Visiting in disguise: Analysis of inpatient companions in the time of COVID-19

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Abstract

Background: As outbreak of COVID-19 infection, on April 3, 2020, it is stipulated that the number of inpatient companions is limited to one in Taiwan. All companions are required to register their real personal data with 14 days of travel history, occupation, contact history, and cluster history. We would like to evaluate the impact of the new regulations to the accompanying and visiting culture in Taiwan, via analyzing the appearance and characteristics of inpatient companions in this period.

Methods: Using intelligent technology, we designed a novel system in managing the inpatient companions (InPatients Companions Management System [IPCMS]), and the IPCMS was used to collect data about characteristics of inpatients and companions between April 27 and May 3, 2020. The database is built using MySQL software. Microsoft Excel 2016 and SPSS version 20.0 statistical software were used for data analysis, including the basic data of the companions, differential analysis of companions' gender, person-days and cumulative time, differential analysis of accompaniment-patient relationship, and frequency of accompaniment and cumulative hours.

Results: During study period, daily inpatient admissions ranged from 2242 to 2514, the number of companions per day ranged from 2048 to 2293, and the number of companions for one inpatient is 1 to 9 per day, with an average of 1.20 to 1.26. The companions were mostly family members, and most of them were the inpatients' children (32.9%), and spouse (26.13%). More females than males were noted in all categories of companionship with statistical significance.

Conclusion: The data obtained in this study could be an important basis for the transformation and reform of the companions culture in Taiwan's hospitals and will also provide a glimpse into the attitudes and culture of companions who have long been ignorant and neglected. The experience gained in our IPCMS could also serve as a reference for other hospitals in Taiwan and worldwide.

Keywords: COVID-19; Inpatient; Taiwan

1. INTRODUCTION

In December 2019, Coronavirus (COVID-19) emerging infectious disease cases were released from Wuhan, mainland China. As of June 27, 2020, nearly 10 million people have been diagnosed worldwide, with >490 000 deaths. The rapid outbreak has spread to >180 countries over a period of 6 months,[1] and the number of patients continues to climb. Studies have shown that its transmission rate is estimated to be two to four people on average, with one person being capable of transmitting up to eight people, making it the biggest threat to global health in this century.[2] In view of the fact that the pandemic caused by the new coronavirus infection would continue to expand, the Taiwan Central Epidemic Command Centre (TCECC) for Severe Special Infectious Pneumonia announced the travel alert on January 20, 2020, which gradually increased to a total ban on foreigners entering the country on March 18, 2020. From March 19, 2020, all Taiwanese returning to Taiwan should be quarantined or isolated at home for 14 days and then self-managed for 7 days.[3] Meanwhile, the management policies of all the hospitals in Taiwan have been revised on a rolling basis as a result of the Command Center's policies. The basic management of all people in each hospital includes visit planning, checking, and real-name registration of all people who come to the hospital with records of their 14 days of travel history, occupation, contact history, and cluster history (TOCC). On April 3, 2020, the TCECC promulgated the "Management Principles of Companion and Visitor for Medical Facilities in Response to COVID-19 (Woo-Han Pneumonia)" for all medical facilities to follow. It is stipulated that the number of inpatient companions is limited to one and no visitor was allowed; each companion is required to register his or her real name, implement a survey on the companion's TOCC, and keep a record of their names, contact phone numbers, and addresses. In addition, hospitals are also asked to provide inpatients and their companions with daily masks, and to check and record the temperature and health status of the inpatients' companions in the hospital. It is a somewhat perplexing problem for a hospital with huge work

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volume to effectively respond to the management principles about the admitted patients and their companions. In order to effectively solve the problem and eliminate the vulnerability of epidemic prevention, we formed the epidemic prevention intelligent technology system development project team and jointly designed a novel system in managing the inpatients and the inpatient companions (InPatients Companions Management System [IPCMS]). This IPCMS system was the first system about managing inpatients and companions in Taiwan.

In the traditional filial piety culture and family structure inherent in Taiwan, emphasis is placed on the filial piety of the parents and the child, which means that the child will be cared for by the parents when the child is young, and the child needs to feedback and take care of the parents when grown up. Therefore, if family members are sick, the other family members need to accompany the sick family members during hospitalization or to visit the hospital to express their condolences.[4] The accompanying and visiting culture of "accompanying or visiting means caring" has been formed traditionally. The primary caregiver at home is often the companion of the sick family member when in hospital. When the primary caregiver has no time to spare, the other family should take over or try to hire some other caregiver to accompany the sick family member in the hospital to assist in the daily living and care, including cleaning, diet, rehabilitation, handling in and out of the hospital, and so on, general duties, and even physical and psychological support. The culture of arranging family members to accompany sick family members to their bedsides has caused many families to be disturbed, especially during the epidemic period. Thus far, no literature has evaluated the appearance and characteristics of companions in hospital, in the Taiwan accompanying and visiting culture.

This study is set up to evaluate the efficacy of the IPCMS in the inpatient companion management and in the analysis of inpatient companions appearance and characteristics.

2. METHODS

The designed IPCMS was officially launched for the research hospital on April 6, 2020. This research hospital is a large medical center in the Northern District of Taiwan, above 2800 inpatient beds, over 6600 employees, and over 10 000 daily outpatient activities in the hospital. The system includes three functions: (1) online application for inpatients and companions, (2) inspection and management by nursing manager, and (3) database management.

2.1. IPCMS design

The inpatients and companions may apply online via a mobile device, such as a computer, or cell phone, to log on to the research hospital's website to apply prior to accompanying the patient to the hospital (https://m.vghtpe.gov.tw:8443/MobileWeb/ncov/init.do). The application contains three sections of information. (1) Authorization code for inpatients and companions: each inpatient will have a unique medical record number, which will be attached to the patient's bracelet during hospitalization. The last six digits of the medical record number are the authorization number, which is required to obtain the inpatient's consent for authorization (Fig. 1). This design is especially important as a security mechanism to maintain patient safety and privacy. (2) Basic information of the applicant: in response to the COVID-19 epidemic prevention, people who come to the hospital are required to register their name and contact information in order to be contacted in the event of an outbreak, and the hospital is required to keep these private information secure for 28 days. (3) TOCC and personal health information: applicant's self-report travel history, occupation, contact history, cluster, and personal health information within 14 days of application. The

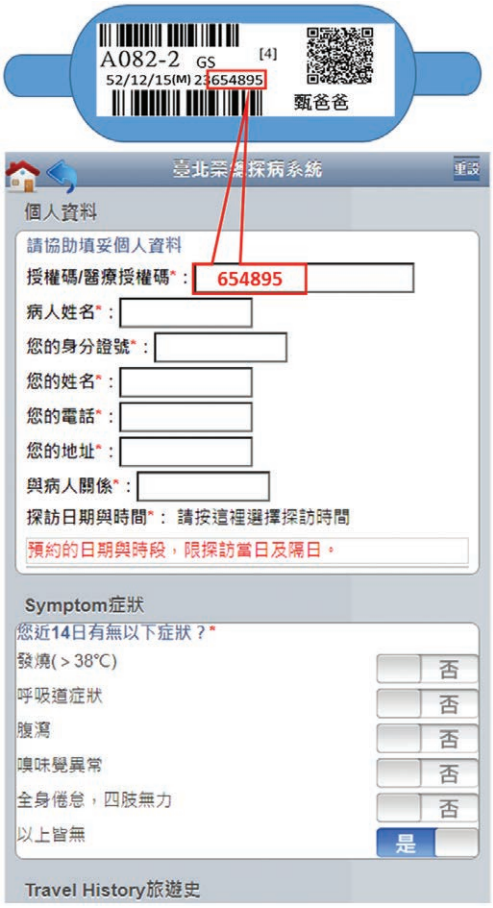

Fig. 1 Authorization code on the patient's wristband.

information system will be linked to the immigration and control list provided by the Ministry of Health and Welfare, based on the applicant's ID number, to verify whether the applicant is listed on the control list. The system will validate the application based on the TOCC and personal health information and issue a QR code to the applicant's mobile device for successful application (Fig. 2). If the companion needs to be changed, the new applicant should follow the steps to apply and the system can only retain one valid companion; therefore, the former applicant will be replaced. All of these operations are stored in the system database as a source of information for subsequent management.

2.2. Data sources

According to the system application list, nursing managers print out the list of the companions daily, check them one by one, issue a companion badge (Fig. 3), measure the companions' temperature and issue masks every day, and instruct them to wash their hands frequently and wear masks in the hospital to prevent hospital-acquired infections. The list produced by this information system can effectively integrate the personnel management of nursing managers and improve management efficiency.

The database built by MySQL software, stored and accumulated applicant information, which is one of the rare hospital companions' data in the world and can be used for database analysis and management in the future.

2.3. Study design and data processing

In this study, information about the inpatients and the companions from April 27 to May 3 were purposively sampled from

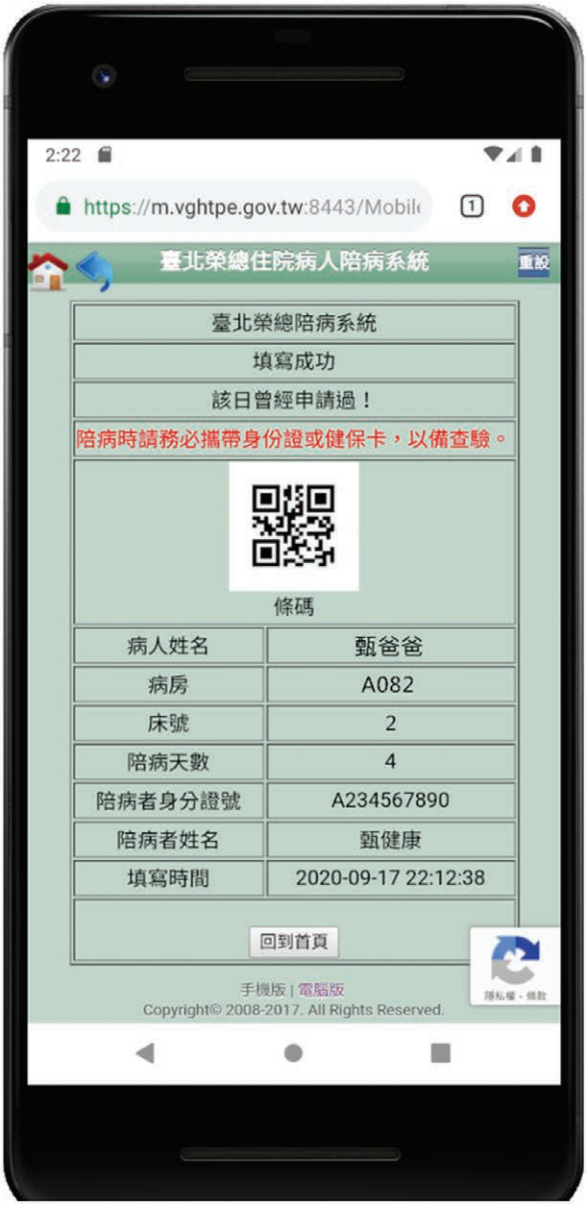

Fig. 2 Mobile screen shows QR code for successful application.

system database. These 7 days were chosen because the average length of hospital stay was 7 days in this hospital and there was no change in the TCECC epidemic policy during these 7 days. Microsoft Excel 2016 and SPSS version 20.0 statistical software were used for data analysis. We analyzed the profile of companions who came to the hospital during the COVID-19 epidemic period, and de-linked personal data. This study has been approved by the research ethics review board of the study hospital (IRB number 2020-06-019CC).

2.4. Statistical analysis

The data were extracted and debug by two researchers. The demographic data were displayed by number, times, and frequencies. The independent variables were analyzed by chi-square with category variables and Student *t* test with binary variable and the analysis of analysis of variance (ANOVA) when the variables were ordinary and the groups were ≥3. The definitions of few items were as follows: the total number of inpatients per

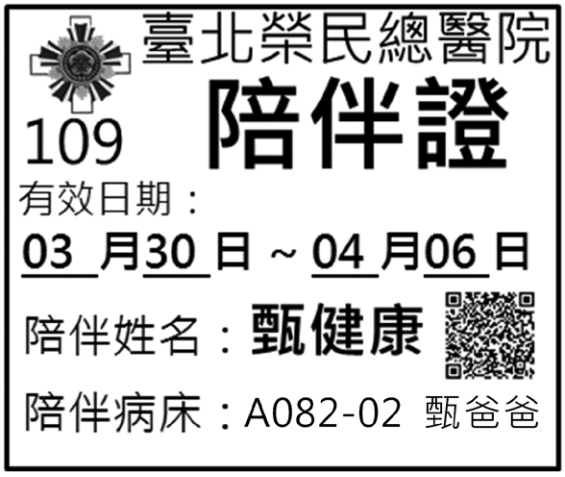

Fig. 3 Companion badge.

day was cumulated total number of inpatients, discharges, and deaths on the same day; the number of companions per inpatient was the number of companions per day by patient ID in the system; the number of companion person times was the person times by patient ID; and the cumulative accompanying time was accumulated hours for each companion ID in the system within the 7-day study period.

3. RESULTS

3.1. Number and characteristics of inpatients and companions

Between April 27 and May 3, 2020, total daily inpatient admissions at the study hospitals ranged from 2242 to 2514. The number of inpatients who had companion ranged from 1674 to 1866, with an average of 74.04% of the inpatients number (73.32%-74.67%; Table 1). The number of companions per inpatient during the study period ranged from 2048 to 2293, and the number of companions' range was 1 to 9 with an average of 1.20 to 1.26 per inpatient. The status of companions' application on an exchange basis is shown in Table 2.

3.2. Analysis of the basic data of the companions

Analyzing the data from April 27 to May 3, 2020, there were 4505 companions, 1588 of whom were male (35.25%) and 2917 were female (64.75%). Analyzing the nine types of relationship between the companions and the inpatients, it was found that the top three types of companions were children, spouse, and hired caretakers, each accounting for 32.90%, 26.13%, and 14.58%, respectively. When analyzing the gender ratio, most of the companions were female, and the number and proportion of females in each relationship was higher than that of males and reached a statistically significant difference by chi-square (Table 3)

3.3. Differential analysis of companions' gender, person-days, and cumulative time

The number of companions in the study was greater for females than for males in gender. The number of accompaniment ranged from 1 to 14 and the cumulative hours of accompaniment ranged from <1 to 161 hours, and the three-variable analysis showed that there were more for females than for males and a statistically significant difference was reached (Table 4).

Table 1

Total daily number of in-patients and accompanying status from 27 April to 3 May 2020

Items/date	Mean ± SD	April 27	April 28	April 29	April 30	May 1	May 2	May 3
Inpatients	2416 ± 103	2444	2495	2514	2513	2423	2242	2284
Inpatients with companion	1789 ± 75	1792	1845	1859	1866	1808	1674	1679
Accompanying rate	74.04% ± 0.48%	73.32%	73.95%	73.95%	74.25%	74.62%	74.67%	73.51%

Table 2

Companion attendance analysis for the period April 27 to May 3, 2020

Date/times/n (%)	April 27 n (%)	April 28 n (%)	April 29 n (%)	April 30 n (%)	May 1 n (%)	May 2 n (%)	May 3 n (%)
Mean ± SD (range)	1.26 ± 0.67 (1-9)	1.21 ± 0.60 (1-6)	1.20 ± 0.55 (1-6)	1.23 ± 0.59 (1-7)	1.23 ± 0.59 (1-7)	1.22 ± 0.61 (1-6)	1.25 ± 0.63 (1-6)
1	1475 (65.38%)	1586 (70.93%)	1598 (71.75%)	1562 (68.12%)	1507 (67.76%)	1422 (69.44%)	1391 (66.30%)
2	215 (19.06%)	160 (14.31%)	175 (15.72%)	206 (17.97%)	214 (19.25%)	162 (15.82%)	189 (18.02%)
3	78 (10.37%)	73 (9.79%)	70 (9.43%)	82 (10.73%)	68 (9.17%)	70 (10.25%)	78 (11.15%)
4	12 (2.13%)	20 (3.58%)	12 (2.16%)	10 (1.74%)	14 (2.52%)	12 (2.34%)	13 (2.48%)
5	8 (1.77%)	5 (1.12%)	3 (0.67%)	4 (0.87%)	2 (0.45%)	4 (0.98%)	5 (1.19%)
6	1 (0.27%)	1 (0.27%)	1 (0.27%)	1 (0.26%)	2 (0.54%)	4 (1.17%)	3 (0.86%)
7	2 (0.62%)	0 (0.00%)	0 (0.00%)	1 (0.31%)	1 (0.31%)	0 (0.00%)	0 (0.00%)
8	0 (0.00%)	0 (0.00%)	0 (0.00%)	0 (0.00%)	0 (0.00%)	0 (0.00%)	0 (0.00%)
9	1 (0.40%)	0 (0.00%)	0 (0.00%)	0 (0.00%)	0 (0.00%)	0 (0.00%)	0 (0.00%)
Sum of person times	2256	2236	2227	2293	2224	2048	2098

3.4. Differential analysis of accompaniment-patient relationship, frequency of accompaniment, and cumulative hours

Analyzing the relationship between the companion and the inpatient, the maximum number of accompanying times for hired caretakers was 4.55 ± 2.40 (1-14). The ANOVA was used to analyze the difference between the groups, and it was found that the hired caretakers were more than other companions and reached a statistically significant difference. Analyzing the cumulative hours of each group, the cumulative hours of hired caretakers were 89.11 ± 57.33 (<1 -161). The difference between the groups was analyzed by ANOVA, and it was found that the hired caregivers group had the higher hours compared with the other groups with a statistically significant difference (Table 5).

4. DISCUSSION

In the past, information on companions in hospitals was recorded in a paper form, which was informal and incomplete, so it was negligent in management and was difficult to explore the characteristics and appearance of companions in Taiwan hospitals. In response to the infection control of COVID-19 emerging infectious disease, all hospitalized patients are required to register their real names, to be tracked and managed. This study was conducted to implement a novel technology-based epidemic prevention model, IPCMS, to monitor and evaluate the hospital's companion information. Although there was no previous companion management system to compare, some papers reviewed checking TOCC of the companions by telephone interview which took much more manpower and time in management.[4–6] According to this study, during the 7 day sampling period, the total number of inpatients in the hospital was 2242 to 2514 per day, and the number of inpatients with companions was 1674 to 1866 per day, accounting for 73% to 75% of the total number of inpatients. According to a survey conducted by the Family Caregiver Care Association of the Republic of China, when a family member is hospitalized in the country, 60% of the family members are taken care of by family members in turn, about 25% of them are taken care of by hired domestic caregivers, and about 10% are taken care of by hired foreign caretakers.[7–10] This is similar to the findings in our study. The number of companions is between 2048 and 2293, and the number of companions for one inpatient is 1 to 9 per day, with an average of 1.20 to 1.26. It would be reasonable to have two companions for one inpatient on the same day to alternative shift. However, it would not be reasonable that 20.4% to 25.0% of the inpatients with

Table 3

Basic data of the companions

Inpatients-escorts relationship	Male n (%)	Female n (%)	Total n (%)	χ^2
Child (1)	739 (49.86%)	743 (50.14%)	1482 (32.90%)	452.52*
Spouse (2)	455 (38.65%)	722 (61.35%)	1177 (26.13%)	
Hired caretaker (3)	36 (5.47%)	621 (94.52%)	657 (14.58%)	
Parents (4)	100 (23.58%)	324 (76.41%)	424 (9.41%)	
Siblings (5)	82 (35.04%)	152 (64.95%)	234 (5.19%)	
Friends (6)	84 (36.68%)	145 (63.32%)	229 (5.08%)	
Relatives (7)	42 (33.33%)	84 (66.67%)	126 (2.80%)	
Son/daughter-in-law (8)	12 (14.28%)	84 (85.72%)	96 (2.13%)	
Grandson (9)	38 (47.50%)	42 (52.50%)	80 (1.78%)	
Total	1588 (35.25%)	2917 (64.75%)	4505 (100%)	

*$p < 0.05$; chi-square test.

Table 4

Differential analysis of gender, frequency, and cumulative hours of accompanying persons

Items	N/mean ± SD	*t*
Cumulative number of accompaniments		22.23*
Male	3.14 ± 2.11	
Female	3.57 ± 2.22	
Cumulative hours of accompaniment		67.95*
Male	46.70 ± 44.32	
Female	59.33 ± 50.90	

*$p < 0.05$; Student *t* test.

Table 5

Differential analysis of accompaniment-patient relationship, frequency of accompaniment, and cumulative hours

Items	Mean ± SD	*F*
Frequency		14.925*
Child (1)	3.09 ± 2.11	(3) > (1), (2), (4), (5), (6), (7), (8), (9)
Spouse (2)	3.54 ± 2.11	(1) < (2)
Employed caregivers (3)	4.55 ± 2.40	
Parents (4)	3.35 ± 2.04	
Siblings (5)	3.01 ± 2.12	
Friends (6)	3.17 ± 2.05	
Relatives (7)	2.75 ± 1.98	
Son/daughter-in-law (8)	2.76 ± 1.92	
Grandson (9)	2.2 ± 1.31	
Cumulative hours		49.252*
Child (1)	41.17 ± 39.28	(3) > (1), (2), (4), (5), (6), (7), (8), (9)
Spouse (2)	60.73 ± 48.21	(2) > (1), (5), (7), (8), (9)
Employed caregivers (3)	89.11 ± 57.33	
Parents (4)	56.21 ± 48.62	
Siblings (5)	44.79 ± 45	
Friends (6)	51.44 ± 47.32	
Relatives (7)	39.90 ± 45.24	
Son/daughter-in-law (8)	33.02 ± 32.56	
Grandson (9)	23.68 ± 25.60	

ANOVA = analysis of variance.

*$p < 0.05$; ANOVA and Scheffe post hoc.

companions were accompanied by ≥3 companions per day. During the study period, all hospitals in Taiwan adopted a high standard of COVID-19 prevention measures that prohibited visits to inpatients.[5,6] Subject to Taiwan's accompanying and visiting culture, it could be understood that a high percentage of 20.4% to 25.0% of the inpatients with higher companions change rate per day meant that about one fourth to one fifth of the inpatient families have used the system to change the companions frequently to let more people to enter the hospital just for visiting the inpatients, that is, to achieve the purpose of visiting the inpatients by accompanying the patients, which is the status of visiting in disguise. It is conceivable that the excessive flow of people in the hospital is really troublesome for the medical care of the patients and the management of the hospital. Domestic scholars also appealed to the Taiwanese after SARS that the hospital is a public area where high infection risk and low immunity groups gather, and rethinking the suitability of the long-standing accompanying and visiting culture in Taiwan hospitals. In the midst of this epidemic, it could be a good time to promote the innovation of technologically televisiting the inpatients so that the inpatients can recuperate sufficiently, and, to teach people to know strengthening the measures of washing hands frequently, wearing masks, dividing inpatients into different compartments to reduce clustering and avoiding unnecessary visits in hospitals are true displays of medical courtesy.[7] If the companions are not properly managed, it is not only easy to transmit the infectious disease to inpatients with relatively low immunity, but also the companions wandering or gathering in the hospital area is also likely to cause the infectious disease to spread, which has a great impact on epidemic prevention. Therefore, all people who flow in the hospital, especially the inpatients and companions of non-hospital workers, should be included in the information system for registration and management. It is especially an urgent task for the hospital management and epidemic prevention with a large flow of people. The experience of IPCMS construction in this article can also provide effective references for domestic and foreign hospitals.

The IPCMS further analyzed the relationship between the companions and the patients and found that the companions were mostly family members, and the most of them were children (32.9%), and spouse (26.13%) is the next in order, followed by parents, siblings, and other relatives, and even grandchildren and daughter-in-law/son-in-law could serve as companions. Friends only account for 5.08%. At the most urgent moment of the epidemic's spread, family members still took the risk to accompany their loved ones in hospitals. This shows the importance of family relationships in Taiwan society. The third place in the role of companions is hired caretakers (14.58%) who are mostly foreign caretakers. This system can also detect illegal foreign caretakers, that is, it can prevent epidemics and also prevent the accidental harvest of illegal workers.

This study further analyzed the gender of the 4505 companions with 2917 (64.75%) females. More females than males were also noted in all categories of companionship. The highest proportion of female gender was noted in hired caretakers (94.52%), while the proportion of male and female children was closest to 50%, with slightly more females (50.14%) than males. In terms of the frequency and cumulative hours of companions, females are significantly more than males. This means that females are often regarded as important caregivers in the traditional culture of Taiwan, which is shown similarly in many domestic research.[9,10] It is also necessary to pay attention to the burden and timely respite of caregivers. The co-employed patient caregiver system that is currently being promoted in Taiwan may be expected to solve some of the problems.[11] However, with the declining birth rate, the gender balance of the children's companions has become more balanced, indicating that with the evolution of society and women entering the workplace, many family responsibilities, such as taking care of the elders and accompanying them, have become shared responsibilities between males and females.

The IPCMS has many other benefits for hospital management. First, the system is so easy to use, the staff and each new applicant can complete the registration process in just a few screens, taking less than a minute to complete the application, and especially it contains the full TOCC checklist. If the applicant has a foreign country travel history within 14 days or has physical symptoms possibly related to COVID-19 or has contact with fever-related relatives/friends/colleagues, or has relatives/friends/colleagues with fever, the applicant cannot be allowed to enter the hospital. Second, the system automatically checks and blocks applicants who are not supposed to come to the hospital, reducing the time and manpower required to check the TOCC history of each inpatient's companion. Calculated based on 2000 person-times per day, if each nurse spends 10 minutes to explain how to fill in and check the TOCC of each applicant in documents, which can spend 334 hours manpower approximately equal to 42 man-shifts of nurse work, the nurse's overtime fee is calculated at NT$250 per hour, and NT$83 340 per day in overtime. The attrition of personnel allows medical staff to return to professional care for their working hours. Third, Taiwan's epidemic prevention policy includes the allocation of medical masks to hospitalized patients and their companions in order to reduce the risk of human-to-human transmission in hospitals and to prevent the impact of epidemics caused by clusters of infections in hospitals. A mask should be issued to each patient and companion daily, and a real-name signature should be required for personal collection. As a result, with no IPCMS, every ward was flooded with files and leaflets for outbreak management, including the establishment of daily mask user/collector information, which was not easy to manage and wasted a lot of paper. By registering the patient's names in the IPCMS, the management staff of each unit can print the name list and apply it to the personnel verification and mask application registration. Forth, in order to prevent the

problem of stranded companions, IPCMS has set the validity date of the companion card to expire after the inpatient is discharged, or at most 1 week. This can avoid the endless flow of companions in the hospital, and also implement isolation and triage management to reduce the risk of cross-infection.

This IPCMS is built in a short time in response to the epidemic situation, so there is no indicator designed to evaluate its satisfaction level, which is the limitation of this study. However, the evaluation of the satisfaction with the system is what we are doing and we hope to continue to improve the system.

In conclusion, IPCMS is the first of its kind to be built in hospitals in Taiwan for managing inpatients' companions in hospitals. There has been no previous study to analyze the status of companions in hospitals. With this new system, the information of hospital companions is incorporated into a management information system for the first time, which can be used as an effective management tool for companions' data checking, registration, and flow control in real time, as well as for quick response to epidemic needs. By the way, it could be an important basis for the transformation and reform of the companions' culture in Taiwan's medical institutions and will also provide a glimpse into the attitudes and culture of companions who have long been ignorant and neglected. The experience gained in IPCMS in a high volume hospital can also serve as a reference for other hospitals in Taiwan and worldwide.

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