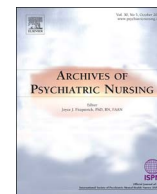




Contents lists available at ScienceDirect

Archives of Psychiatric Nursing

journal homepage: www.elsevier.com/locate/apnu

Staff Training Reduces the Use of Physical Restraint in Mental Health Service, Evidence-based Reflection for China

Junrong Ye^a, Aixiang Xiao^{b,*,1}, Lin Yu^a, Jianxiang Guo^c, Huawei Lei^c, Hongmei Wei^c, Wei Luo^c

^a Traditional Chinese Medicine Department, Affiliated Brain Hospital of Guangzhou Medical University, China

^b Nursing Administration Department, Affiliated Brain Hospital of Guangzhou Medical University, China

^c Medical Administration Department, Affiliated Brain Hospital of Guangzhou Medical University, China

ARTICLE INFO

KEYWORDS:

Staff training
Physical restraint
Reduction
Mental health care

ABSTRACT

OBJECT: The purpose of this article was to synthesize the evidence regarding the reduction of physical restraint, and to seek some practical recommendations based on the current situation in China.

METHOD: Nine databases were retrieved; these were PubMed, CINAHL, MEDLINE, Trip Database, PsycINFO, Cochrane Library, CNKI (Chinese database), Wanfang (Chinese database) and CBM (Chinese database) respectively. The selected articles were screened manually, and the identified researches were appraised through Review manager 5.3.

RESULT: Eight studies (four randomized controlled trials and four quasi-experimental studies) published between June 2013 and May 2017 were selected. Risk ratios (RRs) with 95% confidence intervals (CIs) were used as the effect index for dichotomous variables. The standardized mean differences (SMDs) with 95% CIs were calculated as the pooled continuous effect. The outcome of meta-analysis suggested staff training reduced the duration (IV = -0.88; 95% CIs = -1.65 to -0.10; Z = 2.22; p = 0.03) and adverse effect (RR, 0.16; 95% CIs = 0.09 to 0.30; Z = 5.96; p < 0.00001) of physical restraint, but there were no statistical change in the frequency of physical restraint (RR, 0.74; 95% CIs = 0.43 to 1.28; Z = 1.07; p = 0.28). Noticeably, the result of pooled estimates from 3 RCTs suggested staff training had no effects on the incidence of physical restraint. (RR, 1.01; 95% CIs = 0.45 to 2.24; Z = 0.02; p = 0.99)

CONCLUSION: Staff training was an effective measure to minimize the duration and adverse effects of physical restraint. More studies are needed to examine the effectiveness of staff training in relation to reduce the prevalence of physical restraint. Furthermore, considering the nurse's education background in China, it is recommended to conduct a compulsory training program to reduce the unnecessary restraint.

INTRODUCTION

Physical restraint was defined as a manual approach to reduce one's physical movement (Putkonen et al., 2013). To some extent, physical restraint and mechanical restraint would be comprehended interchangeably. In mental health nursing, although physical restraint was an effective approach to manage the immediate risk, the application of physical restraint still resulted in ethical and clinical controversy particularly its requisites and abuse. However, the frequency of physical restraint varied from one study to another. A systematic review reported the incidence of physical restraint in psychiatric wards was 3.8% to 20%, which implicated physical restraint was frequently employed when patients posed critical risk to themselves or others (Putkonen et al., 2013). Furthermore, it was reported that the rate of physical

restraint in the United States generally increased from 29.8% to 34.1% between 2007 and 2013, meanwhile, the duration of physical restraint fluctuated between 2 h and 3.7 h (Staggs, 2015). In mainland China (not including Hong Kong, Macao, or Taiwan), the use of physical restraint was even more prevalent. An investigation implemented in a psychiatric hospital of Changsha City asserted the frequency of physical restraint was 51.3% (Zhu et al., 2014).

Whereas the frequent application of physical restraint, further studies examined its effect on patients and nurses. Noticeably, various studies verified physical restraint caused adverse effects on patients and nurses. From the patients' perspective, it was evident that the bodily restraint would cause physical injury and psychological trauma to the patients. For one thing, physical restraint potentially led to a great number of physical injuries including skin injury, pulmonary disease,

* Corresponding author.

E-mail address: 543061910@qq.com (A. Xiao).

¹ Address: 36 Mingxin Road Liwan District, Guangzhou City, Guangdong Province 510370, China.

<https://doi.org/10.1016/j.apnu.2017.11.028>

Received 17 January 2017; Received in revised form 8 November 2017; Accepted 18 November 2017
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deep vein thrombosis, nervous system damage, ischemic lesions, or even sudden death (Di Lorenzo, Miani, Formicola, & Ferri, 2014). For another, it was reported the restrained patient undergoes psychological trauma associated with physical restraint, including demoralization, fear, anger, and the loss of dignity (Lancaster, Whittington, Lane, Riley, & Meehan, 2008). From nurses' perspective, implementing restraint caused an ethical dilemma which was described as an inner conflict in their practice, leaving them the difficulty in coping with this issue (Stewart, Van der Merwe, Bowers, Simpson, & Jones, 2010).

In consequence, a great number of studies were conducted to explore potential measures in regard to reduce the use of physical restraint in mental health settings, and several approaches had been verified to be effective to decrease the incidence of physical restraint. The Mental Health Commission (MHC, 2014) of Ireland proposed eight strategies of reducing the application of physical restraint, including leadership, debriefing, staff training et al. Notably, MHC emphasized that staff training was the core of restraint reduction programme, and it explained the training programme helped nurses to acquire necessary skills to cope with workplace violence.

Considering the critical situation in China that physical restraint is prevalent, the author of this article suggested it was vital to implement a training programme in relation to reduce the use of physical restraint. Hence, the objective of this article is to verify the effectiveness of staff training in the reduction of physical restraint in mental health service, and to synthesize the convincing evidence with reference value for nursing practice in China.

METHOD

PICO QUESTION

The PICO strategy is formed as follows. Population: patients with mental illness. Intervention: relevant training for staff. Comparison: staff without specific training. Outcome: the use of physical restraint. The answerable question is: Does staff training reduce the use of physical restraint in mental health service?

SEARCHING STRATEGY

In this study, six English databases and three Chinese databases were searched, including PubMed, CINAHL, MEDLINE, Trip Database, PsysINFO, Cochrane Library, CNKI (Chinese database), Wanfang (Chinese database), and CBM (Chinese database). Search terms were physical restraint, reduce, reduction, train, training, staff, nurse(s), mental health, and psychiatric hospital (note: for the Chinese database, the key words were translated and retrieved accordingly). Inclusive criterion: the study was conducted in psychiatric unit, psychiatric hospital, acute admission ward, and mental health center; the study was randomized controlled trials or quasi-experimental studies; the study was published between June 2013 and May 2017; full text in English or Chinese. Exclusion: qualitative study; intensive care unit (ICU); nursing home; staff training was not the only intervention in the identified study.

DATA EXTRACTION

Two researchers independently screened the content of the identified articles, including titles, abstracts, and full text. And then decided whether the studies met the inclusion criteria. A third reviewer would be consulted in case that agreement had not been achieved. The extracted data included research information (including title, first author, and publication year), characteristics of the study (including sampling size, types of study), and outcome. The primary outcome examined in this meta-analysis was the characteristic of physical restraint, including its frequency and duration. The secondary outcome was the incidence of restraint induced adverse effect.

RISK OF BIAS AND QUALITY ASSESSMENT

The data of included studies will be extracted, and assessed the bias risk by adopting the Cochrane risk of bias assessment tool (Higgins et al., 2011). The selection bias, performance bias, detection bias, attrition bias, reporting bias, and other bias of included studies were appraised by two researchers. In regard to bias risk assessment, a judgment was assigned as "no", "unclear", or "yes" for each domain to indicate a high, unclear, or low risk of bias, respectively. Disagreement would be resolved by discussion. The Grading Quality of Evidence and Strength of Recommendation (GRADE) guideline was adopted to assess to quality of the evidence (Schünemann, Brożek, Guyatt, & Oxman, 2013). The methodological flaws, generalizability of outcomes to the targeted population, and effect will be addressed. The quality would be assessed for each outcome and assigned as high, moderate, low or very low via GRADEpro Guideline Development Tool (GDT).

STATISTICAL ANALYSIS

A table was created to narratively describe the characteristics and results of included studies. Quality assessment and risk of bias examination were conducted via Review Manager 5.3 (RevMan 5.3, Cochrane Collaboration, London, UK), the statistical analysis was imported to GDT for assessing the quality of evidence. The meta-analysis was pooled using a random-effect model (DerSimonian & Laird, 1986). Risk ratios (RRs) with 95% confidence intervals (CIs) were applied as the effect index for dichotomous data, for instance the incidence of physical restraint and its adverse effect. The standardized mean differences (SMDs) with 95% CIs were examined as the pooled continuous effect.

RESULT

STUDY CHARACTERISTICS

Totally, there were 143 related articles identified, including 96 in Chinese and 47 in English. And further studies focused on following up the citation in the found studies, the exact number of identified articles was eight. The process of screening was explained by the PRISMA 2009 Flow Diagram (see Flow Diagram 1). The evidence appraisal matrix (see Table 1) was utilized to extract the following elements of each study: source, type of study design, level of evidence (according to Melnyk and ineout overholt), sample and setting, method and data analysis, implication. Totally four researchers participated in extracting the data of identified studies.

Among the identified studies (N = 8), four randomized controlled trials and four quasi-experimental studies. The evidence appraisal matrix is demonstrated in Table 1. The identified trials were conducted in psychiatric hospital and psychiatric department of general hospital.

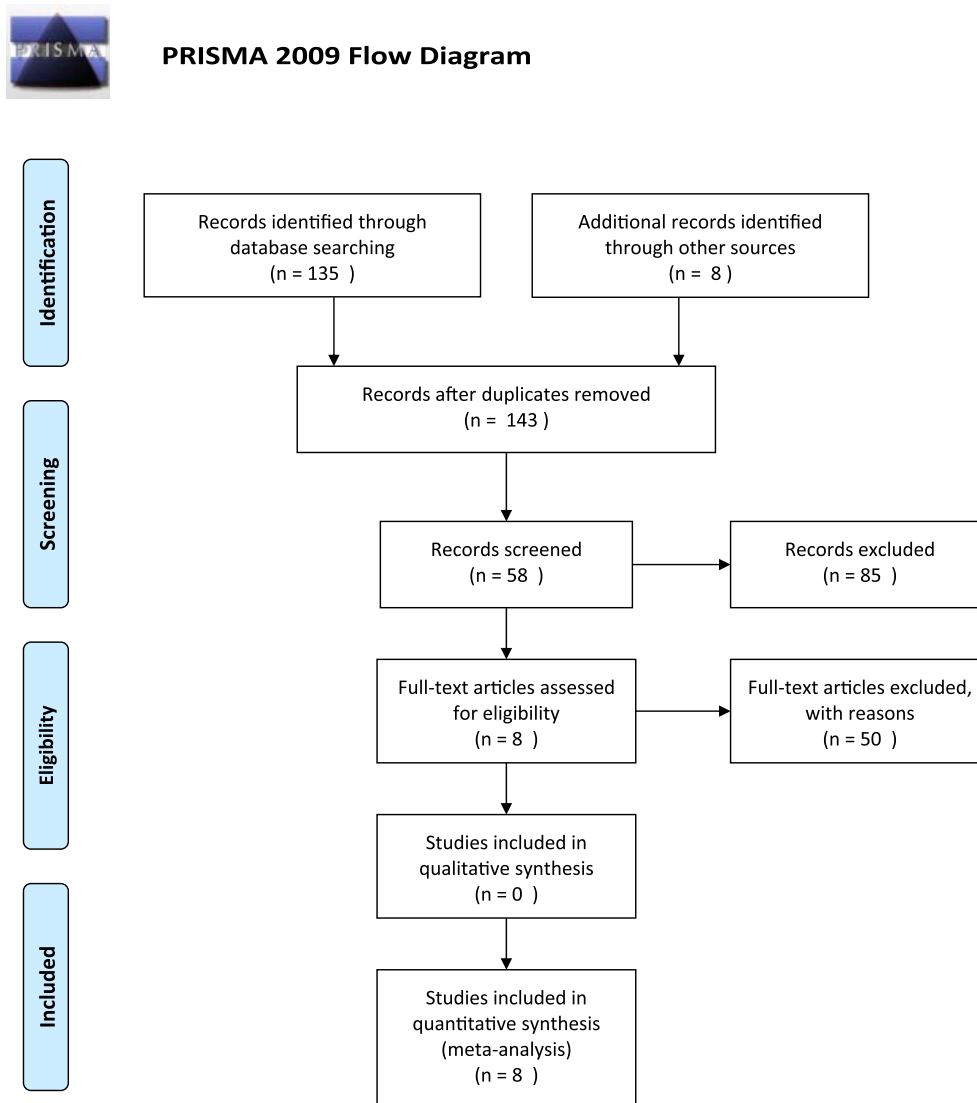
EFFECTS OF STAFF TRAINING

FREQUENCY OF PHYSICAL RESTRAINT

The restrained-to-whole sample ratio was employed to measure the frequency of physical restraint. The Mantel-Haenszel test was applied in this section. The risk ratio was adopted to measure the effect. Five studies offered data for this analysis (Blair et al., 2016; H. Chen et al., 2016; Z. Chen, Zhang, Zong, & Wang, 2014; Hou, Cai, & Xu, 2013; Kontio, Pitkänen, Joffe, Katajisto, & Välimäki, 2014), indicating there were no statistical change in the frequency of physical restraint in the nurses receiving training specific program (RR, 0.74; 95% CIs = 0.43 to 1.28; random-effect model; Z = 1.07; P = 0.28). (see Fig. 1)

Noticeably, when pooled estimates from 3 RCTs was conducted (Chen et al., 2016; Hou et al., 2013; Kontio et al., 2014), the result suggested staff training did not reduce the incidence of physical restraint. (RR, 1.01; 95% CIs = 0.45 to 2.24; random-effect model;

Flow diagram 1
PRISMA 2009 flow diagram.



From: Moher D, Liberati A, Tetzlaff J, Altman DG, The PRISMA Group (2009). Preferred Reporting Items for Systematic Reviews and Meta-Analyses: The PRISMA Statement. PLoS Med 6(7): e1000097. doi:10.1371/journal.pmed1000097

For more information, visit www.prisma-statement.org.

$Z = 0.02$; $P = 0.99$). (see Fig. 2)

DURATION OF PHYSICAL RESTRAINT

Totally four studies were included (H. Chen et al., 2016; Hou et al., 2013; Kontio et al., 2014; Wang et al., 2013). The Inverse Variance (IV) test was applied to analyze the data regarding the length of physical restraint. And SMDs was adopted to measure the effect. This finding suggested staff training significantly reduced the duration of physical restraint (IV = -0.88; 95% CIs = -1.65 to -0.10; random-effect model; $Z = 2.22$; $P = 0.03$). (see Fig. 3)

INCIDENCE OF RESTRAINT INDUCED ADVERSE EFFECT

The adverse effect only included physical injury, including skin

injury, pressure ulcer, and fracture. The Mantel-Haenszel test was employed in this section, and risk ratio was adopted to measure the effect. Totally three Chinese studies were included in this section (Hou et al., 2013; Huang, Wang, & Xiong, 2015; Wang et al., 2013), the analysis predicted staff training could decrease the incidence of restraint induced adverse effect (RR, 0.16; 95% CI = 0.09 to 0.30; random-effect model; $Z = 5.96$; $P < 0.00001$). (see Fig. 4).

GRADE ASSESSMENT

The evidence regarding characteristic and adverse effect of physical restraint was appraised by GRADE according to the Cochrane handbook. The identified studies provided important level of evidence,

Table 1
Evidence appraisal matrix.

Study	Type of study	Level of evidence	Sample, setting	Methods/instruments/data analysis	Findings/implication
Hou et al. 2013	RCT	II	Nurses and psychiatrists in a psychiatric hospital	Training program of risk evaluation	38.0% for intervention group, 58.4% for control group. Duration 4.70 ± 3.37 h for intervention group, 12.30 ± 7.68 h for control group (P < 0.05)
Wang et al. (2013)	Quasi-experimental design	III	Nurses in a psychiatric department	Training program of implementation and the care after restraint	Duration 1.72 ± 0.86 h for intervention group, 3.79 ± 1.26 h for control group (t = -14.571, P < 0.01). incidence of adverse effect 8.3% for intervention group, 38.3% for control group
Putkonen et al. (2013)	RCT	II	Sample size: 804 staffs. Setting: 2 state hospital in Finland.	Methods: group counseling, daily event analysis, consumer meeting. Measurements: duration of restraint, number of patient-days with restraint, details of physical violence against person.	Seclusion-restraint days decreased from 30% to 15% of the total patient time (IRR over time = 0.88, CI = 0.86-0.90, p < 0.001). Seclusion-restraint time decreased from 110 to 56 h per 100 patient-days for intervention wards (IRR over time = 0.85, CI = 0.78-0.92, p < 0.001), yet increased from 133 to 150 h for control wards. Violence decreased for both groups. The duration of restraint decreased
Kontio et al. (2014)	RCT	II	10 wards of two psychiatric hospital	e-learning program	
Chen et al. (2014)	Quasi-experimental design	III	Nurses in a psychiatric hospital	Training program of implementation	22.3% for intervention group, 48.5% for control group (P < 0.05)
Huang et al. (2015)	Quasi-experimental design	III	Staff nurses and nursing managers in a psychiatric hospital	Training program of implementation	Incidence of adverse effect 2.6% for intervention group, 26.4% for control group
Chen et al. (2016)	RCT	II	Nurses in a psychiatric hospital	Training program of implementation	15.4% for intervention group, 20.5% for control group (P < 0.05)
Blair et al. (2016)	Quasi-experimental design	III	120-bed psychiatric urban hospital	Training program of crisis intervention and trauma informed care	A decrease in both the number and duration of restraint

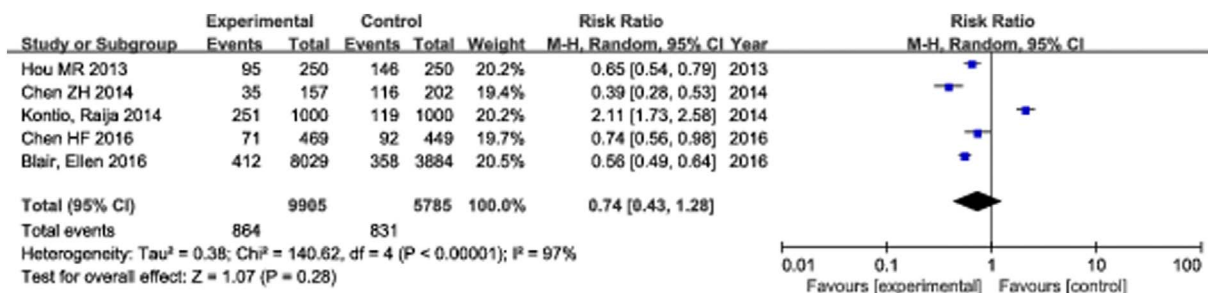


Fig. 1. Forest plot of frequency.

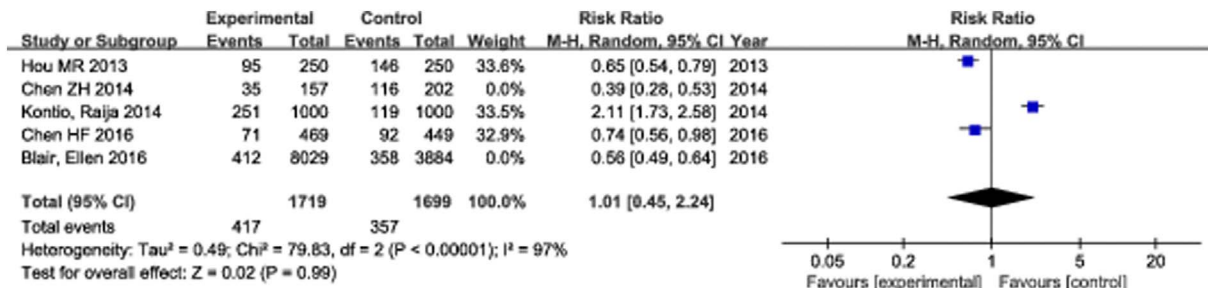


Fig. 2. Forest plot of prevalence.

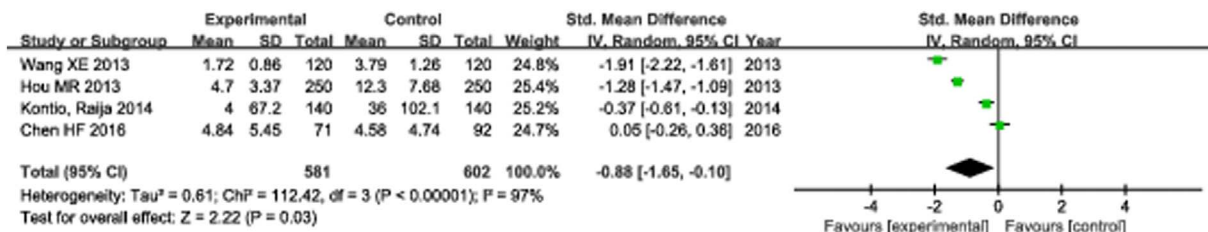


Fig. 3. Forest plot of duration.

which reasonably explained staff training could reduce the duration and adverse effect of physical restraint in the psychiatric hospital. (see Table 2)

DISCUSSION

Demonstrated with the identified studies, staff training was an essential part of a program for reducing physical restraint. Noticeably, for the purpose of enhancing the effectiveness in restraint reducing, Stewart et al. (2010) suggested staff training should be implemented together with other strategies, including changing local policy, review procedure, crisis management, the PRN medication, patient education, violence awareness, and risk assessment. In terms of staff training, lecture learning and seminar were two of the most widely employed approaches. However, staff training emphasized cultivating nurses' capability of providing health education in specific topic which

required professional knowledge in mental health nursing, such as emotion management, aggressive behavior management, and stress coping strategy (Pellfolk, Gustafson, Bucht, & Karlsson, 2010). In addition to nurses' capability, strengthening the awareness of risk and reflections of clinical dynamic scenario were other indispensable elements in training programme; and seminar and group discussion were main approaches to achieve these goals (Putkonen et al., 2013).

This review has following limitations. Firstly, the identified studies were randomized controlled trials and quasi-experimental studies. However, the evidence of quasi-experimental studies provided practical but not convincing argument in relation to the proposed PICO question. To summarize the identified evidence above, in relation to the randomized controlled trials, despite the rigor in randomization, the design of every trial were reasonable and acceptable. The measurements of patient and staff at baseline and follow-up were absent. However it was preferable but unrealistic to collect the characteristic of participants as

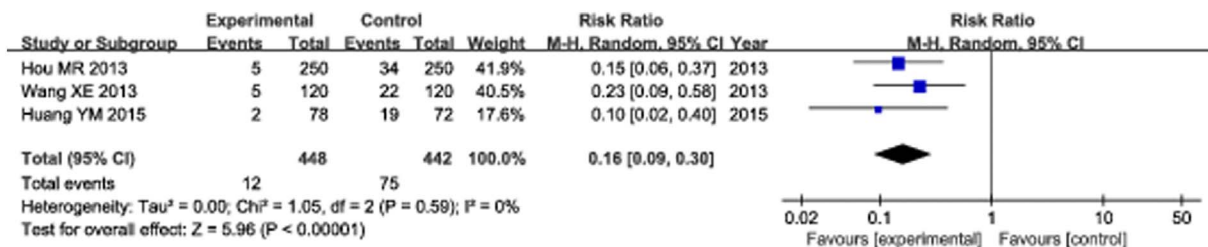


Fig. 4. Forest plot of adverse effect.

Table 2
Grade assessment.

Certainty assessment		No. of patients			Effect		Certainty		Importance			
No. of studies	Study design	Risk of bias	Inconsistency	Indirectness	Imprecision	Other considerations	Characteristics of restraint	Placebo	Relative (95% CI)	Absolute (95% CI)		
5	Observational studies	Serious	Not serious	Not serious	Not serious	All plausible residual confounding would reduce the demonstrated effect	864/9905 (8.7%)	831/5785 (14.4%)	RR 0.74 (0.43 to 1.28)	37 fewer per 1000 (from 40 more to 82 fewer)	⊕⊕○○ Low	Important
4	Observational studies	Serious	Not serious	Not serious	Not serious	Strong association all plausible residual confounding would reduce the demonstrated effect	581	602	-	SMD 0.88 SD lower (1.65 lower to 0.1 lower)	⊕⊕⊕○ Moderate	Important
3	Observational studies	Serious	Not serious	Not serious	Not serious	None	12/448 (2.7%)	75/442 (17.0%)	RR 0.16 (0.09 to 0.30)	143 fewer per 1000 (from 119 fewer to 154 fewer)	⊕○○○ Very low	Important

CI: confidence interval; RR: risk ratio; SMD: standardized mean difference.

it consumes great resources. On the other hand, the trials concerning staff training should be conducted at organizational level, meaning all the members within an organization would take part in its implementation. Furthermore, it collided the ethics of clinical research that trained staff served patients in intervention group and untrained staff for participants in control group if the trial conducted within one ward/unit. From this perspective, for studies focused on organizational change, cluster-randomized controlled trial should be rational to examine the effectiveness of training programme. Secondly, only the studies published between June 2013 and May 2017 were included due to the search timeframe was five years, and those obsolete studies were excluded. However, the studies in recent five year were eligible to offer up-to-date evidence which certified the effectiveness of staff training in regard to reduce the use of physical restraint. Additionally, more studies are needed to examine the effectiveness of staff training in relation to reduce the prevalence of physical restraint.

To conclude, staff training could reduce the use of physical restraint, contents of the training program included restraint technique, health education, violence management, and self-reflection (Huang et al., 2015; Kontio et al., 2014; Wang et al., 2013). However, it had been reported that the use of restraint varies apparently depending on social attitude and clinical tradition (Petti, Mohr, Somers, & Sims, 2001), in other words, it would be unlikely to employ an universal section for all the staffs who work in mental health service, because a specific training program might not fit in all clinical circumstances, then necessary adjustments based on the reality should be considered when conducting a staff training program of reducing physical restraint.

It was recommended to follow the conclusion above. In regard to staff training in China, the following factors should be considered. Firstly, in China, the frequency of physical restraint was higher than global average. It was reported the frequency of physical restraint in a Chinese psychiatric hospital was 51.3% of total admitted patients (Zhu et al., 2014). In contrast, the global average incidence of physical restraint was 6% to 17% (Beghi, Peroni, Gabola, Rossetti, & Cornaggia, 2013). Secondly, the workforce was limited as there were approximately 25,000 registered psychiatric nurses (1.91/100,000 population), which was much less than the global average level (12.79/100,000 population) (Liu et al., 2011). However, such heavy workload was deemed to be a critical reason of prevalent use of physical restraint, since nurses were not allowed to attempt alternatives in terms of coping violence (Betemps, Somoza, & Buncher, 1993). Thirdly, according to author's 4-year experience in China, unlike other regions that only has completed a course and passed the examination could a general nurse works in a psychiatric unit, a great number of nurses just begin their career in mental health system soon after college education which mainly focuses on general nursing. Then after a couple of years, majority of them might participate a course for professional nursing techniques in mental health care (for instance, violence management, crisis alleviation) and become a specialized nurse (which also means a senior psychiatric nurse). Therefore, the staff training of physical restraint should be implemented as a compulsory program before nurses starting their clinical practice in mental health settings. Meanwhile, the National Mental Health Commission should ensure all the nurses are qualified to implement physical restraint as well. In regard to the core content of the proposed program, being enlightened by the studies by Chen et al. (2016) and Wang et al. (2013), the author suggests the training program/course should include basic psychiatric knowledge (for example the reasons of restraint, restraint prevention, alternatives, technical aids, and communication skills) for nurses, particular the newly registered nurses. Equally, the technique of physical restraint is another core content of the program as it could avoid causing secondary injury to the patient. Noticeably, Kontio et al. (2014) proposed e-learning was one of the arising approaches of nursing education. Therefore, the author also proposes it would be worthy of applying e-learning in relation to the proposed training program due to its convenience for the trainers and trainees.

FUNDINGS

This study was funded by the grant of Scientific Research Project of Twelfth Five-year Plan Internal Medicine of the Affiliated Brain Hospital of Guangzhou Medical University (No.GBH2014-HL07), this funding source aims to encourage the relevant research regarding psychiatric nursing within the author's institute, it financially supported the expense in terms of literature accessing and had no involvement of any parts of the paper.

AUTHOR CONTRIBUTION

Xiao and Yu conceived the study and obtained research funding. Ye, Guo, Lei and Wei undertook the retrieval of literature; Ye, Xiao, Yu, and Lei extracted the data and performed statistical analysis; Ye, Yu and Luo drafted the manuscript. All authors contributed substantially to its revision. Xiao takes responsibility for the paper as a whole.

ACKNOWLEDGMENTS

We wish to acknowledge all the staff in TCM Department for their valuable advice and support regarding this study.

COMPETING INTERESTS

All authors had declared that they have no competing interests.

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