

# Tracking Hospital Visitors/Chaperones during the COVID-19 Pandemic

Suh-Meei Hsu<sup>1,2</sup> Tsung-Kuei Cheng<sup>3</sup> Po-Jen Chang<sup>3</sup> Teng-Yu Chen<sup>3</sup> Ming-Huei Lu<sup>4,5</sup> Hui-Tzu Yeh<sup>1</sup>

<sup>1</sup>Department of Nursing, MacKay Memorial Hospital, Taipei, Taiwan

<sup>2</sup>School of Nursing, National Taipei University of Nursing and Health Sciences, Taipei, Taiwan

<sup>3</sup>Department of Information, Mackay Memorial Hospital, Taipei, Taiwan

<sup>4</sup>Department of Nursing, MacKay Children's Hospital, Taipei, Taiwan

<sup>5</sup>Department of Nursing, Mackay Medical College, New Taipei City, Taiwan

**Address for correspondence** Hui-Tzu Yeh, MSN, Department of Nursing, MacKay Memorial Hospital, Taipei 104014, Taiwan (e-mail: smhsu01mmh@gmail.com).

Appl Clin Inform 2021;12:266–273.

## Abstract

**Objective** The coronavirus disease (COVID-19) is an emerging infectious disease with strong infectious power and fatality rate. To protect national health, government agencies have regulations on hospital chaperoning and visiting. This article presents the development and implementation of a monitoring system for hospital visiting and chaperoning during the COVID-19 pandemic. The study aimed to create a hospital visiting and chaperoning monitor system that uses nation-wide data sources to more accurately screen hospital visitors and chaperones, assist contract tracing, and prevent transmission of severe acute respiratory syndrome coronavirus 2.

## Keywords

- ▶ COVID-19
- ▶ epidemic investigation
- ▶ visiting
- ▶ chaperoning
- ▶ hospital
- ▶ hospital information systems
- ▶ public health
- ▶ monitoring and surveillance

**Methods** This project was implemented in 57 ward units of an academic medical center. The system was connected to the National Health Insurance (NHI) system and Hospital Information System (HIS), and built on the data of everyone who accessed either the hospital or ward using an NHI smart card or national identification card. To shorten the time for manual identification, we also developed a new system of “app for appointment visits and chaperones” to make appointments online.

**Results** After the implementation of the system, data from visitors and chaperones in the nursing information system could be accessed. Given that all data were registered in the HIS visiting/chaperoning monitor system, an epidemic investigation could be performed whenever there was a confirmed case.

**Conclusion** Through the establishment of this system, people entering the ward can be accurately controlled, and all the contacts of potential cases can be traced.

received  
November 30, 2020  
accepted after revision  
February 10, 2021

© 2021. Thieme. All rights reserved.  
Georg Thieme Verlag KG,  
Rüdigerstraße 14,  
70469 Stuttgart, Germany

DOI <https://doi.org/10.1055/s-0041-1726348>.  
ISSN 1869-0327.

## Background and Significance

The novel infectious disease named by the World Health Organization (WHO) as coronavirus disease 2019 (COVID-19) is caused by a novel  $\beta$  coronavirus called severe acute respiratory syndrome (SARS) coronavirus,<sup>1,2</sup> which first appeared in Wuhan, China in December 2019. On March 11, 2020, WHO officially declared the COVID-19 a pandemic.<sup>3</sup> As of January 4, 2021, over 85 million laboratory-confirmed cases, including 1,847,030 deaths, were reported from more than 191 countries, territories, or areas.<sup>4</sup> As our country is located near China, it also faced various challenges from COVID-19. However, our country had fewer cases as of March 2020 than the other countries near China, such as Korea and Japan. The SARS epidemic in 2003 might be one of the possible reasons for our country's relatively low number of cases as the outbreak was an important lesson for our country.<sup>5</sup> Our country's Centers for Disease Control (CDC) took extensive precautions to control the outbreak.<sup>6</sup> One of the many precautionary efforts was a change of visiting policies at almost all levels of health care facilities. The CDC recommended that hospitals limit the duration per visiting slot to a maximum of 1 hour, with only two visitors per patient at a one-time period, and to avoid unnecessary inpatient visits.<sup>7</sup> Other countries implemented similar stipulations during the COVID-19 pandemic.<sup>8</sup> After the COVID-19 pandemic, medical institutions promptly initiated various epidemic preventive measures for implementing patient admission and treatment, managing chaperones and visitors, and the correct use of personal protective equipment.<sup>9,10</sup> Most hospitals also conducted other common infection control measures for visitors and chaperones, such as travel, occupation, contact, and clustering (TOCC) history taking, body temperature monitoring, hand sanitizing, and identity checks.<sup>10-12</sup>

Visiting and chaperoning patients is one of the most frequent needs of relatives caring for a hospitalized loved one. Several studies have indicated a significant relationship between the level of satisfaction with social support from relatives with a patient suffering from a life-limiting disease and the degree of life meaningfulness in a patient.<sup>13,14</sup> Studies have highlighted that visits can also lower the anxiety levels in patients and their families and foster communication among them.<sup>15</sup> Although visiting and caregiving by family members is a culturally active standard in our country's health care system, active family care increases the risks of disease transmission through frequent contacts with patients and hand-touch areas.<sup>16-18</sup>

Hospitals established the Health Information System (HIS) to rally resources from organizations in response to this unprecedented event. Through a shared sense of purpose and nimble response to clinical and operational requests, the information technology services team played an integral role in responding to this public health emergency.<sup>19</sup>

## Objectives

The study objectives were to develop a Hospital Visiting/Chaperoning Monitor System and to implement the system

during the COVID-19 pandemic. The newly developed Hospital Visiting/Chaperoning Monitor System allowed medical staff to access the information instantly on the overseas travel history of patients, visitors, and chaperones. As the system was connected to a centralized countrywide system, conducting epidemic investigations, following the infection path, identifying and isolating all contacts, and blocking virus spread could be easily performed.

## Methods

This project involved 2,099 beds (main hospital: 1,078 and branch hospital: 1,021) in 57 ward units of the academic medical center. The Hospital Visiting/Chaperoning Monitor System was connected to the Virtual Private Network (VPN) of the National Health Insurance (NHI) system and the HIS. The developed monitoring system consists of the Microsoft Visual Studio as the main development tool. This tool has an excellent performance, optimized memory usage, and high-security ORACLE 9i to build a safe and fast information system for database system development (—Fig. 1).

The system was built and started on March 20, 2020 so that when people enter the hospital or ward to visit or chaperone patients, their basic information will be read by using their NHI smart card or National identification (ID) card. Then, by logging in to the VPN database to obtain NHI cloud TOCC data (such as travel history, travel location, and so on), the information can be registered in the HIS Visiting/Chaperoning Monitor System.

The government established the NHI system in our country to provide comprehensive medical services for all our country's residents.<sup>20</sup> To address the threat from COVID-19, as of January 13, 2020, our country's health authorities combined each citizen's travel history into the NHI database. This allows the health care personnel to access each user's travel history (other countries globally) for the past 14 days by entering their NHI smart card numbers or inserting their ID cards. Health care staff can obtain comprehensive medical information and services by inserting their NHI smart cards into the HIS. Based on our experience, this newly developed Hospital Visiting/Chaperoning Monitor System utilizes an interdepartmental teamwork model for combining the processes of nursing, infection control, and information technology, and it is connected to the NHI and HIS.

Our hospital, an academic medical center, has a main hospital and a branch hospital. During the COVID-19 pandemic, we set up common rules and processes for visitors and chaperones during the COVID-19 pandemic. When patients or people accessed the hospital, they were asked to insert their NHI smart cards into the system to obtain information of their travel history by VPN of NIH, profession, contact history, and cluster information (TOCC history), they were asked to perform correct hand disinfection with ethyl alcohol, and their body temperature was obtained by using infrared thermometers. If an individual had a high temperature ( $>38^{\circ}\text{C}$ ), he/she was transferred to a fever screening station for further diagnosis, treatment, and decision-

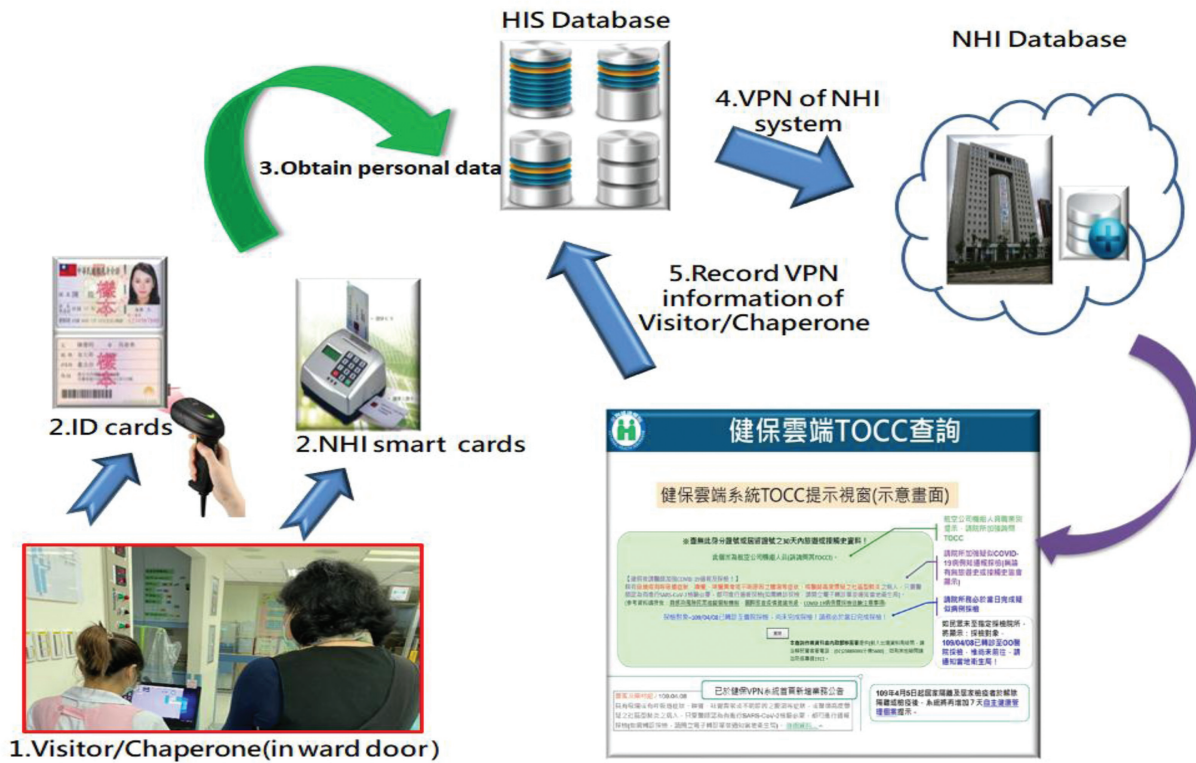


Fig. 1 The monitoring system scheme.

making on where to admit them (individual ward or general ward). Finally, we used the Hospital Visiting/Chaperoning Monitor System to identify hospital check-ins for visitors and chaperones, including whether this check-in was completed with ID cards or NHI smart cards. When the individuals were identified as normal by the system, they could access the ward (→ Fig. 2).

If the individuals requesting access to the hospital still need to enter the hospital wards, they must visit the wards during opening hours. Our country's CDC also suggested time restrictions on hospital visits. Our hospital visiting and chaperoning policies followed the CDC guidelines.<sup>21</sup> Visits were prohibited when the epidemic was at its peak. Thereafter, from the previous once-a-day visits, the visiting time has now become twice a day, and the number of visitors allowed is restricted to two at a time.

In the Hospital Visiting/Chaperoning Monitor System, personal data are obtained from the HIS. First, the system will automatically pull up the ward being checked, and the hospital staff just will choose the bed number. Then, the staff will choose whether the individual is visiting or chaperoning. Chaperones include family members, caregivers, or foreign helpers. Subsequently, the health care staff will check the travel history records by the VPN of the NIH. If the system is able to read the VPN information, it would automatically pull up results on the system, and performing another survey is not necessary. Finally, if the result in the monitoring system is normal (the system displays the “O” symbol), the individual will be able to access the ward to visit or chaperone a patient. Otherwise, if an individual traveled to any country in the last 14 days and has a positive contact history, the system

will display the “×” symbol, and he/she should not be allowed to visit or chaperone a patient and will be denied access to the ward (→ Fig. 3). If the visitor had already been logged into the system, the previous information will show automatically during the next visit. The system is able to determine whether the number of visitors meets the hospital policies, whether the VPN travel history complies with the regulations, and whether the relationship between the patient and visitor is correct before an individual enters the ward. Additionally, if some individuals have not brought their NHI smart cards or ID card, the staff could key in their resident ID card numbers or passport number of non-Taiwanese persons to reveal their travel histories. We also considered that since all data are stored in the database during the COVID-19 outbreak, we can easily retrieve data to carry out contact tracing and to monitor exposed patients, which are key control measures.

It is worth mentioning that, to shorten the time for manual identification, the medical and technology services team of this hospital developed a new system of “app for appointment visits and chaperones,” which was launched in December 2020. The new system allows visitors or chaperones to make appointments online, and only those who visit enter the patient information; visitor or chaperone’s information; risk assessment form and symptom, travel, occupation, contact, cluster (STOCC) survey form; and health statement directly into the online appointment system or “app for appointment visits and chaperones.” Symptom refers to the survey for fever of unknown cause, respiratory symptoms, unknown diarrhea, and loss of smell and taste. The system will also be connected to the VPN of the NHI

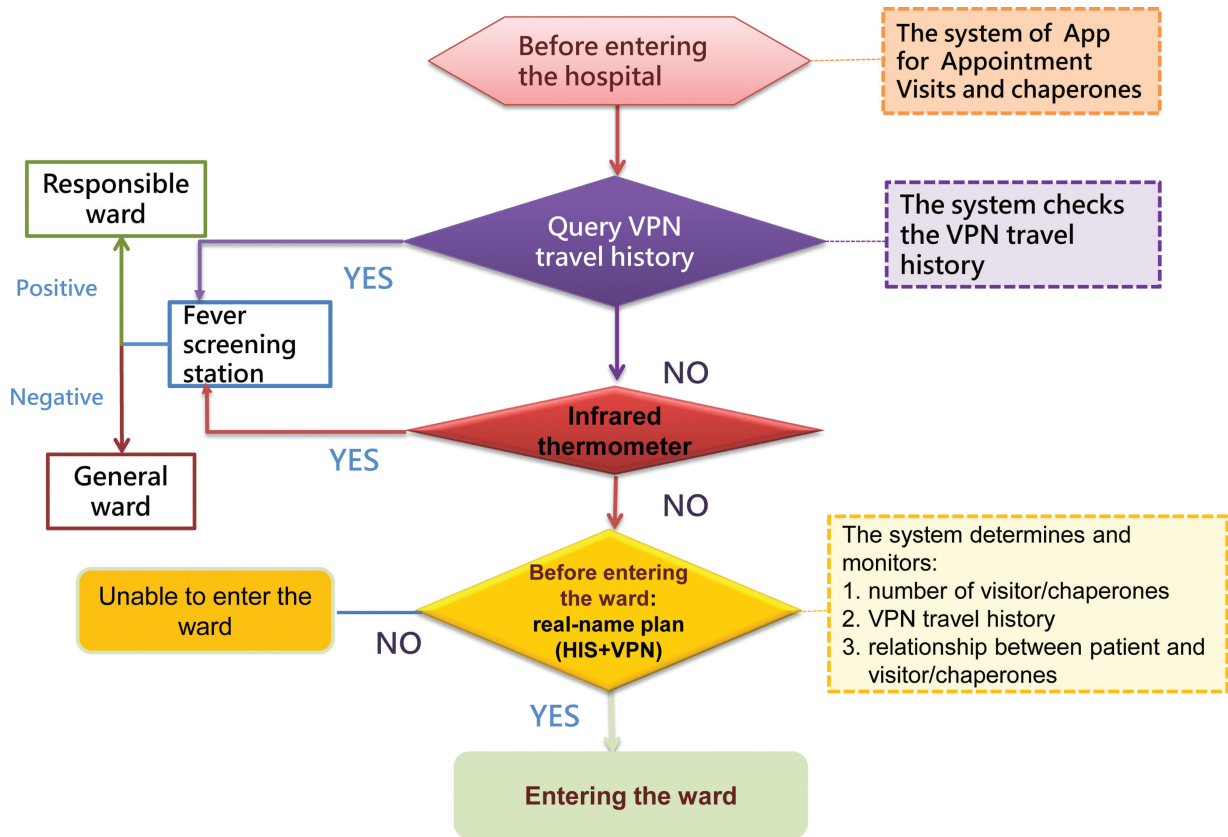


Fig. 2 Process of visiting and chaperoning during the COVID-19 pandemic.

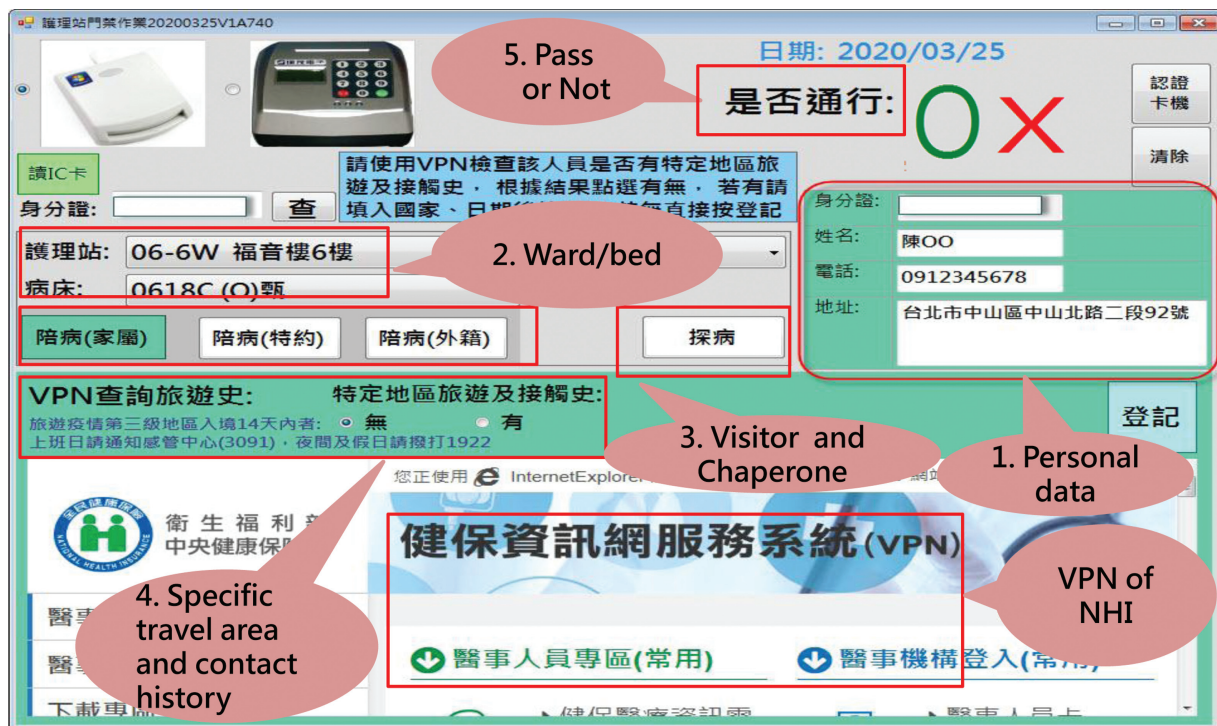


Fig. 3 The newly developed hospital visiting/chaperoning monitor system.

This document was downloaded for personal use only. Unauthorized distribution is strictly prohibited.

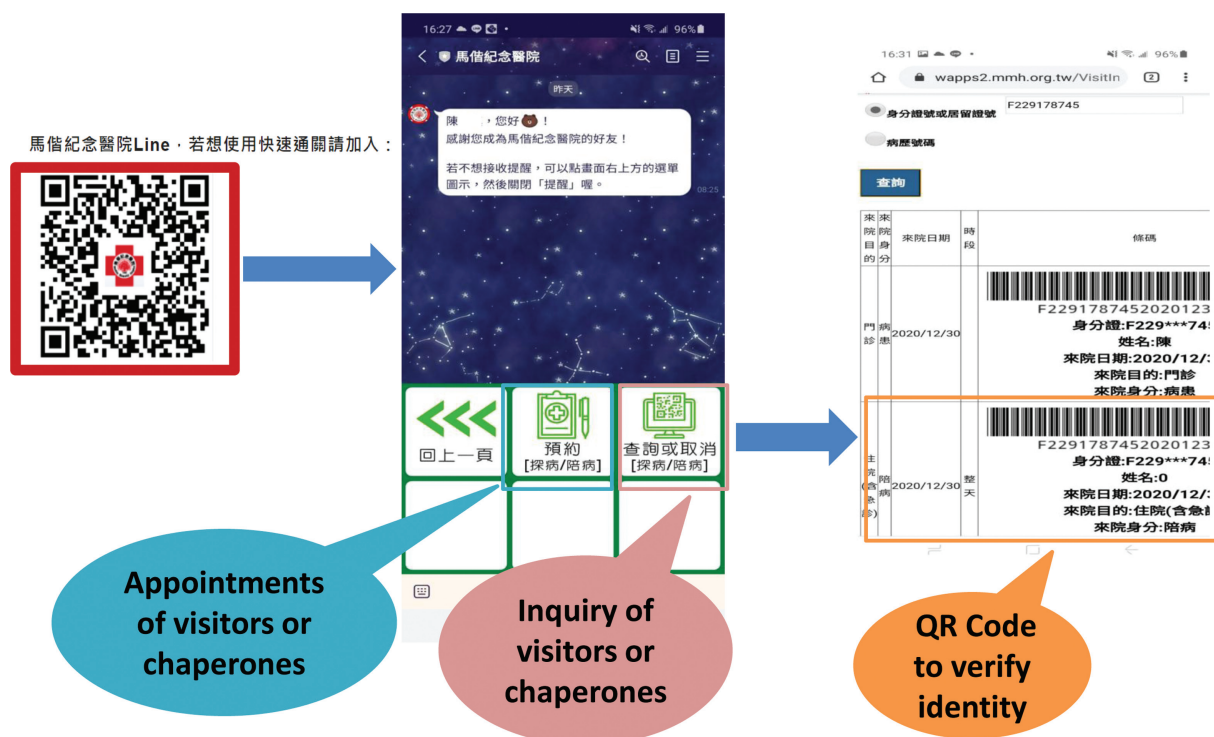


Fig. 4 The system of app for appointment visits and chaperones.

system to check their travel and contact history. At that time, when people go to the hospital to visit, as long as you show your QR Code to verify your identity at the hospital, you can quickly pass without using an NHI smart card or ID card to enter the Visiting/Chaperoning Monitor System (→ Fig. 4).

## Results

Our country's CDC initially regulated visiting and chaperoning in hospitals and then standardized the access measures. Our hospital complies with this regulation. Access control was started on March 9, 2020.

On March 20, 2020, the Visiting/Chaperoning Monitor System was officially used to monitor the entry of chaperones and visitors of patients in the ward. The hospital units include general, outpatient, emergency, and intensive care wards.

The number of visitors is restricted to two at a time. When patients or people accessed the ward every time, they were asked to insert their NHI smart cards or ID card to access the system.

From March 20 to May 30, 2020, 67,692 visitors and chaperones were monitored. Specifically, the number of visitors was 31,259 (main hospital: 15,492; branch hospital: 15,767), while the number of chaperones was 36,433 (main hospital: 22,620; branch hospital: 13,813; → Table 1). A total of 89 people failed the initial checking and went to the hospital's outdoor clinic for medical treatment. There were approximately 420 people who were denied entry to visit or chaperone. Three people who were identified and traced using this system tested positive for COVID-19.

All the data on visitors and chaperones can be accessed from the nursing information system. When an epidemic investigation is needed, the chaperoning and visiting data of all patients within a specified time could be exported from the system to Excel for data sorting (→ Fig. 5).

## Discussion

Our hospital visiting and chaperoning monitoring system that was developed during the COVID-19 pandemic has the following advantages: in case of a confirmed COVID-19 case, regardless of whether it is a visitor or a chaperone, an epidemic investigation can be performed through the system to identify all contacts. Furthermore, when there are policy changes, such as the number of visitors, the system can be easily adjusted by the information staff.

The system plan that uses nationwide data sources is adopted for visitors and chaperones by the information technology team. In addition, to prevent people from hiding their travel histories, the government has made it possible for medical staff to access the travel records of people through their NHI cards, and their basic information will

Table 1 Number of visitors and chaperones from March 20 to May 30 in 2020

	Visitor	Chaperone
Main hospital	15,492	22,620
Branch hospital	15,767	13,813
Total	31,259	36,433

每日維護 | 床位分配資料查詢 | 指定對象查詢 | 護理排班權限 > 3 | ●佔床 ●今辦明出 ○空床 ★昨日照護 #有新病人 | 返回

探病 陪病 | 住院 中 | 病歷號碼 753 | 之 女 | 2020/06/01 ~ 2020/06/29 | 查詢 | 匯出 | 23

護理站	床號	病歷號	類別	訪客姓名	訪客idno	電話	國外旅遊地點	開始時間	結束時間
CVI_B	0721V	753	住-探1					2020/06/21 10:58:49	2020/06/21 23:59:59
CVI_B	0721V	753	住-探2					2020/06/21 11:04:13	2020/06/21 23:59:59
CVI_B	0721V	753	住-探1					2020/06/22 11:29:15	2020/06/22 23:59:59
CVI_B	0721V	753	住-探2					2020/06/22 11:29:49	2020/06/22 23:59:59
CVI_B	0721V	753	住-探1					2020/06/23 11:15:05	2020/06/23 23:59:59
CVI_B	0721V	753	住-探2					2020/06/23 11:15:19	2020/06/23 23:59:59
CVI_B	0721V	753	住-探1					2020/06/23 19:53:27	2020/06/23 23:59:59
CVI_B	0721V	753	住-探2					2020/06/23 19:53:51	2020/06/23 23:59:59
CVI_B	0721V	753	住-探1					2020/06/24 10:59:43	2020/06/24 23:59:59
CVI_B	0721V	753	住-探2					2020/06/24 11:00:13	2020/06/24 23:59:59
CVI_B	0721V	753	住-探1D					2020/06/25 11:01:22	2020/06/25 19:36:03
CVI_B	0721V	753	住-探2D					2020/06/25 11:01:36	2020/06/25 19:33:18
CVI_B	0721V	753	住-探2					2020/06/25 19:35:15	2020/06/25 23:59:59
CVI_B	0721V	753	住-探1					2020/06/26 11:05:35	2020/06/26 23:59:59
CVI_B	0721V	753	住-探2					2020/06/26 11:17:29	2020/06/26 23:59:59
CVI_B	0721V	753	住-探1					2020/06/26 19:34:16	2020/06/26 23:59:59
CVI_B	0721V	753	住-探2					2020/06/26 19:34:32	2020/06/26 23:59:59
CVI_B	0721V	753	住-探1D					2020/06/27 11:04:12	2020/06/27 19:35:50
CVI_B	0721V	753	住-探2D					2020/06/27 11:07:05	2020/06/27 19:30:11
CVI_B	0721V	753	住-探2					2020/06/27 19:30:17	2020/06/27 23:59:59
CVI_B	0721V	753	住-探1					2020/06/27 19:36:17	2020/06/27 23:59:59
CVI_B	0721V	753	住-探1					2020/06/28 10:55:40	2020/06/28 23:59:59
CVI_B	0721V	753	住-探2					2020/06/28 10:55:54	2020/06/28 23:59:59

Fig. 5 Exported visiting and chaperoning data.

be linked to the HIS personnel without additional manual input. It can more accurately screen hospital visitors and chaperones. The previous studies also indicated that the information technology services team is a cornerstone of organizational response, as they coordinate operational and clinical activities; they must also rapidly rearrange infrastructure, policies, and priorities to remain responsive to the COVID-19 outbreak.<sup>19</sup>

We also developed the mobile applications “app for appointment visits and chaperones,” which allows making appointments directly online. It is more convenient for visitors and chaperones, and the staff can save time on history taking and recording information. The studies have demonstrated that with encouragement from clinical professionals, patients can have a positive experience using mobile health applications.<sup>22</sup> Finally, the system uses the existing equipment of the hospital and connects the system to the original hospital system; thus, there is no extra cost involved.

The protocols for the COVID-19 epidemic are still very strict. With the establishment of the system, individuals entering the ward can be accurately identified. When there is a confirmed case, an epidemic investigation can be conducted through the system to identify all contacts. These results can help health policymakers to optimize hospital visiting policies and may lower the risk of hospital cluster outbreaks when novel infectious diseases occur.

We think that the framework of the system can be a reference for other countries. The entry and exit information of countries can be used to control infection in hospitals in the face of an impending crisis.

This study also had some limitations. First, the visiting policies might change at any time due to the progression of an infectious disease. We could only take a snapshot of visiting policies at the hospital during a particular time. For that reason, the results of our study may not correlate with those of another study at a different time. Second, we only set up a Hospital Visiting/Chaperoning Monitor System and did not investigate the opinions of patients, visitors, and staff members toward the change of visiting policies; these data would be valuable to gain an extensive understanding of the influence of visiting policy changes on patients, visitors, and the multidisciplinary team. Further investigations are then required to benefit patients, visitors, and health care providers.

## Conclusion

During the fight against COVID-19, the Hospital Visiting/Chaperoning Monitor System was able to identify potential cases, while public health staff identified their contacts. It is important that medical staff immediately access a patient’s travel history and conduct epidemic investigations to prevent the spread of an infectious disease. However, the impact of the current visiting and chaperoning policy changes on health care teams as well as on patients and their families requires further investigation.

## Clinical Relevance Statement

The spread of emerging infectious diseases may continue to occur in the future. The accurate and timely surveillance of

our newly developed Hospital Visiting/Chaperoning Monitor System provides essential intelligence for hospital operations during the COVID-19 pandemic. This monitoring system can provide hospitals with information on an individual's travel history in high-risk areas, which is useful in performing disease monitoring and contact tracing, playing a key important role. The international pandemic situation is still severe. During this very challenging time, hospitals still need to cooperate with national policies to implement source controls, such as establishing hospital visiting and chaperoning policies, strict STOC history and body temperature taking for hospital visitors, and using face masks, to provide a safe environment for patients and hospital staff during this COVID-19 pandemic.

## Multiple Choice Questions

- Which of the following sources of information is used to create the Hospital Visiting/Chaperoning Monitor System?
  - Emergency Room Information System
  - NHI system and HIS
  - Community Health Information System
  - Reports in the CDC system
- Which of the items below is not the main function of the Hospital Visiting/Chaperoning Monitor System?
  - Determine people's travel history in high-risk areas
  - Perform disease monitoring and contact tracing
  - Monitor an individual's body temperature
  - Determine the number of individuals visiting and chaperoning

**Correct Answer:** The correct answer is option b. The monitoring system was connected to the VPN of the NHI system and HIS.

**Correct Answer:** The correct answer is option c. Monitoring the body temperature is the main function of the Hospital Visiting/Chaperoning Monitor System.

### Protection of Human and Animal Subjects

The Institutional Review Board approved our study protocol after a full review and considered that our study has minimal risk, as we only collected data that is part of the normal health care operations.

### Funding

None.

### Conflict of Interest

None declared.

### Acknowledgments

The authors are grateful to our colleagues in the nursing human resources and information technology departments for their contributions to the project.

## References

- Zhu N, Zhang D, Wang W, et al; China Novel Coronavirus Investigating and Research Team. A novel coronavirus from patients with pneumonia in China, 2019. *N Engl J Med* 2020; 382(08):727–733
- Huang C, Wang Y, Li X, et al. Clinical features of patients infected with 2019 novel coronavirus in Wuhan, China. *Lancet* 2020;395 (10223):497–506
- World Health Organization. Coronavirus Disease 2019 (COVID-19) Situation Report-51. Geneva: WHO; 2020
- Taiwan Centers for Disease Control. Coronavirus disease 2019 (COVID-19). Taiwan Centers for Disease Control. Accessed January 4, 2021 at: <https://www.cdc.gov.tw/?aspxerrorpath=/Category/MPPage/V6Xe4EltDW3NdGTgC5PtKA>
- Wang CJ, Ng CY, Brook RH. Response to COVID-19 in Taiwan: big data analytics, new technology, and proactive testing. *JAMA* 2020; 323(14):1341–1342
- Taiwan Centers for Disease Control. Coronavirus disease 2019 (COVID-Taiwan Centers for Disease Control. Accessed July 20, 2020 at: [https://www.cdc.gov.tw/En/Category/ListContent/bg0g\\_VU\\_Ysrgkes\\_KRUDgQ?uaid=0nAzwpXdBNIAPovJhwrGoQ](https://www.cdc.gov.tw/En/Category/ListContent/bg0g_VU_Ysrgkes_KRUDgQ?uaid=0nAzwpXdBNIAPovJhwrGoQ)
- Taiwan Centers for Disease Control. Principles of visitor restrictions at medical facilities in the time of COVID-19. Taiwan Centers for Disease Control. Accessed July 20, 2020 at: <https://www.cdc.gov.tw/File/Get/-YJtRCjYEncDosM8abV2OQ>
- Gray H, Adam J, Brown D, McLaughlin P, Hill V, Wilson L. Visiting all hours: a focus group study on staff's views of open visiting in a hospice. *Int J Palliat Nurs* 2011;17(11):552–560
- Taiwan Centers for Disease Control. Severe acute respiratory syndrome (SARS). Taiwan Centers for Disease Control. Accessed July 22, 2020 at: [https://www.cdc.gov.tw/En/Category/ListContent/bg0g\\_VU\\_Ysrgkes\\_KRUDgQ?uaid=u1D6dRGtmP4Q5YA1GmSKlW](https://www.cdc.gov.tw/En/Category/ListContent/bg0g_VU_Ysrgkes_KRUDgQ?uaid=u1D6dRGtmP4Q5YA1GmSKlW)
- Birnbaum DJ, Nevo I, Barnes S, et al. Do hospital visitors wash their hands? Assessing the use of alcohol-based hand sanitizer in a hospital lobby. *Am J Infect Control* 2012;40(04):340–343
- Taiwan Centers for Disease Control. Domestic experts recommend that healthy students do not need to wear masks; Central Epidemic Command Center (CECC) announces 1 additional imported case of 2019 Novel Coronavirus (2019-nCoV) infection. Taiwan Centers for Disease Control. Accessed July 22, 2020 at: <https://www.cdc.gov.tw/En/Bulletin/Detail/fuxYlhrqkT5drFreHzhAg?typeid=158>
- Taiwan Centers for Disease Control. Coronavirus disease 2019 (COVID-19). Taiwan Centers for Disease Control. Accessed July 24, 2020 at: [https://www.cdc.gov.tw/En/Category/ListContent/bg0g\\_VU\\_Ysrgkes\\_KRUDgQ?uaid=0nAzwpXdBNIAPovJhwrGoQ](https://www.cdc.gov.tw/En/Category/ListContent/bg0g_VU_Ysrgkes_KRUDgQ?uaid=0nAzwpXdBNIAPovJhwrGoQ)
- Hsu YC, Liu YA, Lin MH, et al. Visiting policies of hospice wards during the COVID-19 pandemic: an environmental scan in Taiwan. *Int J Environ Res Public Health* 2020;17(08):2857–2865
- Whitton S, Pittiglio LI. Critical care open visiting hours. *Crit Care Nurs Q* 2011;34(04):361–366
- Shulkin D, O'Keefe T, Visconi D, Robinson A, Rooke AS, Neigher W. Eliminating visiting hour restrictions in hospitals. *J Healthc Qual* 2014;36(06):54–57
- Shin N, Kwag T, Park S, Kim YH. Effects of operational decisions on the diffusion of epidemic disease: a system dynamics modeling of the MERS-CoV outbreak in South Korea. *J Theor Biol* 2017; 421:39–50
- Centers for Medicare & Medicaid Services (CMS) Guidance for Infection Control and Prevention Concerning Coronavirus Disease 2019 (COVID-19) by Hospice Agencies. Accessed July 24, 2020 at: <https://www.cms.gov/files/document/qso-20-16-hospice.pdf>
- Nassar Junior AP, Besen BAMP, Robinson CC, Falavigna M, Teixeira C, Rosa RG. Flexible versus restrictive visiting policies in ICUs: a systematic review and meta-analysis. *Crit Care Med* 2018;46(07): 1175–1180

- 19 Grange ES, Neil EJ, Stoffel M, et al. Responding to COVID-19: The UW medicine information technology services experience. *Appl Clin Inform* 2020;11(02):265–275
- 20 Liu YA, Hsu YC, Lin MH, et al. Hospital visiting policies in the time of coronavirus disease 2019: a nationwide website survey in Taiwan. *J Chin Med Assoc* 2020;83(06):566–570
- 21 National Health Insurance Administration Ministry of Health and Welfare. Integrating travel record data into the National Health Insurance Administration cloud database. Accessed July 27, 2020 at: [https://www.nhi.gov.tw/News\\_Content.aspx?n=FC05EB85BD57C709&sms=587F1A3D9A03E2AD&s=0120-16EE70C9A226](https://www.nhi.gov.tw/News_Content.aspx?n=FC05EB85BD57C709&sms=587F1A3D9A03E2AD&s=0120-16EE70C9A226)
- 22 Farzandipour M, Nabovati E, Heidarzadeh Arani M, Akbari H, Sharif R, Anvari S. Enhancing asthma patients' self-management through smartphone-based application: design, usability evaluation, and educational intervention. *Appl Clin Inform* 2019;10(05):870–878