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PATIENT-REPORTED OUTCOMES

A Multilevel Analysis of Regional and Individual Effects on Methadone Maintenance Treatment in Taiwan

Chia-Yu Chen, MA[1], Shuo-Yen Ting, MD, MS[2], Happy Kuy-Lok Tan, MD, MPH, MHS[3], Ming-Chin Yang, DrPH[1,4,]*

[1]*Institute of Health Policy and Management and* [2]*Department of Health, Chang-Hua Hospital, Executive Yuan, Puxin Township, Changhua County, Taiwan;* [3]*Department of Health, Taoyuan Mental Hospital, Executive Yuan, Taoyuan, Taoyuan County, Taiwan;* [4]*Department of Public Health, College of Public Health, National Taiwan University, Taipei, Taiwan*

ABSTRACT

Objective: This study evaluated the direct and interactive effects of regional-level and individual-level characteristics on methadone maintenance treatment (MMT), after considering the individual characteristics in Taiwan. **Methods:** This study utilized a survey research method. Opioid-dependent patients who participated in the outpatient MMT program in 2009 and met the eligibility criteria were recruited from five hospitals. The impact of MMT on self-perceived health was assessed by using questionnaires. This study assessed the participants' quality of life and treatment outcomes during 3-month follow-up visits, before evaluating the direct effects of regional and individual characteristics. Multilevel linear models were used to estimate whether regional levels influenced individual behavior and treatment outcomes. **Results:** Three hundred thirty-four opioid-dependent patients agreed to participate in this study. After the follow-up period, 127 participants completed the study (completion rate = 38%). Participants receiving MMT demonstrated significant improvements in psychological state, HIV risk-taking behavior, social functioning, and health. Regional characteristics, such as the lower than junior high school rate, low-income family rate, and related crime rates, of the study regions were negatively associated with improvements in drug abuse behavior. **Conclusions:** This study shows that MMT can significantly improve the HIV risk-taking behavior and health of the study participants. Disadvantaged regions, however, exhibit poor treatment outcomes. This study suggests actions to minimize the treatment variations between regions.

Keywords: methadone maintenance treatment, multilevel analysis, neighborhood disadvantage, treatment outcome.

Introduction

Heroin use is one of the most damaging and serious social problems [1], and it is associated with increased violence and criminal activities. The greatest concern, however, is blood-borne viral infections transmitted through sharing contaminated injecting equipment [2,3]. Methadone maintenance treatment (MMT) is used worldwide to reduce heroin use effectively and safely. Numerous studies have shown that MMT can improve addicts' behavior and treatment outcome [4]. Most studies, however, only evaluated and compared drug treatment programs [5,6] without investigating using multilevel analysis how geographically varied treatment influences individual behavior and treatment outcomes.

Numerous studies have shown that social environment affects health outcomes [7]. *Neighborhood contextual effects* refer to local environmental influences on individual health. Robert [8] delineated the relationship between neighborhood socioeconomic status and health as follows. First, neighborhood effects may influence an individual's socioeconomic status, such as education, work, and income. Second, neighborhood effects may influence the shared environment, causing different health outcomes. Pickett and Pearl [7] reviewed 25 studies considering individual socioeconomic status and concluded that neighborhood-level characteristics have an independent effect on individual-level health outcomes. Several studies have determined that social environmental factors affect mental health and drug use [9–12], and a few have established a relationship between neighborhood poverty and heroin use [11,13,14]. Although limited research considered the neighborhood effects on treatment and intervention outcomes [15,16], no studies have examined the influence of the treatment region on individual behaviors and MMT outcomes.

The Department of Health in Taiwan implemented MMT, and since 2006 has subsidized patients on MMT. As a result, the AIDS contraction rate among addicts fell from 62% in 2006 to 11% in 2009. Despite a government report in 2010 announcing a decline in heroin-addicted AIDS patients [17], only one study has demonstrated the effectiveness of MMT in Taiwan [18]. Whether

Conflicts of Interest: The authors have indicated that they have no conflicts of interest with regard to the content of this article.

* *Address correspondence to:* Ming-Chin Yang, Department of Public Health, Institute of Health Policy and Management, College of Public Health, National Taiwan University, No. 17, Xu-Zhou Road, Room 637, Taipei 100, Taiwan.

E-mail: mcyang637@ntu.edu.tw.

1098-3015/$36.00 – see front matter

doi:10.1016/j.jval.2011.11.010

individual behaviors and MMT outcomes are influenced by region is unknown. Therefore, this study evaluated the direct and interactive effects of regional and individual characteristics on MMT, after considering individual characteristics in Taiwan.

Methods

Study sample

This study utilized a survey research method. Opioid-dependent patients who used MMT were selected from five hospitals in Taiwan for this study. Five hospitals with the largest patient populations in northern, central, and southern Taiwan were selected, and institutional review board approval to disseminate the questionnaire was obtained. Opioid-dependent patients who enrolled for the first time in outpatient methadone maintenance programs between June 1, 2009, and September 15, 2009, who met the eligibility criteria, were recruited into the study. On signing the informed consent form, participants were interviewed by case managers to assess the impact of MMT on self-perceived health. Case managers from each hospital attended a half-day training course to ensure interrater reliability.

The inclusion criteria for selecting participants were as follows: 1) must currently be an opioid-dependent patient; 2) aged 18 to 65 years; 3) deemed by a doctor to have sufficient mental competence to provide informed consent; 4) physically capable of participating in research assessments; 5) have signed the informed consent form; (6) reside near a medical treatment site; and 7) be willing to undergo a follow-up assessment after 3 months. The exclusion criteria eliminated subjects who 1) were diagnosed with severe cognitive impairment or mental retardation; 2) had serious behavioral disturbances or psychiatric symptoms; 3) were unable to attend treatment during the study period; 4) were currently receiving other opiate dependence treatment; and 5) were pregnant or had recently given birth [19].

Measures

This study used two validated questionnaires. Taiwan's 28-item version of the World Health Organization Quality of Life - Brief version (WHOQOL-BREF) questionnaire was used to assess the quality of life (QOL) at baseline and at follow-up 3 months later. This questionnaire uses a multiattribute scale to measure four main categories: physical health, psychological state, social and personal relationships, and environment [20]. The WHOQOL-BREF-TW comprises 28 items; of these, one item measures each of the 24 facets, 2 items measure area-specific questions, and 2 items measure the overall QOL and health. After reverse-coding positive items, scores for each of the four domains were calculated by multiplying the average sum of all items in the scale. The item scores were rated by using a five-point scale, with a higher score indicating a better QOL. Each domain score ranged from 4 to 20 points. In addition, the questionnaire included two self-assessment questions of overall satisfaction. The scores ranged from 0 to 100, with higher scores indicating higher satisfaction among participants.

Heroin use and self-perceived health were measured by using the opiate treatment index (OTI). The OTI scale was used to assess the results of drug treatment. The assessment comprised six independent outcomes: drug use, HIV risk-taking behavior, social functioning, criminality, health status, and psychological adjustment [21–24]. The drug use assessment asked participants when their three most recent days of drug use occurred and the drug quantify used on the last two occasions. These variables were used to calculate an average amount per day (Q), with the higher the value the greater the intake. The equation to calculate Q was as follows:

$$Q = \frac{q_1 + q_2}{t_1 + t_2}$$

where

Q is the average amount per day,

q_1 is the amount consumed during the last occasion of use,

q_2 is the amount consumed during the second last occasion of use,

t_1 is the interval between the last day of drug use and the next to last day of use, and

t_2 is the interval between the second and third last days of drug use.

The HIV risk-taking behavior section measures whether participants risk HIV and other blood-borne viruses through their injecting behavior, including needle use and sexual behavior. The social functioning section contains questions on aspects of social integration, such as employment, residential stability, and interpersonal conflicts. The criminality section measures self-reported recent criminal activity. The health status section comprises a symptom checklist to assess the participants' health. The psychological adjustment section assesses participants' current psychological state. These domains are the cumulative scores of poor condition. The total scores were calculated by summing up scores for all the items in each domain. Higher scores indicated that participants were more severely disabled. The values of content validity of the Chinese version of OTI were as follows: suitability 4.66, clarity 3.98, and usability 3.80. The morphine agreement rate was 86.1%, and the amphetamine urine agreement rate was 80.18%. The Cronbach's alpha of reliability ranged between 0.587 and 0.972 [25].

Variables

Dependent variable OTI scores were calculated by subtracting the posttest OTI scores from the pretest OTI scores. Greater difference indicated more favorable improvement. The individual-level variables included age, marriage, QOL scores (WHOQOL), satisfaction with overall QOL (WHOQOL), satisfaction with overall health (WHOQOL), HIV risk-taking behavior (OTI), social functioning (OTI), health status (OTI), and psychological adjustment (OTI). Age was represented by two dummy variables: less than 30 years old and more than 40 years old. Participants aged between 31 and 40 years comprised one reference group. Marital status was represented by two dummy variables: 1) married and 2) divorced or widowed. Unmarried participants formed another reference group. The QOL score was calculated by summing up the scores for the four domains of WHOQOL. The four OTI scores were the sum of the scores for each domain. Regional-level data were constructed by using variables from the 2008 Taiwan Census. The variables included in the data set were as follows: percentage of people with a lower than junior high school level education, percentage of low-income families, and related crime rates. These variables were selected on the basis of previous theoretical and empirical research. All variables were initially constructed as percentages.

Statistical analysis

This study used multiple regression and multilevel linear regression models to analyze the data. SAS (SAS System for Windows, Version 9.2, [SAS Institute Inc., Cary, NC], and HLM, Version 6.02 [Scientific Software International, Inc., Lincolinwood IL]) statistical packages were used to conduct analysis. Chi-square tests and independent *t* tests were conducted to examine the bivariate association between all outcome predictors (individual and regional) and the improved OTI score from the previous 3 months. This process helped determine how indicators were entered into the model. The variables entered into multiple regression models were based on significant bivariate relationships.