ORIGINAL ARTICLE

Faith-based intervention, change of religiosity, and abstinence of substance addicts

Jerf W.K. **Yeung** iD

Department of Social and Behavioural Sciences, City University of Hong Kong, Kowloon, Hong Kong, China.

Objective: To investigate the effects of developing religiosity on abstinence of substance abuse among recovering addicts in a faith-based and a secular-based treatment program.

Methods: Religiosity of recovering addicts was measured using the 38-item Brief Multidimensional Measure of Religiousness/Spirituality at three points in time: at initiation of substance addiction treatment (wave 1), discharge from treatment (wave 2), and 6 months after treatment (wave 3). Latent growth curve modeling was used to assess the dynamic and developing effects of religiosity on after-treatment abstinence. Secular-based treatment emphasized the role of biological, psychological, and environmental determinants of substance abuse and provided detoxification interventions, such as counseling and group therapies, skill training, health care, and social support, however also relying on religious and spiritual growth to help recovery. Faith-based treatment fundamentally emphasized the Christian theory of addiction to consider substance abuse a sin caused by one's spiritual void and separation from God, although it also acknowledged the importance of biological, psychological, and social needs of rehabilitants.

Results: Recovering addicts in faith-based treatment had significantly higher levels of religiosity at each wave (intercept factor) and better religious development across the three waves (slope factor). This contributed to after-treatment abstinence and mediated the effect of treatment mode on after-treatment abstinence.

Conclusion: Service practitioners and researchers should note the importance of dynamic and developing nature of religiosity in relation to the maintenance of abstinence after treatment is completed.

Keywords: Faith-based treatment; secular-based treatment; religiosity; after-treatment abstinence

Introduction

Substance abuse is a worldwide public health problem that entails massive social costs derived from violence, criminality, disease, public security, health care, judicial burden, and economic losses.[1,2] Once addicted, substance abusers may face tremendous difficulty overcoming habitual use. Research has reported high relapse rates of substance abuse after treatment, ranging from 35 to 81.8%.[3,4] In fact, attainment of abstinence is complicated, and much research is needed.[2,5] Recently, a strategy of full-life transformation used in faith-based treatment to help substance addicts attain complete abstinence has attracted attention.[6,7] Secular-based treatment emphasizes the role of biological, psychological, and environmental determinants of substance abuse and provides relevant detoxification interventions, such as counseling and group therapies, skill training, health care, and social support.[2,8] In contrast, faith-based treatment fundamentally underlines the Christian theory of addiction to

consider substance abuse a sin caused by one's spiritual void and separation from God, although it also acknowledges the importance of biological, psychological, and social needs of addict rehabilitants.[6,9] As faith-based treatment is mainly based on Christian faith, the core of faith-based treatment requires recovering addicts to accept Jesus Christ as their savior and seeks their progressive growth in religiosity.[9,10] In this way, recovering addicts may take up a new drug-free life by accepting constructive religious values, prosocial religious behaviors, guidance from God, and support from a religious community, leading to successful abstinence. Therefore, examining the progression and development of recovering addicts' religiosity in the treatment process in relation to their subsequent abstinence over time has research importance.

Research has corroborated the beneficial effects of religiosity on various health outcomes,[11,12] including prevention of substance abuse. It is thought that religious involvement of recovering addicts connotes their inculcation

of conventional religious beliefs and teachings, acquisition of new and transcendent life directions and meaning, establishment of a pro-abstinent supportive network, application of religious coping strategies, and acknowledgement of a reborn identity and of self-worth,[6,9] all of which are conducive to their overcoming substance use. Although existing studies support a protective effect of religiosity on prevention of substance abuse among community and general populations,[12-14] research on faith-based treatment in contribution to subsequent abstinence of recovering addicts through their development of religiosity is scant. Chu & Sung[15] mentioned that "although religiosity and spirituality have been widely used as a means of treating substance abusers, only a handful of studies empirically examined the effect of religiosity on individuals' recovery from substance abuse" (p. 699). In Hong Kong, faith-based addiction treatment has been used by local Christian organizations since the 1960s.[16,17] Secular-based treatment services are mainly run by non-religious nongovernmental organizations (NGOs).[17,18] Regardless of the treatment mode, the Hong Kong government plays a supportive role in coordinating and financing the services provided by faith-based and secular-based treatments.

Most studies examining the effects of religiosity on treatment outcomes of substance addicts are cross-sectional and preclude conclusions about causality (i.e., is abstinence the result of treatment?).[19-21] Even researchers performing longitudinal investigations of the religious effects on treatment outcomes of recovering addicts have analyzed religiosity as a static predictor at one time point in connection with treatment outcome(s) at another time point.[22,23] Hence, they overlooked the changing and developing nature of religiosity among recovering addicts. More importantly, many current treatment studies examined religious effects on treatment-related outcomes,[19,20,24] such as abstinent self-efficacy, mental health, treatment commitment, and management of cravings, but not on after-treatment abstinence.

Because religiosity is not static, but rather developmental, dynamic, and progressive,[25,26] it is important to examine intrapersonal changes of religiosity *vis-à-vis* after-treatment abstinence among recovering addicts.[12,27] In this study, I expected that the religiosity of recovering addicts would increase during their treatment process, which then would contribute to their subsequent abstinence. This is in agreement with what Allen & Lo[13] said: "research in the future should thus also link religiosity and spirituality to the domain of substance abuse treatment and recovery, determining if changes in religiosity and spirituality affect outcomes" (p. 450).

Specifically, I examined the religious effects on the subsequent abstinence of recovering addicts in Christian faith-based treatment, plus their counterparts in secular-based treatment, for comparison. Although faith-based treatment of substance abuse stresses the importance of religious development of recovering addicts, it has been shown that secular-based treatment also encourages religious and spiritual experiences of the recovering addicts to help their recovery by collaboration with religious organizations.[23,24] Therefore, it is valid to consider the development of religiosity among recovering addicts in both faith-based and secular-based treatment services. More salient religious development of recovering addicts in the former is expected.

Methods

Study design

As the changing and dynamic nature of religiosity and its protective effects on the prevention of substance abuse in community and general populations have been reported,[12-14,27] the present study aimed to investigate the development of religiosity in recovering addicts measured over a time span: at initiation of substance addiction treatment (wave 1), discharge from treatment (wave 2), and 6 months after treatment (wave 3). Considering both faith-based and secular-based treatments adopting religious experiences and spiritual growth to help addict rehabilitation and recovery,[7,23,24] this study intended to longitudinally scrutinize the development of religiosity among recovering addicts in both faith-based and secular-based treatment interventions. Better development of religiosity among recovering addicts in faith-based treatment was anticipated. Second, as an inverse association between religiosity and substance abuse has been reported, it was anticipated that higher religiosity and better development of religiosity in recovering addicts across the three treatment waves would predict greater after-treatment abstinence. Furthermore, it was anticipated that recovering addicts in faith-based treatment would not only have higher religiosity across the treatment waves, but also exhibit better after-treatment abstinence compared with their counterparts in secular-based treatment. This is due to faith-based treatment stressing more the importance of religious development and complete abstinence.[6,7,28]

Also, it was anticipated that characteristics of the religiosity of recovering addicts would be a mediator in the relationship between treatment mode and after-treatment abstinence. Religiosity is multidimensional. Although different religious dimensions are interrelated and mutually reinforced,[14,29,30] explaining the integrated and collective nature of religiosity, it is worthwhile researching how different religious dimensions contribute to the after-treatment abstinence of recovering addicts.

Last, recent studies have indicated that both development of religiosity and successful desistance of substance abuse hinge on the influences of certain sociodemographic factors.[23,26,31] As Lee et al.[26] state: "forming religious identities and patterns of religiosity are a part of a fluid and dynamic process – not only varying throughout the life course, but critically interacting with different sociodemographic factors over time" (p. 678). Therefore, the gender, age, education, and marital status of recovering addicts were adjusted as influential sociodemographic covariates, owing to their prediction of religiosity and recovery of substance abuse.[13,23,26] Generally, those who are female, older, have more education, and are married seem to be more religious and have better treatment outcomes.[13,28,31]

Sample and procedures

The sample included 199 recovering addicts recruited from residential substance addiction treatment programs in Hong Kong; 142 and 57 addict participants came from faith-based and secular-based treatment interventions respectively, constituting a 2:1 ratio of recovering addicts for comparison.[7,32,33] In Hong Kong, residential substance addiction treatment programs are run by local NGOs and financially supported by the Hong Kong government. Faith-based treatment is guided by the Christian theory of substance addiction,[6,9] which presumes substance abuse to be a sin reflecting the addict's departure from God's will and love. A new, healthy, drug-free life can be achieved by the addict if he or she confesses his or her sins and accepts Jesus Christ as a personal savior and then commits to the Christian faith through the process of sanctification by connecting with God, Christ, and the Holy Spirit. Secular-based treatment relies mainly on medical and psychosocial models to deal with recovering addicts' physical and social needs, but also acknowledges the usefulness of catering to the spiritual and religious needs of their clients in order to enhance their recovery process.[7,34] Generally, recovering addicts voluntarily participate in the residential substance addiction services. Assignment to faith-based or secular-based treatment was based on their personal willingness, suggestions of social workers, and availability of service quotas. Both faith-based and secular-based treatment programs provide case work and group work, organized collective activities, individual progress plans, and job training to recovering addict participants. It should be noted that the current study is not a randomized control trial, but rather a naturalistic treatment outcome study in which the choices and freedom of recovering addicts are respected.[35,36] Hence, this study aimed at describing the dynamic development of religiosity in recovering addicts in relation to their subsequent abstinence and as part of their natural treatment processes.

For data collection, participants who showed willingness to participate in the study by the invitation of practitioners were enrolled. In the wave-1 survey, 199 recovering individuals at the initiation of their substance addiction treatment gave consent and took part in the study. For the wave-2 survey, the participants were again interviewed at their discharge from treatment; 6 months after discharge from treatment, the wave-3 survey was carried out. Whether faith-based or secular-based intervention, residential substance addiction treatment in Hong Kong lasts around 9 months, during which recovering addicts are required to live in a treatment facility and then are released to their communities.[16]

In the present study, the intention to treat approach was used to analyze longitudinal data[37,38] from 199 participants in wave-1 through wave-3. However, data were lost on 49 participants in data collection during waves 2 and 3, constituting 24.62% missing values. Rather than simply using mean substitution, expectation maximization (EM) was used for imputation of missing values.[39,40] EM can project simulated values by incorporating all available pertinent variables as predictors and impute missing data through a two-step iterative process involving regression analysis and maximum-likelihood procedures. All the participants were adults aged 18 years old or above. Their personal consent and agreement were sought before the start of the study.

Measurement

Religiosity of recovering addicts was measured using the 38-item Brief Multidimensional Measure of Religiousness/Spirituality (BMMRS), a widely used measure of religious involvement and religious practices[41,42] with a validated Chinese language version.[43] An example item is "How often do you pray privately in places other than at church or synagogue?" All surveys were administered by the author and two research assistants. In wave 3, the survey was administered in the campuses of The Hong Kong Polytechnic University and City University of Hong Kong in private corners of the campuses or classrooms booked for that purpose.

In each wave of data collection, recovering addicts were asked to rate their religiosity according to different religious dimensions: daily spiritual experiences, religious values and briefs, forgiveness, private religiousness, religious coping, religious support, religious commitment, public religiousness, religious meaning, and self-perceived religiosity. Nevertheless, religiosity is an integrated and collective phenomenon performed by believers, which means that different dimensions of religious involvement are inherently connected and mutually reinforced.[14,30] For example, believers of high religious commitment would perform private religious practices and attend public religious activities more saliently. Therefore, after standardization, BMMRS items were summed to form the overall religiosity of recovering addicts at each wave (i.e., different dimensions of BMMS were combined to form a composite score of recovering addicts' overall religiosity across the study waves), tracing the participants' religious change and development in relation to after-treatment abstinence. In this study, Cronbach's alphas were excellent for wave-1, wave-2, and wave-3 scores of BMMRS: $\alpha = 0.957$, 0.954, and 0.935 respectively.

Mode of addiction treatment refers to recovering addicts who received faith-based or secular-based treatment. Faith-based treatment indicates the treatment intervention mainly based on the Christian theory of addiction and organized by a Christian organization to provide religious teachings, values, tenets, and practices derived from scriptures of the Bible.[6,9] Secular-based treatment intervention uses bio-psychosocial approach, e.g., use of methadone, provision of counseling and group therapies, and employment of health and social support services, which are mostly run by non-religious NGOs.[5,7] In this study, mode of treatment was analyzed as a dichotomous variable: faith-based treatment = 2 and secular-based treatment = 1.

Sociodemographic covariates of recovering addicts included gender, age, education, and marital status. Gender (0 = male, 1 = female) and marital status (0 = other, 1 = married) that are dummy variables. Age (years) and education (1 = year 1 of secondary school or below;

2 = year 2 of secondary school; 3 = year 3 of secondary school; 4 = year 4 of secondary school; 5 = year 5 of secondary school; 6 = year 6 of secondary school, 7 = associate degree; 8 = undergraduate degree or higher) are continuous variables.

Abstinence of substance abuse was measured in wave-3 with the following question asked from recovering addicts: "During the past week how many times have you used substances?" This was rated by a 6-point scale of 1 = more than once a day, 2 = once a day, 3 = 4 to 6 times in the past week, 4 = 2 to 3 times in the past week, 5 = 1 time in the past week, and 6 = did not use in the past week. In order to distinguish the drug-free status of recovering addicts from those who were still using, the item was recoded into a binary variable by reclassifying the 6-point scale into 1 = did not use in the past week and 0 = otherwise.

Analytic techniques

As after-treatment abstinence of recovering addicts at wave-3 is a binary outcome, Bernoulli distribution was used to model the effects of treatment mode and religious development of recovering addicts across the three waves on their subsequent desistance of using substances[44]:

$$P(x) = \frac{N!}{x!(N-x)!} \pi^x (1-\pi)^{N-x}$$

where P(x) is the likelihood of successful abstinence of recovering addicts at wave-3, and x is a discrete random variable assuming only one value, such as $x = 1$. Hence, a Bernoulli variable is a random variable having two possible values, 1 and 0, expressed as $I_A \sim Bernoulli\,(P[A])$. Latent growth curve modeling (LGCM) was conducted to predict wave-3 abstinence of recovering addicts by the effects of religiosity, treatment mode, and pertinent sociodemographic covariates.[45] Religiosity of recovering addicts across the three waves was examined as a dynamic and changing latent construct contributing to subsequent abstinence. In the LGCM framework, latent variables are estimated for the initial levels (intercepts) and changes (slopes) occurring over time that can correspond to the religious development of recovering addicts across the three waves. The basic form of an LGCM is

$$Y = \tau_y + \Lambda_y \eta + \varepsilon$$

where Y is a vector of observed scores, τ_y is a vector tending to include the population means of Y, Λ_y is a matrix of factor loadings representing the regression parameters of religiosity of recovering addicts across the three waves, η is a vector of the endogenous constructs that are the latent intercept and slope factors of religiosity, and ε is a vector of residuals.

Due to the small sample of 199 addict participants, the Bayesian analysis approach rather than a frequentist framework was used to model the effects of treatment mode, religiosity of recovering addicts, and pertinent sociodemographic covariates on their after-treatment abstinence.[46]

External validity and accounting for uncertainties can be enhanced, hence avoiding biased results. Posterior predictive p-value (PPP) is used to corroborate model fit in the Bayesian framework. PPP > 0.05 suggests an adequate model fit, and PPP $\cong$ 0.5 represents an excellent model fit.[46] Recently, comparative fit index (CFI) and root mean square error of approximation (RMSEA), commonly estimated in the frequentist analysis, are also available in Bayesian modeling procedures,[47] for which CFI $\geqslant$ 0.90 and RMSEA $\leqslant$ 0.08 indicate good model fit. Furthermore, the effects of different religious dimensions on after-treatment abstinence were estimated by logistic regression modeling. Each religious dimension was formed as a latent predictor by loading its pertinent religious indicators across the three waves to predict subsequent abstinence of recovering addicts. The modeling procedures were conducted using Mplus 8.4.[48]

Ethics statement

The present study protocol was approved by the research ethics committee of City University of Hong Kong.

Results

Table 1 shows the characteristics of the sample. Most participants were male (86.9%), and the overall mean age was 42.3 years (standard deviation [SD] = 13.7). The level of education commonly attained was 3rd year of secondary school. Of the 199 recovering addicts, 66 were married and 133 had another marital status. The religiosity of recovering addicts was measured by z scores. The mean religiosity scores for the overall group were 0.000 with SD of 1.000 across the three waves. Positive values of religiosity appeared in recovering addicts undergoing faith-based treatment. Their counterparts in secular-based treatment assumed negative values of religiosity in the respective waves, showing that the religious development of recovering addicts was more pronounced in the faith-based treatment group. Comparing sociodemographic characteristics and levels of religiosity among recovering addict participants in faith-based and in secular-based treatment, we see that recovering addicts in faith-based treatment were significantly younger (t = 3.943, p < 0.001) and had higher educational attainment (t = -3.058, p < 0.01). However, the proportion of female recovering addicts in faith-based treatment was significantly lower than that in secular-based treatment (χ^2 = 9.294, p < 0.01). There was no significant difference in marital status between treatment modes (χ^2 = 3.413, p > 0.05).

Participants in faith-based treatment had significantly higher levels of religiosity in wave-1 (t = -3.259, p < 0.01), wave-2 (t = -3.749, p < 0.001), and wave-3 (t = -4.036, p < 0.001). Regardless of treatment mode, more than 60% of the recovering addicts abstained from using substances as measured at wave-3. Therefore, it is valid to incorporate these sociodemographic covariates of recovering addicts as control variables in the modeling procedures.

Table 1 Sociodemographic characteristics, religiosity and after-treatment abstinence in the sample of recovering addicts

Variable	Total sample	Faith-based treatment	Secular-based treatment	t-value/χ^2
Gender, n (%)				
Male	173 (86.9)	130 (91.5)	43 (75.4)	9.294**
Female	26 (13.1)	12 (8.5)	14 (24.6)	
Age, years	42.638 (13.744)	40.288 (12.491)	48.491 (15.039)	3.943***
Education, years	2.964 (1.727)	3.197 (1.826)	2.386 (1.292)	-3.058**
Marital status, n (%)				
Married	66 (33.2)	46 (32.4)	11 (19.2)	3.413
Other	133 (66.8)	96 (67.6)	46 (80.8)	
Wave-1 Religiosity, BMMRS z score	0.000 (1.000)	0.142 (0.888)	-0.356 (1.170)	-3.259**
Wave-2 Religiosity	0.000 (1.000)	0.163 (0.911)	-0.406 (1.099)	-3.749***
Wave-3 Religiosity	0.000 (1.000)	0.174 (0.905)	-0.435 (1.095)	-4.036***
After-treatment abstinence, n (%)	132 (66.3)	96 (67.6)	36 (63.2)	0.360

Data presented as mean (standard deviation), unless otherwise specified.
Education is measured on an eight-point scale: 1 = year 1of secondary school or below; 2 = year 2 of secondary school; 3 = year 3 of secondary school; 4 = year 4 of secondary school; 5 = year 5 of secondary school; 6 = year 6 of secondary school; 7 = associate degree; 8 = undergraduate degree or higher. Wave-1, wave-2, and wave-3 religiosity was reported using standardized z scores due to the use of different scales to rate BMMRS measurement items.
*p < 0.05, ** p < 0.01, *** p < 0.001.

Table 2 Latent correlations of BMMRS dimensions obtained by loading their indicators across three study waves

Dimension		1	2	3	4	5	6	7	8	9	10
1	DSE	1									
2	VB	0.521***									
3	FG	0.478***	0.489***								
4	PR	0.600***	0.424***	0.386***							
5	RC	0.496***	0.398***	0.346***	0.548***						
6	RS	0.630***	0.422***	0.427***	0.518***	0.344***					
8	PU	0.468***	0.343***	0.310***	0.548***	0.421***	0.427***				
7	CM	0.583***	0.478***	0.537***	0.463***	0.535***	0.483***				
9	MN	0.472***	0.313***	0.310***	0.464***	0.326***	0.393***	0.436***			
10	SPR	0.525***	0.457***	0.475***	0.389***	0.321***	0.461***	0.310***	0.428***	0.329***	-

Factor loadings of daily spiritual experiences (DSE): λ = 0.808, 0.875, 0.834; religious values and briefs (VB): λ = 0.678, 0.813, 0.686; forgiveness (FG): λ = 0.765, 0.803, 0.699; private religiousness (PR): λ = 0.793, 0.817, 0.822; religious coping (RC): λ = 0.712, 0.714, 0.745; religious support (RS): λ = 0.860, 0.853, 0.869; public religiousness (PU): λ = 0.772, 0.778, 0.872; religious commitment (CM): λ = 0.795, 0.781, 0.795; religious meaning (MN): λ = 0.645, 0.510, 0.712; and self-perceived religiosity (SPR): λ = 0.717, 0.718, 0.654.
BMMRS = Brief Multidimensional Measure of Religiousness/Spirituality.
*p < 0.05, ** p < 0.01, *** p < 0.001.

BMMRS contains multiple religious dimensions and was used as the main religiosity predictor to examine how development of religiosity contributed to after-treatment abstinence in the present sample of recovering addicts. Hence, the interrelations of the respective dimensions of BMMRS were first examined to confirm their internal associations and consistency. Due to BMMRS being measured across the three waves, I loaded the pertinent indicators of different religious dimensions together to form the latent constructs of different religious dimensions of BMMRS. These include daily spiritual experiences, religious values and briefs, forgiveness, private religiousness, religious coping, religious support, religious commitment, public religiousness, religious meaning, and self-perceived religiosity. I then examined the interrelations. Table 2 shows that different latent religious dimensions of BMMRS were significantly and robustly correlated. Standardized correlation coefficients ranged from r = 0.313 to 0.630 (p < 0.001), corroborating their interrelated and inherently connected nature. Specifically, the daily spiritual experience subscale of BMMRS was most strongly correlated with other religious dimensions of BMMRS, ranging from r = 0.472 to 0.630 (p < 0.001). The forgiveness dimension of BMMRS was less strongly correlated with the other religious dimensions of BMMRS, ranging from r = 0.310 to 0.489 (p < 0.001). Nevertheless, the significant and solid correlations among all religious dimensions of BMMRS give evidence that the religiosity of addict participants can be treated as an integrated and common latent construct to predict their after-treatment abstinence.

An unconditional growth curve model of religious development of recovering addicts was examined by averaging the scores of BMMRS at each wave and loading them onto the intercept growth and slope factors of the growth curve model to represent the dynamic nature of recovering addicts' common religiosity over time. An excellent model fit was obtained: CFI = 1.000, RMSEA = 0.000, and PPP = 0.580. Table 3 shows factor loadings of the intercept growth factor and slope factor. The factor loadings of the intercept growth factor at wave-1, wave-2, and wave-3 religiosity were λ = 0.924, 0.930,

Table 3 Unconditional growth model of religious development of recovering addicts

	Factor loading	Posterior SD	95%CI
Intercept factor			
Wave-1 Religiosity	0.924***	0.044	0.849 to 0.917
Wave-2 Religiosity	0.930***	0.039	0.847 to 1.001
Wave-3 Religiosity	0.933***	0.066	0.807 to 1.063
Slope factor			
Wave-1 Religiosity	0.000	0.000	-
Wave-2 Religiosity	0.265***	0.072	0.101 to 0.373
Wave-3 Religiosity	0.528***	0.156	0.194 to 0.773
Model parameters	Coefficient		
Intercept and slope covariance	-0.404**	0.125	-0.611 to -0.094
Intercept variance	0.891***	0.130	0.671 to 1.183
Slope variance	0.071***	0.039	0.010 to 0.147

95%CI = 95% confidence interval; CFI = comparative fit index; PPP = posterior predictive p-value; RMSEA = root mean square error of approximation; SD = standard deviation.
For model fit, CFI = 1.000, RMSEA = 0.000, and PPP = 0.580.
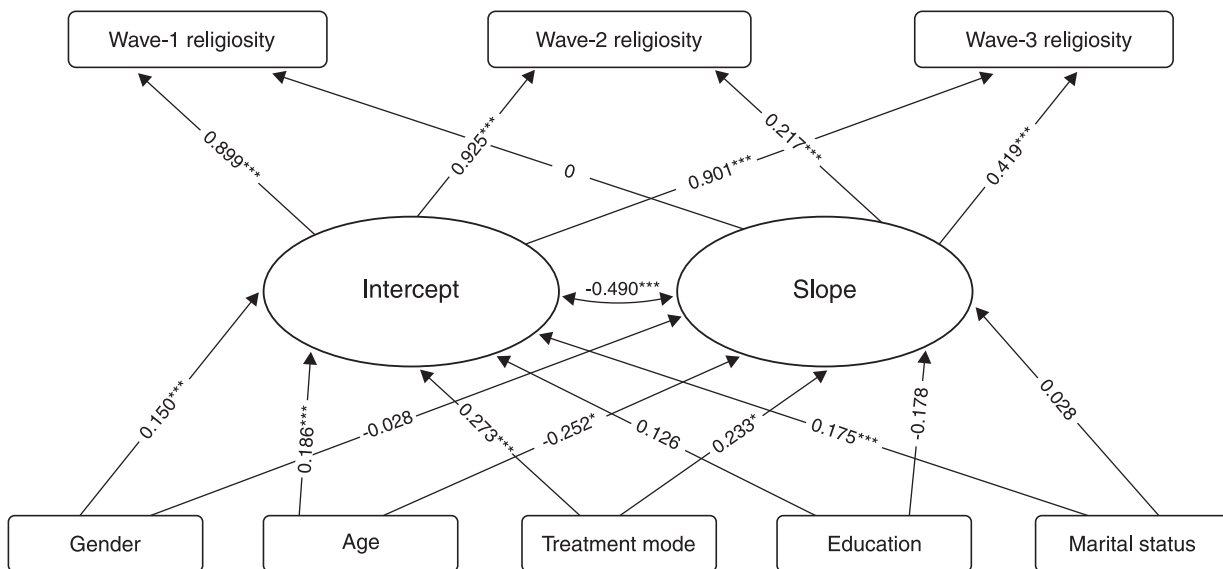* p < 0.05, ** p < 0.01, *** p < 0.001.

Figure 1 Conditional latent growth curve model of religious development of recovering addicts. For model fit, comparative fit index (CFI) = 1.000, root mean square error of approximation (RMSEA) = 0.000, and posterior predictive p-value (PPP) = 0.583. * p < 0.05, ** p < 0.01, *** p < 0.001.

and 0.933 (p < 0.001). The factor loadings of the slope factor at wave-2 and wave-3 religiosity were λ = 0.265 and 0.528 (p < 0.001). Moreover, the intercept growth factor was significantly and negatively correlated with the slope factor (r = -0.404, p < 0.01), indicating that recovering addicts of higher religiosity at the initial level exhibited a lower rate of growth in religious development at later waves. A conditional LGCM analysis was conducted by adding treatment mode and sociodemographic variables of recovering addicts' gender, age, education, and marital status as covariates. The model fit was excellent: CFI = 1.000, RMSEA = 0.000, and PPP = 0.583 (Figure 1). Specifically, recovering addicts in faith-based treatment had a significantly higher level of religiosity at each time point in waves 1, 2, and 3 (β = 0.273, p < 0.001) and better religious development across the three waves (β = 0.233, p < 0.05) compared to their

counterparts in secular-based treatment. For pertinent sociodemographic covariates, recovering addicts who were female, older, of higher education, and married had a significantly higher level of religiosity at each wave (β = 0.150, 0.186; and 0.175, p < 0.001). However, older recovering addicts had significantly poorer religious development across the three waves than did their younger counterparts (β = 0.252, p < 0.05).

LGCM analysis was conducted to predict after-treatment abstinence of recovering addicts at wave-3. As after-treatment abstinence is a binary variable, indexes of CFI and RMSEA are incapably calculated. Hence, PPP was used to indicate model fit, which was PPP = 0.438, indicative of good model fit (Figure 2). Results showed that recovering addicts in faith-based treatment had a significantly higher level of religiosity at each wave (β = 0.264, p < 0.001). Both intercept and slope factors
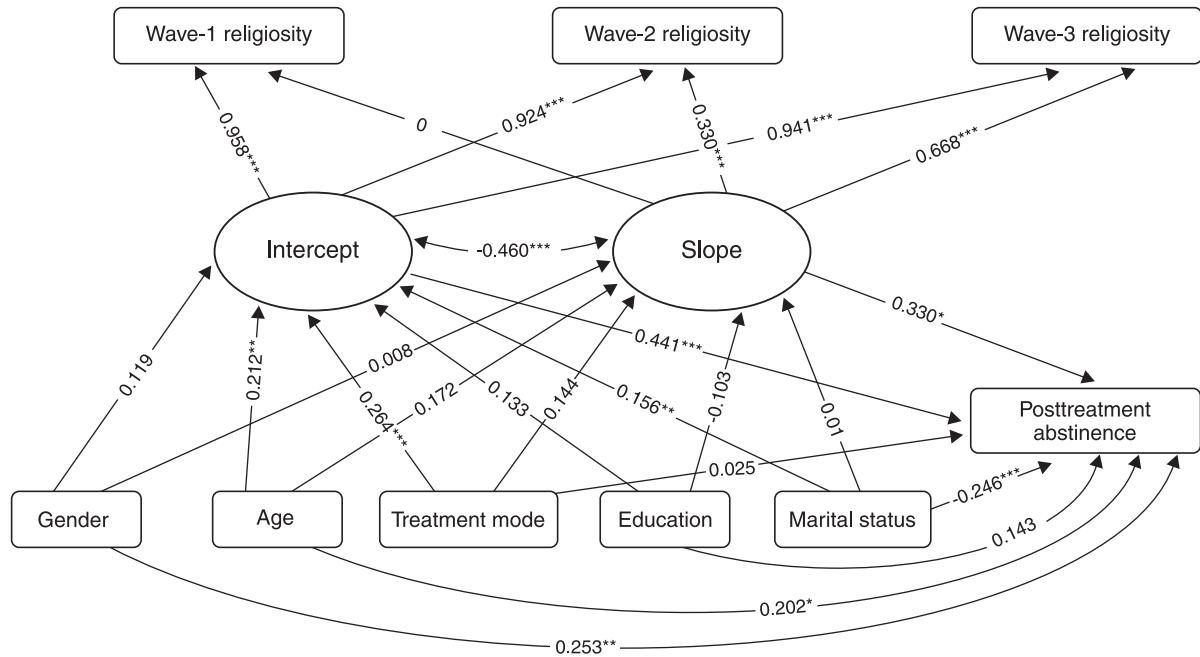
Figure 2 Conditional latent growth curve model of religious development of recovering addicts and predicting their after-treatment abstinence. For model fit, posterior predictive p-value (PPP) = 0.438. * p < 0.05, ** p < 0.01, *** p < 0.001.

were significantly predictive of after-treatment abstinence of recovering addicts at wave-3 (β = 0.441 and 0.330, p < 0.001 and 0.05), indicating that a unit increase in the level of religiosity at each wave commonly and religious development across the three waves particularly contributed to 55.4 and 39.1% higher odds of successful abstinence at wave-3 respectively. For the effects of sociodemographic covariates, being older and married significantly predicted a higher level of religiosity at each wave (β = 0.212 and 0.156, p < 0.01). However, being a married recovering addict significantly and negatively predicted after-treatment abstinence (β = -0.246, p < 0.001), meaning that married recovering addicts had 21.8% lower odds of after-treatment abstinence at wave-3. Furthermore, being a female or older recovering addict significantly and positively predicted after-treatment abstinence (β = 0.253 and 0.202, p < 0.01 and 0.05). Female recovering addicts, compared to their male counterparts, had 28.7% higher odds of desistance from using substances at wave-3. An increase in age by one SD entailed 22.3% higher odds of desistance from using substances at wave-3.

In the complete LGCM, treatment mode did not significantly predict slope factor of religious development of recovering addicts and their after-treatment abstinence. It is assumed that the insignificance of treatment mode on the slope factor of religious development of recovering addicts across the three waves was suppressed by the influence of recovering addicts' initial level of religiosity at each wave in the intercept factor. The insignificance of treatment mode on after-treatment abstinence was suppressed by the shared effects of intercept and slope factors of religiosity and religious development of recovering addicts. Thus, constrained path tests were conducted to investigate the suppressed effects of treatment

mode on the slope factor of religious development of recovering addicts across the three waves and their after-treatment abstinence at wave-3. Table 4 shows that after constraining the path from treatment mode to the intercept factor of recovering addicts' religiosity, treatment mode significantly and positively predicted slope factor of recovering addicts' religious development (β = 0.293, p < 0.001). This means that recovering addicts in faith-based treatment had better religious development than did their counterparts in secular-based treatment. In addition, after constraining effects of intercept and slope factors, treatment mode was also significantly and positively predictive of after-treatment abstinence of recovering addicts (β = 0.180, p < 0.05). This suggests that recovering addicts in faith-based treatment had increased odds of after-treatment abstinence by 19.7%.

The indirect effects of treatment mode through intercept and slope factors of the complete LGCM on after-treatment abstinence were tested to investigate whether the intercept factor of recovering addicts' religiosity and the slope factor of their religious development across the three waves significantly mediated the relationship between treatment mode and after-treatment abstinence. It was found that the intercept factor significantly mediated the effect of treatment mode on after-treatment abstinence when constraining the effect of slope factor (β_{ind} = 0.094, p < 0.001) (Table 4). Moreover, the slope factor significantly mediated the effect of treatment mode on recovering addicts' after-treatment abstinence when constraining the effect of intercept factor (β_{ind} = 0.210, p < 0.01) (Table 4). Accordingly, changes and growth in the religiosity of recovering addicts in the treatment process critically and proximally influenced after-treatment abstinence.

Table 4 Constrained and indirect effects of treatment mode on slope factor and after-treatment abstinence

	β	Posterior SD	95%CI
Constrained effect			
Treatment mode → slope factor	0.293***	0.079	0.139 to 0.444
Treatment mode → after-treatment abstinence	0.180*	0.089	0.008 to 0.352
Indirect effect	β_{ind}	Posterior SD	95%CI
Treatment mode → intercept factor → after-treatment abstinence	0.094***	0.033	0.036 to 0.162
Treatment mode → slope factor → after-treatment abstinence	0.210**	0.133	0.020 to 0.549

95%CI = 95% confidence interval; β = standardized regression beta; SD = standard deviation.
* p < 0.05, ** p < 0.01, *** p < 0.001.

Table 5 Logistic regression of the latent religious dimensions of BMMRS on after-treatment abstinence of recovering addicts

Dimension		β	Posterior SD	OR	95%CI
1	DSE	0.315***	0.091	1.370	0.147 to 0.493
2	VB	0.240**	0.093	1.271	0.057 to 0.412
3	FG	0.303***	0.084	1.353	0.122 to 0.489
4	PR	0.234*	0.100	1.263	0.010 to 0.414
5	RC	0.299***	0.083	1.348	0.117 to 0.461
6	RS	0.452***	0.088	1.571	0.258 to 0.609
8	PU	0.199†	0.110	1.220	-0.040 to 0.399
7	CM	0.369***	0.094	1.446	0.183 to 0.547
9	MN	0.405***	0.096	1.499	0.228 to 0.595
10	SPR	0.320***	0.096	1.377	0.120 to 0.500

All logistic regression models adjusted for gender, age, education, marital status, and treatment mode of recovering addicts.
95%CI= 95% confidence interval; β = standardized regression beta; BMMRS = Brief Multidimensional Measure of Religiousness/Spirituality; CM = religious commitment; DSE = daily spiritual experiences; FG = forgiveness; MN = religious meaning; OR = odds ratio; PR = private religiousness; PU = public religiousness; RC = religious coping; RS = religious support; SD = standard deviation; SPR = self-perceived religiosity; VB = religious values and briefs.
† p < 0.1, * p < 0.05, ** p < 0.01, *** p < 0.001.

Although the current study considered the religiosity of recovering addicts an integrated and comprehensive concept, it is useful to investigate the effects of different religious dimensions on after-treatment abstinence for inquisitive and referential values. As a single dimension of religiosity only reflects a specific sphere of religious attitude and practices, which is dependent on the influences of other religious dimensions concomitantly, I loaded the indicators of religious dimensions across the three waves to form different latent religious constructs and test their ability to predict after-treatment abstinence by logistic regression. Table 5 shows that, except for public religiousness, all religious dimensions significantly and positively predicted higher after-treatment abstinence of recovering addicts. Specifically, religious support had the strongest effect on after-treatment abstinence (β = 0.452, p < 0.001) – a unit increase in religious support contributed to 57.1% higher odds of subsequent abstinence. Moreover, religious meaning had a substantial effect on after-treatment abstinence (β = 0.405, p < 0.001) – a unit increase in religious meaning occasioned 49.9% higher odds of subsequent abstinence. Of the significant religious dimensions, private religiousness had the smallest significant effect on recovering addicts' after-treatment abstinence (β = 0.234, p < 0.05); a unit increase in private religiousness resulted in 26.3% higher odds of subsequent abstinence. Further, daily spiritual experiences, religious values and briefs, forgiveness, religious coping, religious commitment, and self-perceived religiosity had

significant effects on recovering addicts' after-treatment abstinence (from β = 0.240 to 0.369, p < 0.01 and 0.001). This means that a unit increase in these religious dimensions led to 27.1 to 44.6% higher odds of subsequent abstinence. Public religiousness had a marginally significant effect on recovering addicts' after-treatment abstinence (β = 0.199, p < 0.1), with the increased odds of 22%. It should be noted that the effects and odds ratios (OR) generated from these religious dimensions in relation to after-treatment abstinence by logistic regression cannot directly be compared to the effects and OR obtained from the change and development of recovering addicts' religiosity by LGCM, as they are two different modeling procedures.

Discussion

Although existing studies have corroborated the positive effects of religion on prevention of substance abuse among community samples and other representative populations, little empirical evidence is available on the contribution of religious involvement of recovering addicts in relation to their subsequent abstinence. Explicitly, religious values, teachings, and practices are generally promotive of healthy lifestyles, self-worth, altruism, and prosociality,[11,29] which are conducive to the avoidance of substance use and prevention of substance abuse. In this study, faith-based treatment was found to be more effective in enhancing religiosity and religious development

among recovering addicts than secular-based treatment. This is valid, as the former is basically founded on the Christian theory of addiction to support complete abstinence and full-life transformation,[6,7] and is more beneficially contributive to desistance of using substances.

It is thought that the religious involvement of recovering addicts in the treatment process denotes their inculcation of a new cognitive perspective on human suffering and difficulty, life meaning and purpose, interpersonal relationships, social structures, and moral standards in a constructive way,[10,28] which is thought promotive of a drug-free life. Positive relationships between religiosity, life meaning and purpose, self-control, mental health, morality, supportive network, and social participation[12,27] have been shown as important resources to help maintain abstinence. More complicated is the reciprocity between religiosity and these cognitive, psychological, behavioral, interpersonal, and social resources contributing to later abstinence. This makes researchers question the plausibility that religiosity and these mentioned resources are substantially related in the treatment process. Therefore, conducting multiple mediational models is suggested for future research to scrutinize the interactive processes of religiosity and these resources in relation to after-treatment abstinence, which can enhance our understanding of the recovery of addiction.

Importantly, the current study supported the dynamic and developing nature of the religiosity of recovering addicts across the three waves in relation to after-treatment abstinence. In the complete conditional LGCM model of recovering addicts' religious development in prediction of after-treatment abstinence (Figure 2), the intercept factor of recovering addicts' religiosity at each wave significantly and positively predicted after-treatment abstinence. This suggests that recovering addicts of higher religiosity over time exhibited a higher likelihood of desisting from using substances. Moreover, the slope factor of religious development of recovering addicts across the three waves significantly and positively predicted after-treatment abstinence, connoting that recovering addicts who showed better growth in religiosity with time progressively tended to abstain from using substances more successfully after treatment. The validation of this dynamic and developing attribute of religiosity among recovering addicts in relation to their subsequent abstinence is important for researchers and practitioners, who should pay attention to the oscillating and varying nature of the religious development of addict rehabilitants in influencing their later recovery during the treatment process.[27,29] This is critical because, as mentioned, religiosity is related to the development of various resources at different levels that are conducive to the prevention of substance abuse. Hence, more longitudinal research is needed to understand how the changes in the religiosity of recovering addicts in the treatment process may affect their development of cognitive, psychological, behavioral, interpersonal, and social resources, which then act together to predict later abstinence.

For sociodemographic effects, only age and marital status of recovering addicts significantly predicted their level of religiosity at each wave and their after-treatment abstinence. However, while older recovering addicts had significantly better after-treatment abstinence, married recovering addicts exhibited significantly lower after-treatment abstinence (β = -0.246, p < 0.001). Addict rehabilitants living with a partner presented 21.8% lower odds of desisting substance use after completing their treatment. It is thought that partner influence may be a cause of relapse of recovering addicts, as substance abuse is common in couples.[2,31] Therefore, researchers and practitioners should not underestimate the adverse influence of partner effect on subsequent relapse.

Some limitations of the current study should be noted. First, after-treatment abstinence of participants was measured by only one self-administrated question. This may not reflect the actual desisting situations. In fact, use of multiple assessment methods, such as biomarker tests, related party reporting, and validated measures would more genuinely ascertain abstinence. Second, the small sample size and recruitment of only Chinese addict participants in this study compromise external validity of the findings. Therefore, recruitment of addict participants of diverse racial and cultural origins would better support the relationship between religion and abstinence. Third, desistance of substance abuse is a lengthy process, with relapse being possible over a long period of time. However, the current study only investigated after-treatment abstinence of recovering addicts at 6 months after completion of residential treatment. Future research should extend longitudinal waves to confirm after-treatment abstinence over a longer time. Fourth, if future longitudinal research can trace changes in religiosity and other cognitive, psychological, interpersonal, and social factors of recovering addicts and their subsequent abstinences in multiple waves, a more vigorous view can be attained. Fifth, although the recovering addict participants from both faith-based and secular-based treatments were local Chinese of homogenous cultural background, their different sociodemographic characteristics reveal their differences. We should keep this in mind in explanation of the results. Finally, comparative research is suggested, as different societies and cultures have different treatment models and acceptance of using substances, casting doubt on the effects of treatment intervention, religiosity, and other cognitive, psychological, interpersonal, and social factors on abstinence of recovering addicts over time.

In summary, this study investigated also different dimensions of religiosity in contribution to recovering addicts' after-treatment abstinence. It was found that the religious dimensions of religious support, religious meaning, and religious commitment more robustly predicted after-treatment abstinence, although other religious dimensions had significant protective effects. Addictive behaviors are considered the result of interpersonal influence and intrapersonal propensity.[2,49,50] Therefore, positive religious support and worthwhile religious meaning and commitment can help recovering addicts establish a strong pro-abstinent social network and resolute determination to lead a purposeful and constructive lifestyle to avoid relapse.[13,20,27] Nevertheless, other religious

dimensions also significantly contributed to after-treatment abstinence, except for public religiosity, with marginally significant effect. This means that different dimensions of religiosity may function to prevent substance addiction differently, but all are conducive. Notably and practically, different dimensions of religiosity are significantly interrelated and inherently connected.[14,29,30] Hence, when we consider the contribution of religious dimensions to recovering addicts' subsequent abstinence, taking into account the integrated and mutually reinforced nature of religiosity is important for us to understand the beneficial and health implications of religion.

Acknowledgements

Disclosure

The author reports no conflicts of interest.

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