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Original Article

An analysis of Taiwan's vaccination services in public health centers and contracted medical institutions and applications for vaccine injury compensations

Yu-Chen Hsu[1], Hsun-Yin Huang [1], Yu-ling Chen [1],
Shin-Yi Wang[2], Shu-Fang Chen[3], Shih-Yan Yang[4]

1. Division of Planning and Coordination, Centers for Disease Control, Ministry of Health and Welfare, Taiwan
2. Division of HIV/AIDS and TB, Centers for Disease Control, Ministry of Health and Welfare, Taiwan
3. Division of Acute Infectious Diseases, Centers for Disease Control, Ministry of Health and Welfare, Taiwan
4. Taipei Regional Center, Centers for Disease Control, Ministry of Health and Welfare, Taiwan

Abstract

Vaccination is the most cost-effective weapon against vaccine-preventable diseases. Taiwan's earliest implementation of vaccination was vaccinia against smallpox. In 1948, diphtheria toxoid was introduced in Taiwan. Since then, DTP (diphtheria, tetanus, and pertussis) combination vaccines, BCG (Bacille Calmette-Guérin vaccine), OPV (oral polio vaccine), Japanese encephalitis vaccine, MMR (measles, mumps and rubella vaccine), influenza vaccine, and varicella vaccine have been implemented progressively. In 1988, local governments of cities and counties started to contract with local hospitals and clinics to assist in vaccination. Up to now, the contracted vaccination services have increased from the original 369 public health centers to the current 1,733 contracted medical institutions, enabling the coverage rate of each routine vaccine in Taiwan to reach 90%-95% or above. Data on annual routine vaccination services conducted by public health centers and contracted medical institutions countrywide showed that the share of vaccination services provided by public health centers had decreased from 87.5% in 1996 to 22% in 2012, while the share from contracted medical institutions had increased services from 12.5% to 78% in the same period, which meant the providers of the majority of vaccination services nowadays have shifted from public health centers to contracted medical institutions. In addition, the "Vaccine Injury Compensation Fund" was established in June, 1988. And in 1992, the "Vaccine Injury Compensation Program

Working Group (VICPWG)" was organized by the Department of Health for independent deliberation. Whenever people suffered from deaths, disabilities, critical illnesses and adverse reactions induced by any vaccination, they could quickly get fair compensation after professional assessments. This helped eliminate their doubts about the possible side effects of vaccination. As of March 20, 2013, a total of 108 “Review Meetings of VICPWG " had been held to assess 1,285 applications. Among them, 498 applications were approved for compensation with the compensation rate of 38.75%. Cumulative compensation was NT $ 63,533,637 with an average of NT $ 127,578 for each application. To date, the applications for injuries from the vaccine against the 2009 H1N1 influenza virus accounted for the largest number of applications. However, BCG was the vaccine with the largest number of both approved applications and compensations for vaccine injuries, followed by the seasonal flu vaccine and DTP vaccine.

Keywords: public health center, contracted medical institutions, vaccination, vaccine injury compensation

Foreword

Vaccination is the most cost-effective weapon against vaccine-preventable diseases, and also the primary strategy of WHO (World Health Organization) for global disease prevention, control, elimination, and even eradication. Vaccine development is also the mutual goal for countries and pharmaceutical companies, which make long-term investments in human and financial capital to constantly achieve breakthroughs. The experiences from the advanced countries also proved that to establish a vaccine injury compensation system was helpful for governments in promoting vaccination policies successfully [1].

Taiwan has launched vaccination as a disease prevention and control measure. The earliest implementation of vaccination was vaccinia against smallpox. In 1948, diphtheria toxoid was introduced in Taiwan. Since then, Diphtheria-Tetanus-Pertussis vaccine (DTP), Bacillus Calmette–Guérin vaccine (BCG), oral polio vaccine (OPV), Japanese encephalitis vaccine (JE), Measles vaccine, Measles-Mumps-Rubella vaccine (MMR), influenza vaccine, and varicella vaccine have been introduced progressively [2,3]. In order to facilitate citizens’ access to vaccination in their neighborhoods and to improve vaccination coverage rates, the “Vaccination Practice Guideline for Hospitals and Clinics” [2] was drawn up in July 1988 to encourage city and county governments to contract with local hospitals and clinics to assist in vaccination. Up to now, the contracted vaccination service providers have increased from the original 369 public health centers to the current 1,733 contracted medical institutions to offer routine vaccination services, enabling the coverage rate of each routine vaccine in Taiwan to reach 90%-95% or above. Therefore, several infectious diseases have been effectively controlled, vanished, eliminated, or even eradicated. For example, polio was eradicated in Taiwan; diphtheria was vanished; measles, congenital rubella, and neonatal tetanus also met the standards of elimination.

In response to an unfortunate event of vaccine-derived poliovirus–c (VDPV) in 1986, Taiwan established the “Vaccine Injury Compensation Fund" in June 1988. And in 1992, the “Vaccine Injury Compensation Program Working Group (VICPWG)" was organized by the Department of Health for independent deliberation. With this mechanism, we hoped that whenever people suffered from deaths, disabilities, critical illnesses and adverse reactions induced by any vaccination could quickly get fair compensation after professional assessments. This helped eliminate public doubts about the possible side effects of vaccination, to keep high vaccine completion rates and herd immunity, and to guarantee the effectiveness of vaccination. Nevertheless, with contracted medical institutions increasing and changes in the healthcare system in recent years, the vaccination rates in contracted medical institutions had shown an obvious upward trend. As diverse vaccines were developed and new vaccines continued to become publicly available, and given an increasing attention to vaccination safety, the applications for compensation for vaccine-related adverse reactions had also increased from one deliberation in 1989 to 607 deliberations in 2010, with the majority of the applications for vaccine-related adverse reaction compensations caused by the vaccine against the 2009 H1N1 influenza virus during 2009 to 2010 [4].

Taiwan promotes vaccination services for public convenience, ensuring vaccine safety, and enhancing completion rates. In order to strengthen the interaction and cooperation between health authorities and contracted medical institutions in response to public demands for enhancement of vaccination quality, this study analyzed the annual applications in public health centers and contracted medical institutions for compensation for vaccine-related adverse reactions as a reference for reviewing Taiwan’s vaccination program and vaccine injury compensation policies.

Materials and Methods

1. Data sources:

(1) National Immunization Information Management System (1996~2012)

(2) Vaccine Injury Compensation Database (1988~March 20, 2013)

2. Definitions:

The vaccine injury compensations in Taiwan cover the Expanded Programme on Immunization (EPI), seasonal influenza vaccine, and 2009 H1N1 influenza vaccine. This study analyzed vaccines as follows:

(1) The Expanded Programme on Immunization (EPI): Tetanus, diphtheria toxoids and acellular pertussis vaccine (Tdap); tetanus, diphtheria toxoids, acellular pertussis and inactivated polio vaccine (Tdap-IPV); diphtheria and tetanus toxoid with acellular pertussis, inactivated polio and haemophilus influenzae type b vaccine (DTaP-Hib-IPV, abbreviation as 5 in 1); Bacille Calmette-Guérin vaccine (BCG); diphtheria, tetanus, and pertussis vaccine (DTP); hepatitis B vaccine (HepB); Japanese encephalitis vaccine (JE); measles vaccine; rubella vaccine; measles, mumps and rubella vaccine

(MMR); oral polio vaccine (OPV); tetanus and diphtheria toxoid for older children/adults (Td); tetanus toxoid (TT); and varicella vaccine.

(2) Seasonal influenza vaccine and 2009 H1N1 influenza vaccine: Since 1998, the seasonal influenza vaccine has been publicly funded first for the high-risk group of elderly above 65 years old and subsequently more groups year after year. On the other hand, the 2009 H1N1 influenza vaccine was rolled out in response to the 2009 H1N1 influenza pandemic. These two vaccines were mass vaccination administered over a short term, which made them different from the routine vaccination implementation of the Expanded Programme on Immunization.

(3) Optional vaccines: Diphtheria and tetanus toxoid with acellular pertussis vaccine (DTaP); haemophilus influenzae type b vaccine (Hib); hepatitis A and hepatitis B vaccine (HepA-HepB); inactivated polio vaccine (IPV); measles, mumps, rubella and varicella vaccine (MMRV); rotavirus vaccine; and human papillomavirus vaccine (HPV).

3. Methods of Analysis:

This study used Microsoft Office Excel 2003 and 2010 as the statistical software. We collected information from the Vaccine Injury Compensation Database, debugged, and excluded “inadmissible” and “self-withdrawal” applications. Due to rare applications for vaccine injury compensation before 1989, the cases vaccinated before 1989 were merged with cases in 1989 shown in the following charts. We used EXCEL to run descriptive statistics on data from the deliberations of Vaccine Injury Compensation Database recorded from 1988 to March 20, 2013. We also preformed pivot analysis and comparison using year and other important independent variables. Our analysis included descriptive statistics with the caseload of deliberations, approved applications, and the compensation from each vaccine recorded in the Vaccine Injury Compensation Database; statistics with annual applications for compensation from vaccination data of The Expanded Programme on Immunization; identification of the EPI vaccines with abnormally high vaccine injury compensation rates; analysis based on vaccination localities which were classified as contracted medical institutions, vaccination stations, public health centers, schools and others (with incomplete records); as well as the data of the EPI vaccines, 2009 H1N1 influenza vaccine, and seasonal influenza vaccines in the Vaccine Injury Compensation Database. Of note, we excluded the compensation applications induced by two or more vaccines in our study, in order to clarify the injury of each vaccine.

Results

1. The evolvement of routine vaccination services in public health centers and medical institutions

Since Taiwan encouraged city and county governments to contract with local hospitals and clinics for vaccination services in July 1988, the routine vaccination service providers

had increased from the original 369 public health centers to 1,733 contracted medical institutions along with 342 public health centers in January 2013 (Table 1). The 12 district health stations in the Department of Health under the Taipei City Government were restructured into 12 district health centers in 2005. The eleven public health centers in the Department of Health under the former Kaohsiung City Government no longer offer vaccination services.

Table 1. Geographical distribution of routine vaccination services in public health centers and medical institutions (As of January, 2013)

County / City	2012 births	Vaccination localities		Total	Administrative regions (District)
		No. of contracted medical institutions	No. of public health centers		
New Taipei City	40,847	351	28	379	29
Taipei City	29,498	190	0	190	12
Taichung City*	28,324	262	30	292	29
Tainan City	17,752	135	37	172	37
Kaohsiung City*	24,963	189	27	216	38
Yilan County	3,930	24	12	36	12
Taoyuan County	19,866	167	13	180	13
Hsinchu County	6,204	29	13	42	13
Miaoli County	6,207	32	18	50	18
Changhua County*	13,658	98	28	126	26
Nantou County	4,056	26	8	34	13
Yunlin County	6,167	42	20	62	20
Chiayi County	3,889	15	18	33	18
Pingtung County	6,285	44	33	77	33
Taitung County	1,858	11	16	27	16
Hualien County	2,782	8	13	21	13
Penghu County*	978	3	7	10	6
Keelung City	2,399	31	7	38	7
Hsinchu City	6,161	42	3	45	3
Chiayi City	2,072	30	2	32	2
Kinmen County	1,431	3	5	8	6
Lienchiang County	154	1	4	5	4
Total	229,481	1,733	342	2,075	368

Note 1: Twenty three public health centers in 12 districts of Taipei City and 11 districts of former Kaohsiung City did not provide vaccination services.

Note 2: * Part of township has two public health centers.

Note 3: The 2012 births data were from the statistics website of the Ministry of the Interior. (http://statis.moi.gov.tw/micst/stmain.jsp?sys=100)

According to the data from Interior Ministry, the annual births in Taiwan had decreased gradually since 1996 (325,545 births), and the lowest record of 166,886 births was in 2010. Although in 2012, the dragon year, the births slightly increased to 229,481, the overall trend was generally downward. The annual share of routine vaccinations conducted by public health centers and contracted medical institutions countrywide is shown in Figure 1. The public health centers providing vaccination services had obviously decreased from 87.5% in 1996 to 22% in 2012, while the contracted medical institutions had increased services from 12.5% to 78% in the same period. This result revealed that the providers of the majority of vaccination providers nowadays have shifted from public health centers to contracted medical institutions.

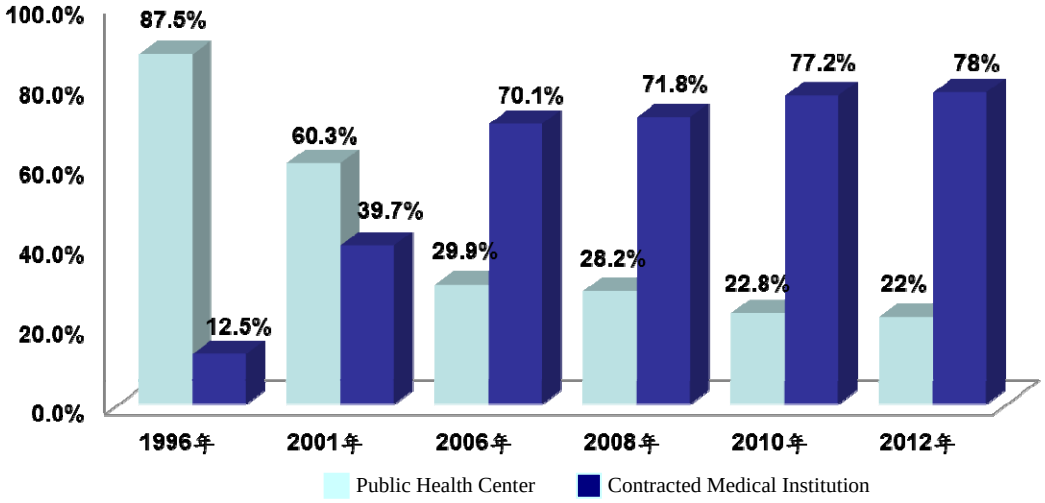

Figure 1. The share of routine vaccinations conducted by public health centers and contracted medical institutions

Note 1: Data was collected as of January 1, 2013, not including influenza vaccines and optional vaccines.
Note 2: The routine vaccines recorded in the dataset included a few self-funded doses.
Note 3: The public health centers in Taipei City no longer perform vaccination services. The volume of vaccinations in Taipei City included vaccination services in policlinics at public health centers operated by Taipei City Hospital.
Note 4: The vaccinations performed at elementary schools were not included in the statistics.

2. Deliberations and compensations of vaccine injury in Taiwan

Taiwan established the “Vaccine Injury Compensation Fund" in 1988. As of March 20, 2013, a total of 108 “Review Meetings of VICPWG" had been held to assess 1,285 applications. Among them, 498 applications were approved for compensation, with the compensation rate being 38.75%. Cumulative compensation was NT $ 63,533,637, with an average of NT $ 127,578 for each application.

For further analysis by vaccine (Figures 2 3), the vaccine against the 2009 H1N1 influenza virus accounted for the largest number of applications, followed by the seasonal flu vaccine, BCG, DTP, JE, PPV and 5 in 1 vaccine. However, for approved applications, BCG, 2009 H1N1 influenza vaccine, seasonal flu vaccine, DTP, and PPV were the top five. As for compensation, BCG had the highest amount of compensation in total, followed by DTP, seasonal flu vaccine, 2009 H1N1 influenza vaccine, and OPV.

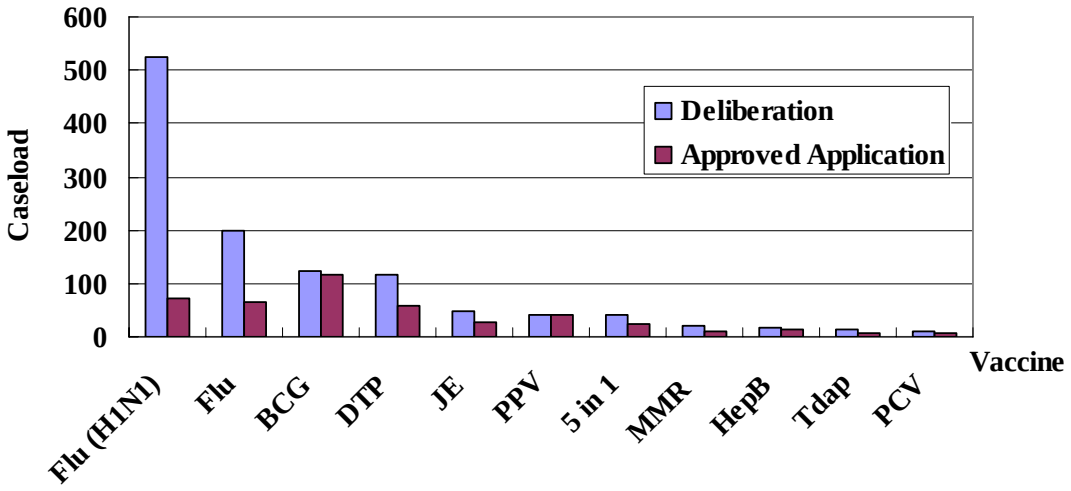

Figure 2. Deliberations and approved applications for vaccine injury compensation (from 1988 to March 20, 2013)

Note 1: For clearer presentation, the vaccines with fewer than 10 deliberations or with fewer than seven applications for injury compensations were not included in this chart.

Note 2: Abbreviation of vaccines:

Flu (H1N1): 2009 H1N1 influenza vaccine; Flu: Seasonal influenza vaccine;
BCG: Bacille Calmette-Guérin vaccine; DTP: diphtheria, tetanus, and pertussis vaccine;
JE: Japanese encephalitis vaccine; PPV: Pneumococcal polysaccharide vaccine;
5 in 1: Inactivated polio and haemophilus influenzae type b vaccine;
MMR: Measles, mumps and rubella vaccine; HepB: Hepatitis B vaccine;
Tdap: Tetanus, diphtheria toxoids and acellular pertussis vaccine;
PCV: Pneumococcal conjugate vaccine.

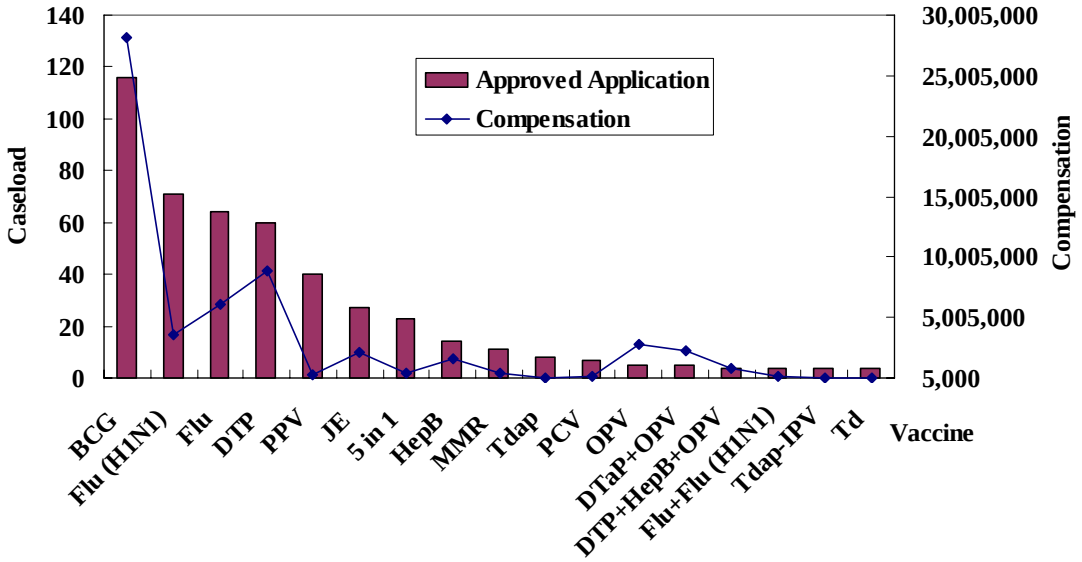

Figure 3. Applications and compensations for vaccine injury (from 1988 to March 20, 2013)

Note 1: For clearer presentation, the vaccines with fewer than four applications for injury compensations were not included in this chart.

Note 2: Abbreviation of vaccines:

BCG: Bacille Calmette-Guérin vaccine; Flu (H1N1): 2009 H1N1 influenza vaccine;
Flu: Seasonal influenza vaccine; DTP: Diphtheria, tetanus, and pertussis vaccine;
PPV: Pneumococcal polysaccharide vaccine; JE: Japanese encephalitis vaccine;
5 in 1: Inactivated polio and haemophilus influenzae type b vaccine;
HepB: Hepatitis B vaccine; MMR: Measles, mumps and rubella vaccine;
Tdap: Tetanus, diphtheria toxoids and acellular pertussis vaccine;
PCV: Pneumococcal conjugate vaccine; OPV: Oral polio vaccine;
DTaP: Diphtheria and tetanus toxoid with acellular pertussis vaccine;
IPV: Inactivated polio vaccine.

3. Analysis of vaccines with injury compensations in Taiwan annually

From 1989 to 2012, a total of 465 applications for vaccine injury compensation were deliberated in Taiwan (Figure 4). Among them, 295 applications were approved for compensation. We analyzed the annual compensation caseload of each vaccine and found that the compensation caseload of 5 in 1, BCG, DTP, JE, MMR, OPV, Tdap, and Tdap-IPV vaccines showed unusual upward trends in some years. A further analysis of these eight vaccines (Figure 5) revealed that the compensation caseload of 5 in 1 vaccine in 2010; BCG vaccine in 2008, 2009 and 2011; DTP vaccine in 1992; JE vaccine between 2008 and 2010; MMR vaccine in 2010; OPV in 1999; and Tdap vaccine in 2009 were more than other years.

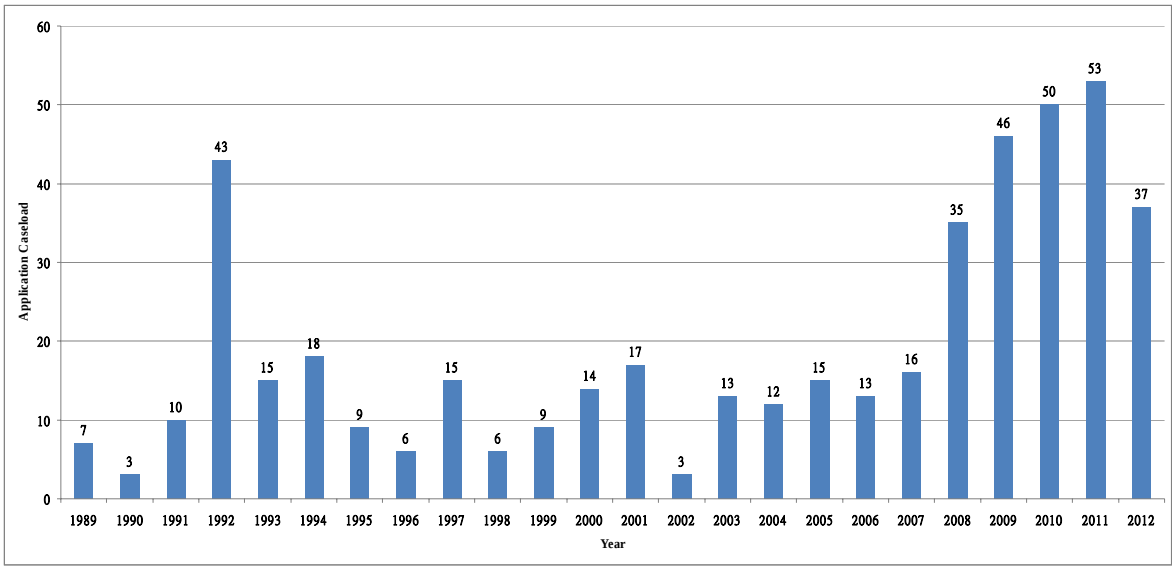

Figure 4. Annual applications for vaccine injury compensation (from 1989 to 2012)

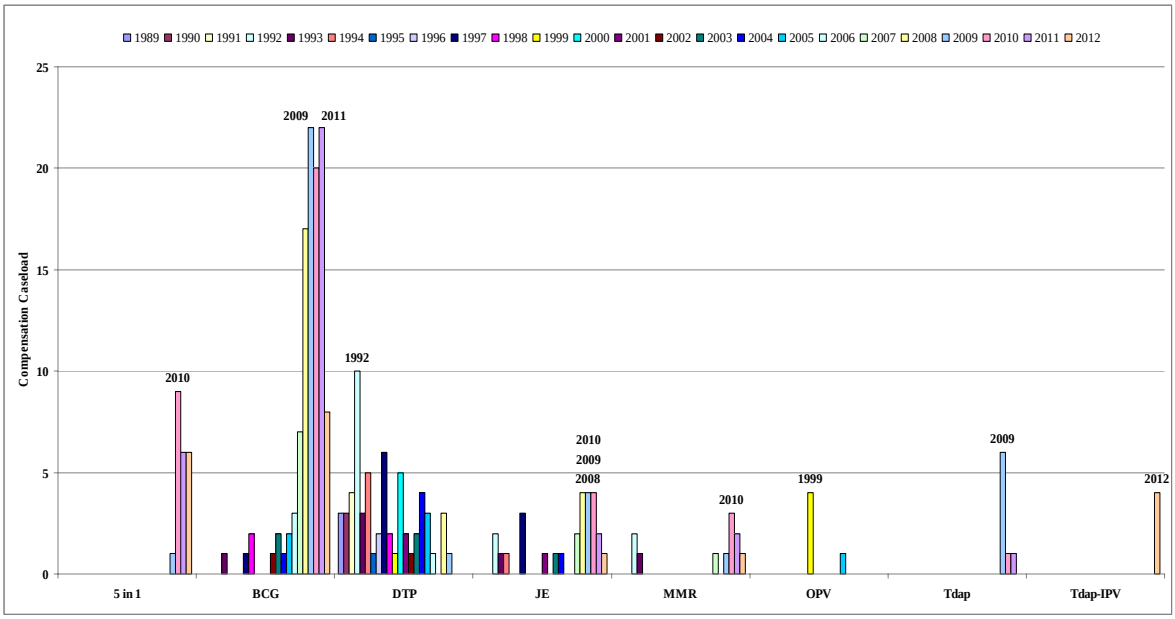

Figure 5. Annual injury compensations of eight vaccines (from 1989 to 2012)

4. Vaccination localities of annual cases who applied for vaccine injury compensations in Taiwan

To explore the evolution of vaccination services in public health centers and contracted medical institutions, we classified the vaccination localities as “public health centers”, “contracted medical institutions”, “schools”, and “vaccination stations” for further analysis of vaccine injury compensation cases from 1989 to 2012. The results (Figure 6) showed that the annual compensation caseload occurring at contracted medical institutions had been higher than the caseload occurring at public health centers since 2007, except in 1997.

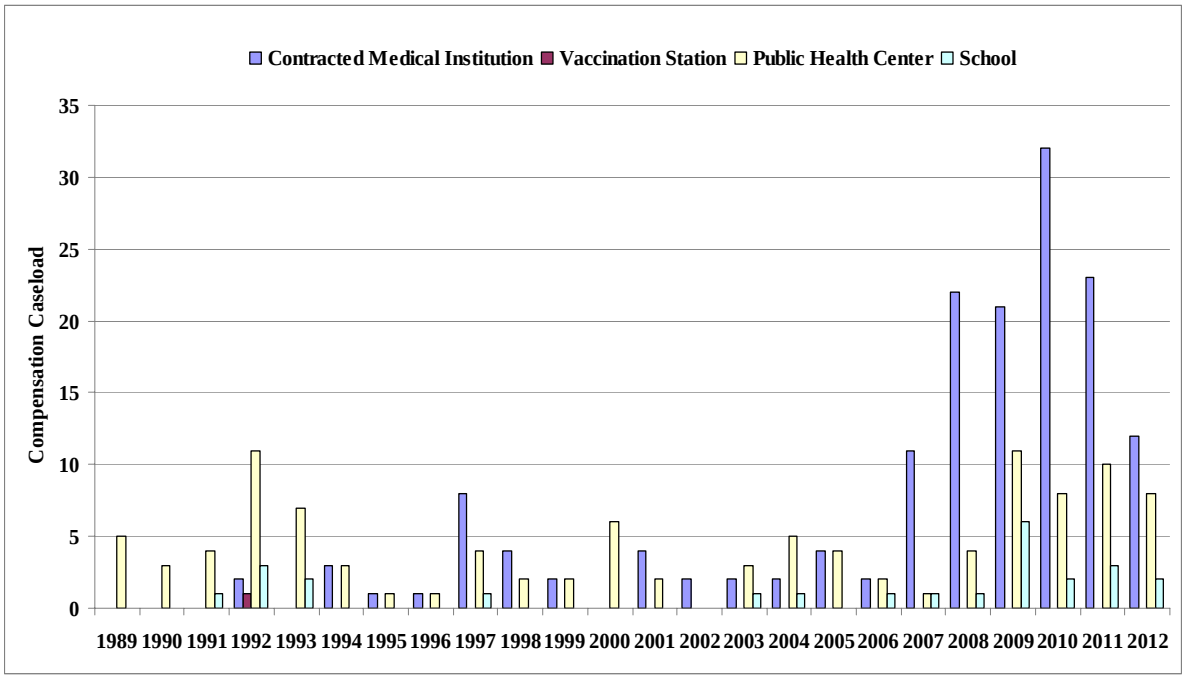

Figure 6. Vaccination localities of annual applications for vaccine injury compensations (from1989 to 2012)

5. Adverse reactions induced by seasonal influenza vaccine and 2009 H1N1 influenza vaccine

In response to the 2009 H1N1 influenza pandemic, Taiwan launched an immunization program against H1N1 influenza in 2009. The caseload of applications for vaccine injury compensations due to the 2009 H1N1 influenza vaccine in that year hit a highest record of 504 applications [5]. After deliberations, only 67 applications were approved since causal relations could not be ruled out based on the timing of their occurrence. However, the adverse reaction rate of this event at that time had a serious impact on citizens’ willingness to take seasonal influenza vaccine or EPI vaccines. Public awareness and concerns about vaccine safety increased significantly. The analysis in this study (Figure 7) indicated that the compensation caseload of seasonal influenza vaccine and EPI vaccines both peaked during 2009 and 2010, and started to subside after 2010.

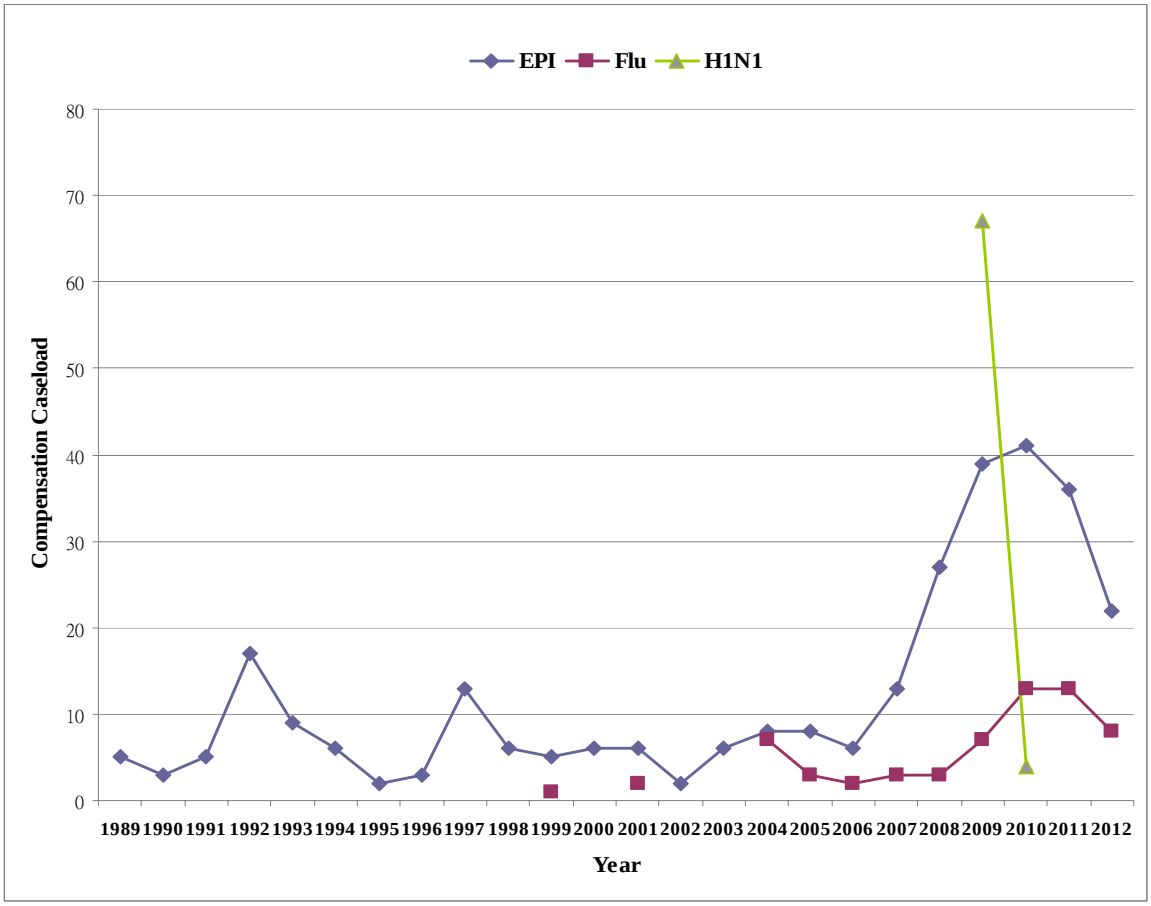

Figure 7. Annual compensation caseload of EPI vaccines, seasonal influenza vaccine and 2009 H1N1 influenza vaccine

Note: EPI: Tetanus, diphtheria toxoids, acellular pertussis and inactivated polio vaccine (Tdap-IPV); diphtheria and tetanus toxoid with acellular pertussis, inactivated polio and haemophilus influenzae type b vaccine (DTaP-Hib-IPV); Bacille Calmette-Guérin vaccine (BCG); diphtheria, tetanus, and pertussis vaccine (DTP); hepatitis B vaccine (HepB); Japanese encephalitis vaccine (JE); measles vaccine; rubella vaccine; measles, mumps and rubella vaccine (MMR); oral polio vaccine (OPV); tetanus and diphtheria toxoid for older children/adults (Td); Tetanus, diphtheria toxoids, and acellular pertussis vaccine (Tdap); tetanus toxoid (TT); varicella vaccine; Flu: seasonal influenza vaccine; H1N1: 2009 H1N1 influenza vaccine.

Discussion and recommendations

Taiwan has involved contracted medical institutions in providing vaccination services since 1988. As Taiwan's healthcare system evolved, services improved, and public health awareness rose, the vaccination rates for both EPI vaccines and other publicly funded vaccines for adults in contracted medical institutions have increased gradually, resulting in a declining share of the vaccination services conducted by public health centers year after year. To maintain Taiwan's high completion rates of routine vaccination, it is important to find ways to operate and promote the vaccination system effectively in the future. Health authorities have to adjust its role on the overall management and operation of public health, and strengthen the interaction and cooperation with contracted medical institutions, so that they can respond effectively to the public requirements for vaccination quality and increase public recognition and confidence in vaccination.

In Taiwan, BCG vaccine accounts for the largest number of approved applications and compensations of vaccine injuries. In Japan, MMR vaccine had the largest number of applications for publicly funded vaccine injury compensations, followed by BCG [4]. As for the United States, most applications for vaccine injury compensations were due to DTP vaccine in the 1990s. However, since the traditional diphtheria, tetanus, and pertussis vaccine (DTP) was replaced by Diphtheria and tetanus toxoid with acellular pertussis vaccine (DTaP), the applications for vaccine injury compensations had significantly declined [6].

The DTaP-Hib-IPV (5 in 1) was introduced into Taiwan as an optional vaccine in 2002, and was adopted as a routine publicly funded vaccine in 2010 [7], resulting in a large rise in the number of people who took the 5 in 1 vaccine in 2010 compared to previous years. That could be a possible factor for the increased caseload of vaccine injury compensations in 2010.

The Mycobacterial Laboratory of the Centers for Disease Control in Taiwan (Taiwan CDC) had developed differential diagnosis methods since 2002, providing bacteriological evidence that demonstrated clear and direct causality during the deliberations of BCG vaccine injury claims. Since 2008, Taiwan CDC has conducted active surveillance for adverse reactions induced by BCG vaccine. Hospitals were required by health authorities to notify culture-positive results of extrapulmonary tuberculosis in children under 5 years old and to increase test rates. Hence, the test rates of extrapulmonary tuberculosis specimens and strains from children under 5 increased from 19% in 2007 to 86% in 2008 and 94% in 2009 [10]. The active surveillance for adverse reactions induced by BCG vaccine was expanded to children under age 15 with extrapulmonary tuberculosis in 2010, and this surveillance was sustained to the end of 2011 [8]. These measures led to a rise in the detection rate of adverse reactions due to BCG vaccine and the number of compensation applications from 2008 to 2011. The approved applications were also increased. That suggested that applications and compensations were likely to be significantly affected by political factors.

There were more applications for compensations due to adverse reactions of DTP vaccine detected in 1992. The database showed that several suspected cases of sudden infant death syndrome after vaccination were reported near the end of 1992. Among them, 18 deaths occurred after DTP vaccination. This triggered public doubts about whether DTP vaccine induced sudden infant death syndrome at that time. Therefore, health authorities had conducted an investigation, but did not find significant causality. Some international literature also published reports about the correlation between DTP vaccine and sudden infant death syndrome with conclusions indicated there was no causally related but temporal coincidence [9-13].

Even though the compensation caseload of Tdap vaccine in 2009, MMR vaccine in 2010, and JE vaccine between 2008 and 2010 were more than previous years, the adverse reactions were limited and the prognosis was good. It was suggested that people were alerted to the adverse reactions related to the 2009 H1N1 influenza vaccine, sensitizing them to adverse reactions from other vaccines and leading to a rise in reported cases. This prompted the “Vaccine Injury Compensation Program” to reconsider the expansion of the compensation

standards. In addition, Taiwan had planned to provide Tdap instead of Td for elementary students at first grade, not only for providing tetanus and diphtheria toxoid vaccines but also for additional immunization to pertussis [14]. However, because of vaccine supply, the implementation was delayed and the Tdap vaccination for both first grade and second grade pupils was not completed till 2009, resulting in an increase in the applications for Tdap vaccine injury compensations in 2009. Among the eleven applications, eight were approved, including six injuries of cellulitis, one for painful swelling, and one for limbs edema, with the majority of adverse reactions being at local sites. That was also a main factor for the higher caseload of adverse reactions related to Tdap vaccine in 2009.

The findings in Figure 6 was consistent with Figure 1, which illustrated the amount of routine vaccinations conducted by public health centers and contracted medical institutions. It reflected that the higher the volume of vaccinations, the more the number of adverse reactions. The results also showed that the vaccine injuries occurred most frequently during 2008 and 2001, no matter in public health centers or in contracted medical institutions. This was not only because Taiwan began to engage in active surveillance for adverse reactions induced by BCG vaccine in 2008 so that the caseload of BCG vaccine injury compensations surged. The results also revealed that the adverse reactions related to 2009 H1N1 influenza vaccine had great impacts on public willingness to take routine vaccination, applications for vaccine injury compensations, and expansion of approved compensations. At that time, several countries faced the same impacts when promoting their 2009 H1N1 vaccination programs in response to the global pandemic [15-19].

Even though the 2009 H1N1 influenza vaccine accounted for the largest number of annual applications for vaccine injury compensations, BCG was the vaccine with both the largest number approved applications and compensations for vaccine injuries. This was because health authorities took active surveillance for adverse reactions induced by the BCG vaccine and improved laboratory identification so that the correlation between adverse reactions and vaccines could be confirmed to approve the compensations. Moreover, the National Vaccine Injury Compensation Program (VICP) and the Advisory Committee on Immunization Practices (ACIP) had discussed the vaccination age, immunization methods, vaccine strains, and inoculation skills several times, and had conducted research on the immunity of cases with adverse reactions. Besides the examination policies that would cause more applications for compensations, they tried to figure out if any other factor could make people be not suitable for the BCG vaccination, in order to avoid adverse reactions in advance. Since vaccination services have largely shifted to be performed in medical institutions, the focus of these services needs to be further reviewed and adjusted in order to find ways to monitor the post-vaccination adverse reactions promptly, to immediately intervene for cases with serious adverse reactions and to clarify the cause, to achieve the original goals of vaccine injury compensation, and to avoid the rumor of suspected vaccine reactions bringing negative impact on vaccination policies.

The review and analysis in this study demonstrated that medical institutions would be dominant in the future of vaccination service provision and post-vaccination interventions to deal with adverse reactions. Health authorities need to communicate and interact with medical institutions in establishing good policies, knowledge transmission, creating operating procedures for the public health business, and event responses. Furthermore, empowering medical institutions to strengthen their knowledge and willingness to participate in public health works, and maintaining the effectiveness of vaccination and disease prevention system in Taiwan, will be the issues we have to face.

The adverse reactions related to the 2009 H1N1 influenza vaccine prompted the public and the health authorities to be more concerned about vaccine injury compensations. Taiwan CDC has held several educational trainings for local health bureaus and distributed leaflets. The vaccination services and cases with post-vaccination adverse reactions have been substantially transferred to the contracted medical institutions. Therefore, it is recommended to enhance the training and education for contracted medical institutions in order to increase knowledge about pre-vaccination and post- vaccination, possible vaccine induced adverse reactions, and proper interventions.

We will conduct further analysis of victims who had approved vaccine injury compensations in the future. It is expected to establish clearer and more objective standards of evidence-base deliberation, in order to reduce the effects of policy change and extraordinary events.

Limitations

This study used descriptive analysis to assess the annual applications for vaccine injury compensations in Taiwan, but not for causes of adverse reactions by each vaccine or further correlation analysis. Also, the knowledge, attitude, behavior, and recommendations surveys of changes in the work regarding vaccine injury compensations for personnel in health authorities and medical institutions may be helpful to catch the overall profile of each role on vaccination services and their opinions, so that we are able to develop respond strategies based on this.

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A Survey of Specialist Physicians about the" Taiwan Guidelines for TB Diagnosis & Treatment" Issued by the Centers for Disease Control, Ministry of Health and Welfare

Chiao-Ni Wen[1, 2], Chi-Tai Fang[1, 2, 3], Pan-Chyr Yang[3, 4]

1. Ministry of Health and Welfare and National Taiwan University Infectious Diseases Research and Education Center
2. Institute of Epidemiology and Preventive Medicine, National Taiwan University
3. Department of Internal Medicine, National Taiwan University Hospital, National Taiwan University College of Medicine
4. National Taiwan University College of Medicine

Abstract

This survey collected opinions and feedback from pulmonologists, infectious disease specialists, and tuberculosis specialists on the "Taiwan Guidelines for TB Diagnosis & Treatment" issued by the Centers for Disease Control, Ministry of Health and Welfare（Taiwan CDC） and about the policy of tuberculosis (TB) management as a reference for future policy making. The study was approved by Research Ethics Committee, National Taiwan University Hospital, in advance. The anonymous questionnaires were sent to members of Taiwan Society of Pulmonary and Critical Care Medicine, The Infectious Diseases Society of Taiwan, and Taiwan Society of Tuberculosis from December 2012 to April 2013.

In total, 477 questionnaires were collected. Most respondents were attending physicians with more than five years of seniority or specialist physicians who were experienced in TB diagnosis and treatments. More than 85% of physicians believed the recommendations in the "Taiwan Guidelines for TB Diagnosis & Treatment " were helpful for diagnosis and treatment. Compared to other pulmonary or infectious diseases, 33.1% of the respondents reported being "very willing" or "willing" to continually provide TB treatments, while 13.8% reported being "never willing" or "unwilling" to keep providing TB treatments. Further analysis found that the significant factors which affected physicians' willingness to diagnose and treat TB cases were the "inspection and management of TB drug prescriptions" (OR 7.21, P <0.001) and "the load of medical paperwork" (OR 3.88, P = 0.001). Moreover, "the availability of assistance from epidemic preventing system in treating critical cases" was the significant factor that affected physicians' experience on TB diagnosis and treatment.

The "Taiwan Guidelines for TB Diagnosis & Treatment " did provide useful recommendations for most specialist physicians. Nevertheless, the authorities should pay more attention to the "inspection and management of TB drug prescriptions", the

“assistance from epidemic preventing system”, and the “rational load of medical paperwork,” and should keep improving and communicating with medical practitioners for their recognition and cooperation, thus further upgrading Taiwan’s quality of medical care for tuberculosis.

Keywords: tuberculosis, Guidelines for TB Diagnosis & Treatment, policy of tuberculosis management, opinion survey

Foreword

Tuberculosis, caused by *Mycobacterium tuberculosis*, is a major chronic infectious disease in the world. According to Global Tuberculosis Report 2012 issued by World Health Organization (WHO), there were an estimated 8.7 million new cases of TB and 1.4 million deaths from TB in 2011, mainly in undeveloped and developing countries. About 60% of the disease burden of TB was in the Southeast Asian and Western Pacific regions [1]. Thus, TB is an important global issue on public health, society, and economy. In Taiwan, TB is the notifiable disease with the highest annual case number and deaths. With the epidemic prevention measures gradually showing effects, especially under the "Directly observed treatment, short-course (DOTS) program" and "Halving TB incidence in a decade” initiative, TB epidemic has gradually declined from 16,000 new cases in 2005 to 12,600 in 2012 [2]. In view of the current TB control policy in Taiwan, there are still some dimensions which can be largely improved, such as the general unwillingness of medical institutions to treat TB cases, considerable doubts about the treatment of "latent tuberculosis infection (LTBI)" from medical practitioners, difficulty in curing cases infected with multidrug-resistant tuberculosis (MDR-TB); and complexity and difficulty involved in case management. All of these need the epidemic prevention authorities to target the problems and implement more effective strategies to further curb the TB epidemic in Taiwan.

Since the national health insurance system has been implemented, TB cases are no longer treated only by the assigned hospitals, but patients can choose any medical institutions countrywide. Therefore, guaranteeing every TB patient can access the standard and complete medical services, improving TB treatment success rate, and reducing the TB epidemic effectively have become important issues for TB control [3]. In order to make medical practitioners well informed about the main points of TB diagnosis and treatments and to effectively improve TB treatment success rate, the Taiwan CDC invited experts and referred to the WHO’s standard in TB diagnosis and treatments to compile the first edition of the “Taiwan Guidelines for TB Diagnosis & Treatment ” in 2004. So far, it has been updated to the fifth edition. The contents contain the essential dimensions of TB diagnosis and treatments, including elaborate basic knowledge of TB, diagnosis, treatments, anti-tuberculosis agents, and treatments of LTBI [4-5]. Specialist physicians can obtain the explicit recommendations of TB treatments with the guidelines.

In order to make all clinicians achieve the standard of TB treatments and avoid improper prescriptions that worsen patients' conditions, the epidemic prevention authorities have launched the "inspection and management of TB drug prescriptions" measure. Through this mechanism, the authorities invited experts in TB diagnosis and treatments to establish the TB Advisory Committee which helped clinicians to diagnose suspected TB cases or to treat refractory cases, and also provided consultation for TB relevant issues as a communicating channel between epidemic prevention system and medical practitioners. To motivate physicians to follow the Diagnosis and treatment guidelines and treating TB patients with appropriate prescriptions, the epidemic prevention authorities have also collaborated with National Health Insurance and Administration on administrative reviews to disallow the applications of medical expenses for improper TB prescriptions and have held educational trainings and case discussions to maintain a high quality of medical care [3].

Nevertheless, many clinicians have raised their doubts and objections to the "Taiwan Guidelines for TB Diagnosis & Treatment " and the "inspection and management of TB prescriptions" measure. To clarify the practicality of the "Taiwan Guidelines for TB Diagnosis & Treatment " and to gather medical profession's reflection on TB control policy, this study surveyed pulmonologists, infectious disease specialists and tuberculosis specialists as a reference for future revisions of the "Taiwan Guidelines for TB Diagnosis & Treatment " and relevant policy making.

Materials and Methods

The subjects of this study were mainly pulmonologists and tuberculosis specialists. The study was approved by Research Ethics Committee, National Taiwan University Hospital in advance. The anonymous questionnaires were sent via E-mail or print to members of Taiwan Society of Pulmonary and Critical Care Medicine, The Infectious Diseases Society of Taiwan, and Taiwan Society of Tuberculosis from December 2012 to April 2013. After filling out the questionnaires, the respondents returned their replies via the Internet or by post. The questionnaire was designed to cover seven topics, including professional background, experience in TB diagnosis and treatment, willingness to offer TB treatments, TB cases management, treatments for refractory TB cases, the inspection of TB prescriptions, and the opinions on the fourth edition of the "Taiwan Guidelines for TB Diagnosis & Treatment ". Except professional background and the opinions on the "Taiwan Guidelines for TB Diagnosis & Treatment ", the remaining five parts of the questionnaire used either three or five point scales.

We used SAS 9.2 statistical software to analyze survey responses. The respondents' backgrounds and the experience in TB diagnosis and treatment were demonstrated as descriptive data. Chi-square test was used for the distributions and correlation between respondents' backgrounds and their experience in TB diagnosis and treatment, and also for

the experience in TB diagnosis and treatment and the willingness to offer TB treatments, while univariate and multivariate logistic regression was used for analysis of the main factors associated with the respondents' backgrounds, their experience in TB diagnosis and treatment, and their willingness to offer TB treatments. The variables in the analysis were divided into two groups for performing binary logistic regression. We merged the three willingness levels of "no difference", "willing", and "very willing" into one group, and the other two willingness levels of "never willing" and "unwilling" were merged into another group. As for the experience in TB diagnosis and treatment, we combined the three accomplishment levels of "no difference", "rewarding" and "very rewarding" into one group, and the other two accomplishment levels of "very frustrated" and "frustrated" were combined into another group. In multivariate analysis, we adjusted for the statistically relevant variables of respondents' backgrounds and the experience in TB diagnosis and treatment. The statistically significant level was set at $P < 0.05$.

Results

We sent out a total of 2,228 questionnaires. The highest response rate was 27.5% (378 responses) from members of Taiwan Society of Pulmonary and Critical Care Medicine, while the lowest rate of 3.8% (19 responses) was from members of The Infectious Diseases Society of Taiwan. The survey had 477 responses in total from the three medical associations with an overall response rate of 21.4% (Table 1).

Table 1. The questionnaire collection by each medical association

Medical association	No. of questionnaires sent	No. of responses received	Response rate (%)
Taiwan Society of Pulmonary and Critical Care Medicine	1,377	378	27.5
Taiwan Society of Tuberculosis	351	80	22.8
The Infectious Diseases Society of Taiwan	500	19	3.8
Total	**2,228**	**477**	**21.4**

1. The respondents' backgrounds and the experience in TB diagnosis and treatment:

Among the 477 respondents, most had more than five attending years, were pulmonologists or internal medicine specialists, practiced in medical centers or regional hospitals; and had treated more than 10 TB patients within one year (Table 2). Compared with treating other pulmonary or infectious diseases, 33.6% of the respondents thought treating TB cases were "very rewarding" or "rewarding", but 14.5% felt "very frustrated" or " frustrated". About 33.1% of the respondents reported being "very willing" or "willing" to keep on treating TB cases, but 13.8% reported being "never willing" or "unwilling" to treat TB cases any more (Table 2).

Table 2. The respondents' backgrounds and the experience in TB diagnosis and treatment

Respondents' background	No. of respondents (N=477)	Proportion (%)
Seniority of attending years		
> 10 years	211	44.2
6 - 10 years	120	25.2
1 - 5 years	108	22.6
Fellow / Resident	35	7.3
Missing data	3	0.6
Specialist qualification (Multiple Choice)		
Pulmonologist	386	80.9
Infectious disease specialist	26	5.5
TB specialist	78	16.4
Internal medicine specialist	348	73
Pediatric specialist	8	1.7
Surgical specialist	20	4.2
Family medicine specialist	45	9.4
Thoracic and Cardiovascular Surgery Specialist	40	8.4
Missing data	3	0.6
Practicing place		
Medical center	154	32.3
Regional hospital	161	33.8
Local hospital	101	21.2
Clinic	57	11.9
Pharmacy	1	0.2
Missing data	3	0.6
Ever treating any TB patient within one year		
Yes, > 100 cases	9	1.9
Yes, 51- 100 cases	51	10.7
Yes, 11- 50 cases	226	47.4
Yes, 1- 10 cases	166	34.8
No	24	5
Missing data	1	0.2
Experience in TB treatment (Compared to other pulmonary or infectious diseases)		
Very rewarding	38	8.0
Rewarding	122	25.6
No difference	247	51.8
Frustrated	61	12.8
Very frustrated	8	1.7
Missing data	1	0.2
Willingness to offer TB treatments (Compared to other pulmonary or infectious diseases)		
Very willing	92	19.3
Willing	66	13.8
No difference	252	52.8
Unwilling	64	13.4
Never willing	2	0.4
Missing data	1	0.2

2. Cross-analysis of respondents' backgrounds and the experience in TB diagnosis and treatment:

For all respondents, greater seniority of attending years brought greater levels of rewarding feeling in TB treatment, and also higher willingness to offer TB treatments. Conversely, fellows or residents more likely felt frustrated in treating TB cases, and were less willing to offer TB treatments (statistically significant with P <0.001 and P = 0.003 respectively). Among all specialist physicians, TB specialists felt more rewarding in TB treatment and also reported greater willingness to offer TB treatments. On the contrary, infectious disease specialists were more likely felt frustrated in treating TB cases, and were less willing to offer TB treatments (statistically significant with P = 0.003 and P = 0.002, respectively). Moreover, of all respondents, those had treated more TB cases within one year felt significantly more rewarding in TB treatment (P < 0.001), and also significantly more willing to offer TB treatments (P < 0.001). Statistic results shown in Table 3 suggested that different practicing places for physicians had no significant correlation with the level of rewarding feeling in TB treatments (P = 0.216) or the degree of willingness to offer TB treatments (P = 0.058).

Table 3. Cross-analysis of respondents' backgrounds and the experience in TB diagnosis and treatment

Variables	The experience in TB diagnosis and treatment compared to other pulmonary or infectious diseases						*P* value	The willingness to offer TB treatments compared to other pulmonary or infectious diseases						*P* value
	Very rewarding or rewarding		No difference		Very frustrated or frustrated			Very willing or willing		No difference		Never willing or unwilling		
	No.	%	No.	%	No.	%		No.	%	No.	%	No.	%	
	160	33.3	247	52.2	69	14.5		158	33.1	252	53.3	66	13.6	
Seniority of attending years														
>10 years (n=211)	89	42.2	96	45.5	26	12.3	**< 0.001**	88	41.7	97	46.0	25	11.8	**0.003**
6-10 years (n=120)	37	30.8	69	57.5	14	11.7		40	33.3	62	51.7	18	15.0	
1-5 years (n=108)	27	25.0	59	54.6	22	20.4		22	20.4	69	63.9	17	15.7	
Fellow/Resident (n=35)	4	11.4	23	65.7	7	20.0		6	17.1	24	68.6	5	14.3	
Missing data	3		0		0			2		0		1		
Specialist qualification (Multiple Choice)														
Pulmonologist (n=386)	130	33.7	209	54.1	47	12.2	**0.003**	122	31.6	210	54.4	54	14.0	**0.002**
Infectious disease specialist (n=26)	8	30.8	10	38.5	8	30.8		10	38.5	13	50.0	3	11.5	
TB specialist (n=78)	37	47.4	31	39.7	9	11.5		42	53.8	30	38.5	5	6.4	
Internal medicine specialist (n=348)	119	34.2	189	54.3	40	11.5		123	35.3	187	53.7	38	10.9	
Other specialist (n=113)	28	23.1	60	49.6	24	19.8		27	22.3	63	52.1	22	18.2	
Missing data	3		0		0			1		0		2		
Practicing place														
Medical center (n=154)	45	29.2	79	51.3	30	19.5	**0.216**	51	33.1	80	51.9	23	14.9	**0.058**
Regional hospital (n=161)	60	37.3	86	53.4	15	9.3		65	40.4	80	49.7	16	9.9	
Local hospital (n=101)	31	30.7	55	54.5	15	14.9		21	20.8	62	61.4	18	17.8	
Clinic (n=57)	22	38.6	27	47.4	8	14.0		18	31.6	30	52.6	9	15.8	
Missing data	2		0		1			3		0		0		
Ever treating TB patients within one year														
≧51 cases (n=60)	34	56.7	17	28.3	9	15.0	**< 0.001**	37	61.7	15	25.0	8	13.3	**< 0.001**
11-50 cases (n=226)	84	37.2	118	52.2	24	10.6		68	30.1	138	61.0	20	8.9	
0-10 cases (n=190)	41	22.1	112	58.9	36	19.0		53	27.9	99	52.1	38	20.0	
Missing data	1		0		0			0		0		0		

[a] There was a missing value in the "experience in TB diagnosis and treatment" and the "willingness to offer TB treatments". In which a same missing value was in "ever treating TB patients within one year" and the "willingness to offer TB treatments".

3. Factors associated with respondents' experience in TB diagnosis and treatment and their willingness to offer TB treatments:

Table 4 showed a statistically significant correlation ($P = 0.015$) between feeling "very frustrated or frustrated in TB diagnosis and treatment compared to other pulmonary or infectious diseases" and the "assistance from epidemic prevention system in treating refractory TB cases". In addition, "never willing or unwilling to offer TB treatments compared to other pulmonary or infectious diseases infections" was significantly associated with "physicians' load of medical paperwork" ($P = 0.006$) and "inspection and management of TB drug prescriptions" ($P < 0.001$).

Table 4. Factors associated with respondents' experience in TB diagnosis and treatment and their willingness to offer TB treatments

The factors that affected the willingness to offer TB treatments	The experience in TB diagnosis and treatment compared to other pulmonary or infectious diseases						*P* value	The willingness to offer TB treatments compared to other pulmonary or infectious diseases infections						*P* value
	Very rewarding or rewarding		No difference		Very frustrated or frustrated			Very willing or willing		No difference		Never willing or unwilling		
	No.	%	No.	%	No.	%		No.	%	No.	%	No.	%	
	160	33.3	247	52.2	69	14.5		158	33.1	252	53.3	66	13.6	
Physicians' load of medical paperwork														
No influence (n=173)	65	37.6	86	49.7	22	12.7	**0.367**	68	39.3	90	52.0	15	8.7	**0.006**
Some influence (n=246)	79	32.5	132	53.7	34	13.8		74	30.1	136	55.3	36	14.6	
Great influence (n=56)	15	26.8	29	51.8	12	21.4		15	26.8	26	46.4	15	26.8	
Missing data	1		0		1			1		0		0		
Inspection and management of TB drug prescriptions														
No influence (n=148)	58	39.2	74	50.0	16	10.8	**0.085**	61	42.0	77	52.0	10	6.8	**<0.001**
Some influence (n=280)	90	32.1	150	53.6	40	14.3		81	28.9	158	56.4	41	14.7	
Great influence (n=47)	12	25.5	23	48.9	12	25.6		15	31.9	17	36.2	15	31.9	
Missing data	0		0		1			1		0		0		
Assistance from epidemic prevention system in treating refractory TB cases														
No influence (n=65)	25	38.5	38	58.4	2	3.1	**0.015**	30	46.2	30	46.2	5	7.6	**0.070**
Some influence (n=249)	89	35.7	116	47.0	43	17.3		81	32.5	128	51.4	40	16.1	
Great influence (n=161)	46	28.6	23	57.7	22	13.7		46	28.6	94	58.4	21	13.0	
Missing data	0		0		2			1		0		0		
Assistance from medical professions in treating refractory TB cases														
No influence (n=74)	32	43.2	31	41.9	11	14.9	**0.336**	31	41.9	35	47.3	8	10.8	**0.316**
Some influence (n=249)	82	32.9	131	52.6	36	14.5		81	32.5	129	51.8	39	15.7	
Great influence (n=147)	44	29.9	82	55.8	21	14.3		43	29.3	85	57.8	19	12.9	
Missing data	2		3		1			3		3		0		

[a] There was a missing value in the "experience in TB diagnosis and treatment" and the "willingness to offer TB treatments". The same case had missing values in "inspection and management of TB drug prescriptions", "assistance from medical professions in treating refractory TB cases" and the "experience in TB diagnosis and treatment"; another same case had missing value in "inspection and management of TB drug prescriptions", "assistance from epidemic prevention system in treating refractory TB cases", "assistance from medical professions in treating refractory TB cases", "physicians' load of medical paperwork" and the "willingness to offer TB treatments".

4. Multivariate logistic regression analysis for factors associated with the respondents' experience in TB diagnosis and treatment, and their willingness to offer TB treatments:

Table 5 showed the crude odds ratio (OR) for the odds of feeling "very frustrated and frustrated" in the. experience in TB diagnosis and treatment compared to other pulmonary or infectious diseases was 2.83 ($P = 0.015$) between those reporting "great influence" and those reporting "no influence" regarding the effect of the "inspection and management of TB drug prescriptions" measure on their willingness to offer TB treatments. After adjusting for the two variables of "seniority of attending years" and "the number of treated TB patients within one year", the OR remained 2.52 ($P = 0.031$). The crude OR for the odds of feeling "never willing and unwilling" to offer TB treatments compared to other pulmonary or infectious diseases infections was 2.37 ($P = 0.019$) between those reporting "some influence" and those reporting "no influence" regarding the effect of the "inspection and management of TB drug prescriptions" measure on their willingness to offer TB treatments, and the odds ratio was 6.47 ($P < 0.001$) between those reporting "great influence" and those reporting "no influence" regarding the effect of the "inspection and management of TB drug prescriptions" measure. After adjusting for the two variables of "seniority of attending years" and "the number of treated TB patients within one year", the OR remained as high as 2.63 ($P = 0.011$) and 7.21 ($P < 0.001$), respectively. These results revealed that "inspection and management of TB drug prescriptions" had significant influence on "frustrating experience in TB diagnosis and treatment" and the "willingness to offer TB treatments" for some physicians.

Table 5. Multivariate logistic regression analysis for factors associated with the respondents' experience in TB diagnosis and treatment, and their willingness to offer TB treatments

The factors that affected the willingness to offer TB treatments	The experience in TB diagnosis and treatment compared to other pulmonary or infectious diseases: [a](Very frustrated + frustrated) / (No difference + rewarding + very rewarding)				The willingness to offer TB treatments compared to other pulmonary or infectious diseases infections: [b](Never willing + unwilling) / (No difference + willing + very willing)			
	crude OR	*P* value	[c]OR	*P* value	crude OR	*P* value	[c]OR	*P* value
Physicians' load of medical paperwork								
No influence (Reference base)	1.0		1.0		1.0		1.0	
Some influence VS. No influence	1.10 (0.62-1.96)	0.744	0.96 (0.54-1.74)	0.903	1.81 (0.96-3.41)	0.069	1.78 (0.92-3.45)	0.088
Great influence VS. No influence	1.87 (0.86-4.09)	0.115	1.66 (0.75-3.67)	0.207	3.85 (1.74-8.52)	<0.001	3.88 (1.71-8.81)	0.001
Inspection and management of TB drug prescriptions								
No influence	1.0		1.0		1.0		1.0	
Some influence VS. No influence	1.38 (0.74-2.55)	0.312	1.32 (0.71-2.47)	0.371	2.37 (1.15-4.87)	0.019	2.63 (1.23-5.63)	0.011
Great influence VS. No influence	2.83 (1.23-6.53)	0.015	2.52 (1.08-5.91)	0.031	6.47 (2.67-15.71)	<0.001	7.21 (2.85-18.25)	<0.001
Assistance from epidemic prevention system in treating refractory TB cases								
No influence	1.0		1.0		1.0		1.0	
Some influence VS. No influence	6.57 (1.55-27.90)	0.011	6.76 (1.57-29.03)	0.010	2.30 (0.87-6.08)	0.094	3.34 (1.13-9.91)	0.029
Great influence VS No influence	5.25 (1.20-22.90)	0.028	5.04 (1.14-22.29)	0.033	1.80 (0.65-5.00)	0.259	2.42 (0.78-7.46)	0.123
Assistance from medical professions in treating refractory TB cases								
No influence	1.0		1.0		1.0		1.0	
Some influence VS. No influence	0.97 (0.47-2.01)	0.930	1.05 (0.50-2.22)	0.908	1.53 (0.68-3.44)	0.302	2.09 (0.88-5.00)	0.088
Great influence VS. No influence	0.95 (0.43-2.10)	0.908	0.91 (0.40-2.03)	0.806	1.22 (0.51-2.95)	0.652	1.42 (0.56-3.60)	0.443

[a] The three accomplishment levels of "no difference", "rewarding" and "very rewarding" were merged into one group, and the other two accomplishment levels of "very frustrated" and "frustrated" were merged into another group.

[b] The three willingness levels of "no difference", "willing", and "very willing" were merged into one group, and the other two willingness levels of "never willing" and "unwilling" were merged into another group.

[c] The OR of the two variables of "seniority of attending years" and "the number of treated TB patients within one year" in multivariate analysis were adjusted.

Table 5 also showed the crude OR for the odds of feeling “very frustrated and frustrated” in the experience in TB diagnosis and treatment compared to other pulmonary or infectious diseases was 6.57 (P = 0.011) between those reporting “some influence” and those reporting “no influence” regarding the effect of assistance from epidemic prevention system in treating refractory TB cases on their willingness to offer TB treatments, whereas the odds ratio was 5.25 (P = 0.028) between those reporting “great influence” and those reporting “no influence” regarding the effect of “assistance from epidemic prevention system in treating refractory TB cases.” After adjusting for the two variables of "seniority of attending years" and "the number of treated TB patients within one year", the OR remained as high as 6.76 (P = 0.010) and 5.04 (P = 0.033), respectively. The crude OR for the odds of feeling “never willing and unwilling” to offer TB treatments compared to other pulmonary or infectious diseases infections was 3.85 (P < 0.001) between those reporting “great influence” and “no influence” regarding the effect of “physicians’ load of medical paperwork” on their willingness to offer TB treatments. After adjusting for the two variables of "seniority of attending years" and "the number of treated TB patients within one year", the OR remained 3.88 (P = 0.001). These results revealed that “assistance from epidemic prevention system in treating refractory TB cases” and “physicians’ load of medical paperwork” had significant influence on “frustrating experience in TB diagnosis and treatment” and the “willingness to offer TB treatments” for some physicians.

5. The evaluation of the “Taiwan Guidelines for TB Diagnosis & Treatment ” by the respondents based on their profession and experience:

Among the respondents, 90.4% believed that the recommendations for the side effects of the anti-tuberculosis drugs in the “Taiwan Guidelines for TB Diagnosis & Treatment ” were very helpful or helpful. There were 85.2% of the respondents who believed that the guidelines were very helpful or helpful for the treatment of drug-resistant TB (Table 6). The results indicated that most physicians could get effective recommendations for TB diagnosis and treatment from the “Taiwan Guidelines for TB Diagnosis & Treatment”. However, in the fourth edition of the “Taiwan Guidelines for TB Diagnosis & Treatment”, lots of respondents thought that Chapter IV (12.2%), Chapter V (10.9%), Chapter VI (8.6%) and Chapter X (13.1%) needed to be written and compiled more clearly, and Chapter IV (9.2%), Chapter V (7.6%) and Chapter X (11.0%) were difficult to put into practice. This study provided relevant comments and feedback to the health authorities and served as a reference for future revisions of the “Taiwan Guidelines for TB Diagnosis & Treatment”.

Table 6. The evaluation of the “Diagnosis and treatment guidelines of tuberculosis” by the respondents

Questions in the questionnaire	No. of respondents(N=477)	Proportion (%)
Are the recommendations for the side effects of the anti-tuberculosis drugs in the “Taiwan Guidelines for TB Diagnosis & Treatment” helpful in treating TB patients?		
Very helpful	91	19.1%
Helpful	340	71.3%
No comments	21	4.4%
Not very helpful	23	4.8%
Not helpful at all	1	0.2%
Missing data	1	0.2%
Are the recommendations for the treatment of drug-resistant TB in the “Taiwan Guidelines for TB Diagnosis & Treatment” helpful in treating TB patients?		
Very helpful	79	16.6%
Helpful	327	68.6%
No comments	41	8.6%
Not very helpful	25	5.2%
Not helpful at all	4	0.8%
Missing data	1	0.2%

6. The evaluation of the "inspection and management of TB drug prescriptions" by the respondents:

Of the respondents, 70% thought the current "post-prescription review of medical records by TB experts to make physicians propose explanation for prescription deficiencies" was "appropriate" or "very appropriate" accounted for 70.0%; 23.7% had no comments; and 5.4% thought it was "inappropriate" or "very inappropriate". For the measure of "disallowing the applications of improper medical expenses for cases that violated the principles of TB diagnosis and treatment", only 30.8% of the respondents believed it was "appropriate" or "very appropriate"; 31.0% had no comments; and 37.1% thought it was "inappropriate" or "very inappropriate" (Table 7).

Table 7. The evaluation of the various schemes of the "inspection and management of TB drug prescriptions" by the respondents

Items in the questionnaire	No. of respondents (N=477)	Proportion (%)
Post-prescription review of medical records by TB experts to make physicians propose explanation for prescription deficiencies		
Very appropriate	84	17.6%
Appropriate	250	52.4%
No comments (neutral)	113	23.7%
Inappropriate	22	4.6%
Very inappropriate	4	0.8%
Missing data	4	0.8%
Disallow the applications of improper medical expenses for cases that violated the principles of TB diagnosis and treatment		
Very appropriate	29	6.1%
Appropriate	118	24.7%
No comments (neutral)	148	31.0%
Inappropriate	129	27.0%
Very inappropriate	48	10.1%
Missing data	5	1.0%
More clearly define the common conditions which are applicable standard prescriptions and the exceptions of clinicians' discretion based on individual patient's condition in the "Taiwan Guidelines for TB Diagnosis & Treatment"		
Very appropriate	108	22.6%
Appropriate	282	59.1%
No comments (neutral)	75	15.7%
Inappropriate	9	1.9%
Very inappropriate	0	0.0%
Missing data	3	0.6%
Physicians report refractory cases to nosocomial TB management committee for making medical decisions and leaving written records for physicians to follow		
Very appropriate	78	16.4%
Appropriate	273	57.2%
No comments (neutral)	101	21.2%
Inappropriate	16	3.4%
Very inappropriate	3	0.6%
Missing data	6	1.3%

For other possible solutions, Table 7 showed that a high proportion of respondents agreed that the Taiwan CDC should more clearly define the common conditions which are applicable standard prescriptions and the exceptions of clinicians' discretion based on individual patient's condition in the "Taiwan Guidelines for TB Diagnosis & Treatment" (81.7% believed it would be "appropriate" or "very appropriate"; 15.7% had no comments;

and only 1.9% thought it would be “inappropriate”). As for the other scheme of “reporting refractory cases to nosocomial TB management committee for making medical decisions and leaving written records for physicians to follow”, results were similar to those regarding “post-prescription review” (73.6% believed it would be “appropriate” or “very appropriate”; 21.2% had no comments; and 4.0% thought it would be “inappropriate” or “very inappropriate”).

Discussion

The most effective way of TB control is to block the infection chain. Early detection, providing a standardized medical care for patients, and improving treatment success rate can reduce the infection sources in the community. Thus, the quality of TB diagnosis and treatment is an important part of epidemic prevention. Undeniably, there are difficulties and uncertainties to treat tuberculosis, especially for cases with side effects or multi-drug resistant. In order to ensure the quality of TB treatment and take patients’ individual differences into account, Taiwan CDC, took TB experts’ recommendations to compile the “Taiwan Guidelines for TB Diagnosis & Treatment”, and constantly collected feedback and refined the contents of the guidelines to meet the needs of both physicians and patients. This study collected the opinions and feedback from 477 specialist physicians on the fourth edition of the “Taiwan Guidelines for TB Diagnosis & Treatment”. It is found that more than 85% of the physicians believed that the recommendations in the “Taiwan Guidelines for TB Diagnosis & Treatment” for treating patients with side effects of the anti-tuberculosis drugs and for the treatment of drug-resistant TB were very helpful or helpful. The results indicated that most physicians could get useful information about TB diagnosis and treatment from the guidelines.

To maintain the quality of TB prescriptions, the epidemic prevention authorities collaborated with National Health Insurance and Administration on administrative reviews of TB prescriptions to disallow the applications of medical expenses for improper TB prescriptions. However, this policy also increased physicians’ work load. These guidelines are not applicable to some refractory TB patients due to comorbidities or drug allergy, so that clinicians will put the patients’ individual conditions as a top priority, while the epidemic prevention system usually prioritizes the overall performance of public health. These two approaches are not always consistent, and both sides often have different opinions on inspection of prescriptions. Moreover, the epidemic prevention system is only concerned about the administrative indicators even when physicians bear the legal responsibility of toxicity from standard prescription medications in some cases. That may affect physicians’ willingness to offer TB treatments. The authorities should face the negative feedback on the “inspection and management of TB drug prescriptions” from some physicians, and continue to seek balance between epidemic prevention and social acceptance. More clearly defining the common conditions which are applicable standard prescriptions and the exceptions of clinicians’ discretion based on individual patient's condition in the future revision of the “Taiwan Guidelines for TB Diagnosis & Treatment” may be a feasible solution.

The results of this study also revealed that “assistance from epidemic prevention system

in treating refractory TB cases" had significant influence on the experience in TB diagnosis and treatment for some physicians. If the epidemic prevention officers can offer information about treating refractory TB cases to clinicians about past prescriptions, sputum culture results, antimicrobial susceptibility, and medication compliance at clinical attending, that will be greatly helpful for TB diagnosis and treatment. In addition, we found that "physicians' load of medical paperwork" had significant influence for some physicians on their willingness to offer TB treatments". The authorities should pay attention to the "assistance from epidemic preventing system" and the "rational load of medical paperwork" and should keep improving and communicating with medical practitioners for their recognition and cooperation, thus further upgrading Taiwan's quality of medical care for tuberculosis.

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