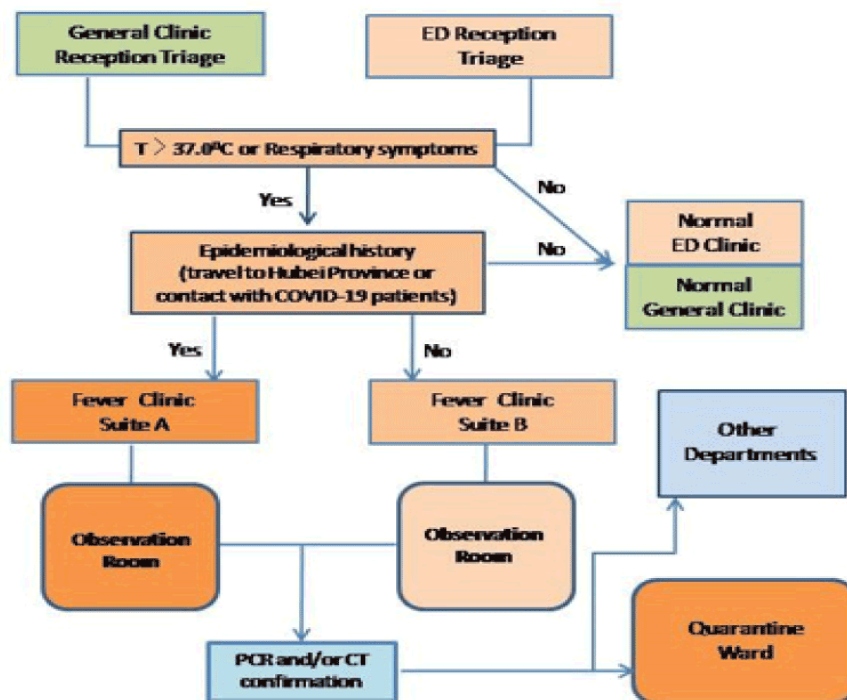


Figure 3: Fever clinic general layout model and processing road map.

Table 1: Checklist for PPE to staffs of Shangqiu First People's Hospital for protection from SARS-CoV-2 infection during the pandemic outbreak.

- Should choose;
- o Select based on exposure risk;
- Δ: Long sleeve thick rubber gloves.

#For operations with higher exposure risks, power-supply filter respirators can be used when conditions permit.

Jobs	Hand washing	Working cap	Surgical Mask	N95 Mask	Working clothes	Medical protective clothing	Medical gloves	Isolation suit	Protective screen/ medical goggle	Shoe/ boot cover
General departments	●	○	●		●					
Surgical departments	●	●	●	○	●		●	○	○	○
Pretest triage	●	●	●		●		●	●		
fever clinics	●	●	●	○	●		●	●	○	○
Possible splattered operation	●	●			●	○	●	●	●	○
Deal with Suspected/ confirmed patients	●	●			●	●	Double	○	●	●
Suspected/ confirmed patients transfer/escort	●	●			●	●		○	●	●
Suspected/ confirmed patient specimen collection	●	●			●	●	Double	○	●	○
Laboratory routine tests	●	●	●	●	●		●			
Laboratory suspected specimen tests	●	●			●	○	●	●		
Laboratory virus RNA tests	●	●			●	●	Double	○	●	○
Environmental cleaning and disinfection	●	●			●	●	Δ	○	●	○
Specimen transport	●	●	●		●					
Dead body transport	●	●			●	●	Δ	○	●	●

contaminated zone in the hospital. Staff in contact with patients were instructed to have full body isolation suits, N95 face masks and eye shields. PCR positive patients are transferred to the dedicated City hospital immediately upon diagnosis. Shangqiu First People's Hospital provides physicians and staff for medical service for the positive patients off campus in the dedicated City hospital to ensure continuation of care yet minimize the exposure of the Hospital campus to SARS-CoV-2 patients.

Social distancing in outpatient clinics is strictly applied. Outpatients at the clinic are screened with checking temperatures and history collection first, patients are directed to the general clinic if they are asymptomatic and have no history of contact. Febrile patients were issued face masks to wear on the spot with detailed instructions and H&P for SARS-CoV-2 were collected for them. High risk patients are mitigated to febrile clinic, if SARS-CoV-2 is ruled out then the patient is returned to ER or other clinics, suspects are either observed in the contaminated zone in febrile clinic or hospitalized to a special contaminated zone.

Results

We still maintained a total of 137964 outpatient clinic visits in January and 55406 visits in February. The monthly average outpatient clinic visits is 136875 from 2017-2019. We notice a decline in visits in Jan 25 to Feb 23 (Figure 4), which is possibly due to the temporary suspension of our health checkup department, as well as patient awareness to stay away from a cluster environment in hospital for minor medical issues. Our febrile clinic had 832 visits from 1/23-

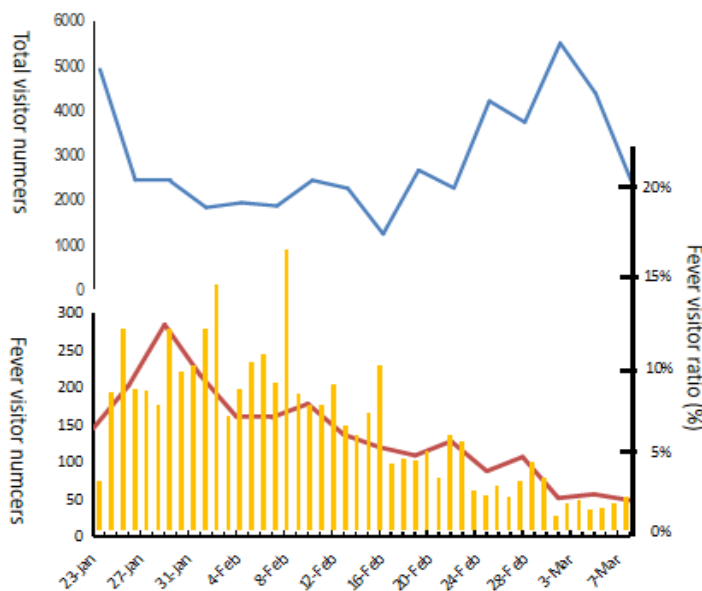


Figure 4: The daily number of total visitors (blue curve), fever visitors (brown curve) and the ratio of fever patients (yellow bar) in the hospital from January 23 to March 8, 2020.

1/31, 19 patients are suspected, 7 samples were collected. Out of the 1920 visits in Feb, 49 patients are suspected, 37 patients are observed or admitted, 330 samples were collected, 292 submitted for analysis.

A total of 7 patients are confirmed with SARS-CoV-2 infection between Jan and Feb, 2020 in our hospital (Tables 2). The Median age of the patients is 49 years old (Range 27-73) and the ratio of Male: Female is 2.5:1. All the patients had fever with an average highest body temperature of 38.2 ± 0.374 °C, and had a ground-glass image which was found in most COVID-19 patients. 5 patients displayed a mild clinical course, 2 patients experienced severe illness conditions and 1 patient (PP) developed respiratory failure with support of ventilator during the acute phase of respiratory failure. However, all 7 patients were cured finally. These 7 patients are all physically transferred to the designated hospital within 24 hours of diagnosis by PCR. SARS-CoV-2 Positive rate was 0.25% among all febrile clinic visits.

Table 2

patient	age	Gender	epidemiological history Travel to Hubei or contact to patient	maximal Temperature	CT with characteristics of COVID-19 pneumonia	disease condition	outcome
QSX	27	Male	no	38.6°C	yes	mild	cured
LMY	73	Male	no	38.3°C	yes	mild	cured
LHW	49	Male	no	38.0°C	yes	severe	cured
CYL	51	Female	no	38.1°C	yes	mild	cured
ZY	47	Female	no	38.1°C	yes	mild	cured
PP	42	Male	no	39.0°C	yes	severe	cured
JBX	62	Male	yes	38.0°C	yes	mild	cured

No infection in the hospital was observed among staff or outpatient clinics during Jan to Feb. Till Feb. 29, the final patient had been discharged and no new COVID-19 case back to hospital in the shangqiu City area. Currently, outpatients volumes return back to routine level (Figure 5). However hospital managements still maintain strict controls, such as checking body temperature, keeping social distance between the visitors and wearing masks to prevent potential secondary infection of the SARS-CoV-2 virus.

Discussion

Our hospital adopted special strategic plans and protocols for handling COVID-19 patients. We have established dedicated teams, segregating hospital space into clean, potentially contaminated and contaminated zones. We also used three pathway channels to maintain the segregation of zones. Patients are screened at febrile clinic



Figure 5: Out-patients waiting for a medical consultant with a distance from person to person and wearing a mask. The gray buildings in front are the original hospital: St. Paul's Hospital established in 1912 by the Canada episcopal church.

and subsequently dispatched into corresponding zones for either discharge, observation or admission. Once suspected patients are admitted, they are tested for SARS-CoV-2 with PCR methods promptly. Positive patients are removed from our hospital to a designated hospital. Meanwhile we protect high-risk staff with PPEs with special protocol. It is noticed that we employed similar strategies like active case-finding which has been suggested to contain spread effectively [17].

These plans and protocols have resulted in a “zero infection” rate in our hospital while maintaining relatively normal operations with over 5,000 clinic visits again on March 3.

This gives a potential model for medical service in an epidemic area, the key principles are:

1. Not to mix care of COVID-19 patients with normal hospital operation.
2. Use the designated area/hospital for COVID-19 patient care.
3. Minimize exposure of SARS-CoV-2 positive patients to other patients and staff.
4. Use early screening methods to identify positives and start segregation early.
5. Proper use of PPEs for medical staff and social distancing to susceptible populations.

These key principles are essential to minimize spreading in the hospital and protect medical staff and patients from infection of the virus. However, failing to follow or neglect the essential rules may result in a severe disaster in a hospital [18,19]. According to a study report from China CDC

released by the China News Agency: Until February 11th, 3019 medical staff have been infected with the SARS-CoV-2 from 422 medical facilities [20]. In addition, there were 54 medical staff infected with SARS-CoV-2 in a single medical center in Wuhan, China, reported in a retrospective study [10]. Therefore, a carefully planned and strictly enforced hospital emergency plan and management would be critically important for the protection of the hospital staff and patients as well from the current SARS-CoV-2 pandemic.

Our practice and outcome is similar to a case in Italy, Vo Euganeo, a village in northern Italy which was home to the country's first death from COVID-19, on Feb. 21, 2020 [21]. Following this death, all 3,300 residents were tested for SARS-CoV-2 and all positives were quarantined. 3% residents were positive upon the initial test. Yet after two weeks of a strict lockdown and quarantine of cases, only 0.25% of residents were infected upon 2nd screening. The outcome and strategy are similar in this village model and our experience: Early screening and identification the positives; use quarantine methods on the positives and minimize the exposure to positives from the susceptible populations. In conclusion, the emergency plan from Shangqiu First People's Hospital worked in a successful manner to protect patients and staff from infection yet maintaining outpatient operation. The principles that we have followed can be applied to other medical facilities according to their practical needs and conditions.

Conflict of Interest Disclosure

The authors declare no conflict of interest.

Acknowledgement

*Xiaohui Yu and *Chuanen Han contributed equally to this work.

References

1. World Health Organization (2020) Director-General's opening remarks at the media briefing on COVID-19.
2. Vincent J Munster, Marion Koopmans, Neeltje van Doremalen, Debby van Riel, Emmie de Wit (2020) A Novel Coronavirus Emerging in China - Key Questions for Impact Assessment. *N Engl J Med* 382(8): 692-694.
3. World Health Organization (2020) Coronavirus disease (COVID-19) outbreak situation report.
4. Bedford J, Enria D, Giesecke J, Heymann DL, Ihekweazu C, et al. (2020) WHO Strategic and Technical Advisory Group for Infectious Hazards. COVID-19: towards controlling of a pandemic. *Lancet* S0140-6736(20): 30673-30675.
5. Yu IT, Li Y, Wong TW, Tam W, Chan AT, et al. (2004) Evidence of airborne transmission of the severe acute respiratory syndrome virus. *N Engl J Med* 350(17): 1731-1739.
6. Liang W, Zhu Z, Guo J, Liu Z, Zhou W, et al. (2004) Beijing Joint SARS Expert Group. Severe acute respiratory syndrome, Beijing, 2003. *Emerg Infect Dis* 10(1): 25-31.
7. Svoboda T, Henry B, Shulman L, Kennedy E, Rea E, et al. (2004) Public health measures to control the spread of the severe acute respiratory syndrome during the outbreak in Toronto. *N Engl J Med* 350(23): 2352-2361.
8. World Health Organization (2014) Infection prevention and control of epidemic-and pandemic prone acute respiratory infections in health care - WHO guidelines.
9. Xiang YT, Jin Y, Wang Y, Zhang Q, Zhang L, et al. (2020) Tribute to health workers in China: A group of respectable population during the outbreak of the COVID-19. *Int J Biol Sci* 16(10): 1739-1740.
10. Chu J, Yang N, Wei Y, Yue H, Zhang F, et al. (2020) Clinical Characteristics of 54 medical staff with COVID-19: A retrospective study in a single center in Wuhan, China. *J Med Virol* 92(7):807-813.
11. Sommer P, Lukovic E, Fagley E, Long D, Sobol J (2020) Initial Clinical Impressions of the Critical Care of COVID-19 Patients in Seattle, New York City, and Chicago. *Anesth Analg* 131(1): 55-60.
12. Gagliano A, Villani PG, Cò FM, Paglia S, Bisagni PAG, et al. (2020) 2019-ncov's epidemic in middle province of northern Italy: impact, logistic & strategy in the first line hospital. *Disaster Med Public Health Prep* 24: 1-15.
13. Cheung JC, Ho LT, Cheng JV, Cham EYK, Lam KN (2020) Staff safety during emergency airway management for COVID-19 in Hong Kong. *Lancet Respir Med* 8(4): e19.
14. Willan J, King AJ, Jeffery K, Bienz N (2020) Challenges for NHS hospitals during covid-19 epidemic. *BMJ* 20: 368.
15. Pan X, Ojcius DM, Gao T, Li Z, Pan C et al (2020) Lessons learned from the 2019-nCoV epidemic on prevention of future infectious diseases. *Microbes Infect* 22(2): 86-91.
16. Williams S (2020) Person-to-Person Spread of Novel Coronavirus Confirmed in China. *The Scientist*.
17. Pung R, Chiew CJ, Young BE, Chin S, Chen MI, et al. (2020) Investigation of three clusters of COVID-19 in Singapore: Implications for surveillance and response measures. *Lancet* 395(10229): 1039-1046.
18. Cabrini L, Landoni G, Zangrillo A (2020) Minimise nosocomial spread of 2019-nCoV when treating acute respiratory failure. *Lancet* 395(10225): 685.
19. Gan WH, Lim JW, KOH D (2020) Preventing intra-hospital infection and transmission of COVID-19 in healthcare workers. *Saf Health Work* 11(2): 241-243.
20. Report from China News Agency, Beijing, February 17
21. S. Coronavirus. In Veneto il primo studio al mondo con confronto tra due campionamenti sulla stessa popolazione, all'inizio e alla fine della quarantena. Presentato oggi da universita' di Padova E regione. Nuovi Tamponi Da Domattina A Vo' Euganeo.

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