



Evaluation and mechanism analysis of HIV prevention programme using resilience framework among female sex workers: A randomised controlled trial

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ABSTRACT

Background: Evidence shows traditional sexual harm reduction for female sex workers (FSW) based on health behaviour theories is effective but short-lived. This study aimed to evaluate and understand the effectiveness of a resilience-promoting programme in improving psychological health and, ultimately, safe sex practice.

Methods: A randomised controlled trial was conducted at three Hong Kong-based non-governmental organisations. 127 sex workers were recruited and randomly assigned to the intervention or control groups. The former received a six-session resilience-promoting programme designed to improve self-esteem, self-efficacy and coping skills, whereas the latter had the usual care. Between-group differences in psychological outcomes and condom use were tested using the intention-to-treat, with ANOVA and *chi*-square tests, measured at baseline, post-intervention and 3-month follow-ups. Multiple mediation analysis was used to examine how the intervention worked through resilience factors.

Results: Significant between-group improvements in adaptive coping ($F_{1,119} = 5.82, p < .05$) and reduction in psychological distress ($F_{1,118} = 5.00, p < .05$) were seen at post-intervention and 3-month follow-ups, with significant time \times group interaction changes suggesting the changes occurred at different rates between the two groups. Condom use during the last transactions had increased in the intervention group and the rate of consistent condom use during transactions improved in the intervention group at follow-ups ($\chi^2 = 4.35, p < .05$). Self-esteem and resilience significantly mediated the effect of intervention at reducing psychological distress.

Conclusions: These findings suggest that resilience improves the psychological health and general wellbeing of Chinese FSWs.

1. Introduction

HIV infection remains a global public health challenge, with two million new infections annually (UNAIDS, 2015). Female sex workers (FSWs), with high mobility and risk of exposure, are at greater risk of contracting HIV and other sexually transmitted infections (STIs). Baral et al. (2012) conducted a systematic review and meta-analysis, which estimated that the overall prevalence of HIV infection among FSWs across 50 low- and middle-income countries was as high as 11.8% (95% confidence interval (CI) 11.6–12.0). Additionally, FSWs tend to have disproportionately poor access to HIV-related service (UNAIDS, 2010),

despite World Health Organization's (WHO) advocacy for early identification and optimising contextually-tailored prevention programmes for the vulnerable population (World Health Organization, 2011).

Harm reduction intervention based on health behaviour theories, such as Health Belief Model (Rosenstock, 1974) or Theory of Planned Behaviour (Ajzen, 1985), have shown to be effective in promoting condom use by improving knowledge, removing barriers to access, or changing attitudes and beliefs (Merson et al., 2000; Shahmanesh et al., 2008). However, they seldom addressed the underlying issues that initially bring these women into commercial sex or other social determinants of health, such as poverty, work-related violence and stigma

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in the wider socio-cultural and political context. Hence, their effectiveness can be short-lived (Manhart and Holmes, 2005). Moreover, FSWs were more likely to report anxiety, depression, self-harm and lower quality of life (Sanders, 2004; Hong et al., 2010). Study has found that those with self-reported psychological distress were more likely to engage in risky behaviour, such as substance abuse or inconsistent condom use (Yuen et al., 2016). Therefore, developing evidence-based empowerment interventions that reduce FSWs' psychological stress could potentially inform future directions for sustainable HIV prevention (Manhart and Holmes, 2005).

Resilience, defined as “the ability to adapt and function competently after adversity”, has received growing attentions. Several resilience interventions addressing personal, familial and environmental factors were effective in promoting autonomy, personal growth and improved psychological wellbeing of young people and adults (Steinhardt and Dolbier, 2008). At the same time, although previous research has found these qualities could be associated with better psychological health, how these attributes were mediated through the resilience process remained unclear. The aims of this randomised controlled trial were to investigate the effectiveness and explore a mediation model of a resilience intervention in improving both the psychological and sexual health of FSWs. It was hypothesised that FSWs in the intervention group would learn to identify their strengths to increase their sense of self-esteem, self-efficacy, and to apply problem-solving skills to deal with life challenges. Consequently, they would be more likely to take care of their own physical and psychological health, which may in turn lead to an increase in protected sex and regular HIV/STI testing (Fig. 1).

2. Methods

2.1. Sampling frame and sample size

FSWs who 1) were 18 years or older; 2) claimed to have working as a FSW in Hong Kong within the previous six months; and 3) could speak Cantonese or Putonghua were recruited through three local non-governmental organisations (NGOs), namely AFRO, JJJ Association, and Society of Rehabilitation and Crime Prevention. They are all community-based, non-profit organisations in Hong Kong to provide a variety of services such as health education, sexually transmitted disease screening and legal advice, for FSWs. Previous local studies found a wide range of condom usage from 37.9% to 98.5% (Lau et al., 2007; Wong et al., 1994).

Power calculations estimated a necessary sample size of 124 in total to detect a difference of 20%, based on an average 70% consistent condom use and 0.05 significance. A focus group was conducted after the intervention, 12 participants of different levels of attendance (high, medium, low) were recruited to explore their perception of the intervention, as well as facilitators and barriers for them to attend the sessions. Additionally, the representative of each participating NGOs

($n = 3$) were invited for meetings throughout the intervention period for their feedback and perceptions towards the intervention.

2.2. Procedures

At recruitment, the group facilitator (who was an experienced clinical psychologist) or research assistant would approach potential participants through outreach services or at the service centres to explain the purpose and procedure of the study, including the number of sessions, duration, equal chance of being in the intervention or control group and the receipt of HK\$50 (about US\$6.5) after completion of each questionnaire. Each potential participant was screened and excluded from the study if they had a known diagnosis of a mental disorder (such as psychosis, bipolar disorder, severe affective disorders) or had been screened positive for suicidal ideation. All recruited participants would complete a comprehensive baseline survey, at post-intervention (after completion or within 15 weeks of enrolment whichever came earlier) and at 3-month follow-ups.

Participants were randomly allocated on a 1:1 ratio into the intervention or control group according to a pre-determined randomisation list generated by an online software. Both group facilitator and participants were not blinded to the group allocation but an independent research assistant who remained masked to the intervention allocation would assist in administering the questionnaires to ensure the trial was assessor-blinded. Additional arrangements were adopted to minimise attrition: 1) FSWs were contacted and followed-up by NGO outreach staff; 2) Stand-alone sessions and flexible time intervals between sessions to accommodate the mobile nature of FSWs' jobs; and 3) small group meetings of three to six persons, so FSWs could feel more comfortable about sharing their experiences.

All women provided verbal informed consent and the trial was conducted and reported in accordance with CONSORT guidelines. Ethics approval was obtained from the University of Hong Kong/Hospital Authority Hong Kong West Cluster Internal Review Board prior to data collection (UW 12-220). The protocol of this multi-centred randomised controlled trial has been published (Yuen et al., 2013).

2.3. The intervention and control

The programme was designed as six one-hour sessions, based on the resilience framework and the Transactional Model of Stress and Coping (Lazarus and Folkman, 1984). The content and mode of delivery was devised from the previously published qualitative study (Yuen et al., 2014) and ethnographic observations in the local context. The therapeutic approach of the intervention utilised psychoeducation (Colom, 2011), cognitive-behavioural strategies (Beck, 1967), and social learning principles (Bandura, 1989). Psychoeducation addressed personal knowledge on stress, its association between cognitive, emotional and behavioural components as well as individual resilience. Cognitive-

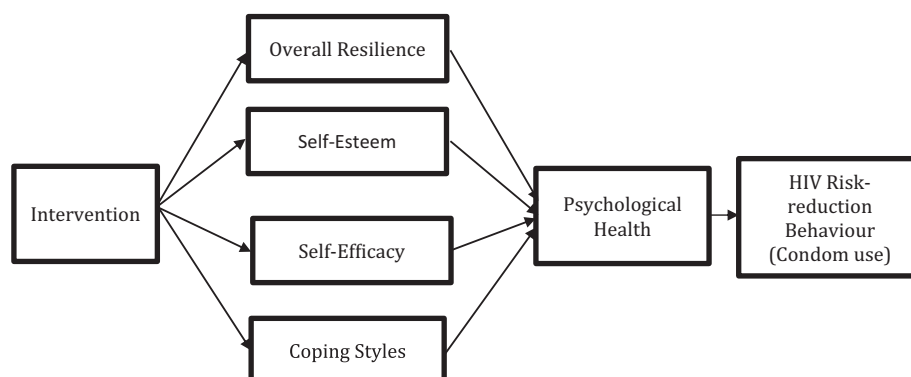


Fig. 1. Proposed model of individual resources in predicting HIV risk-reduction behaviour.

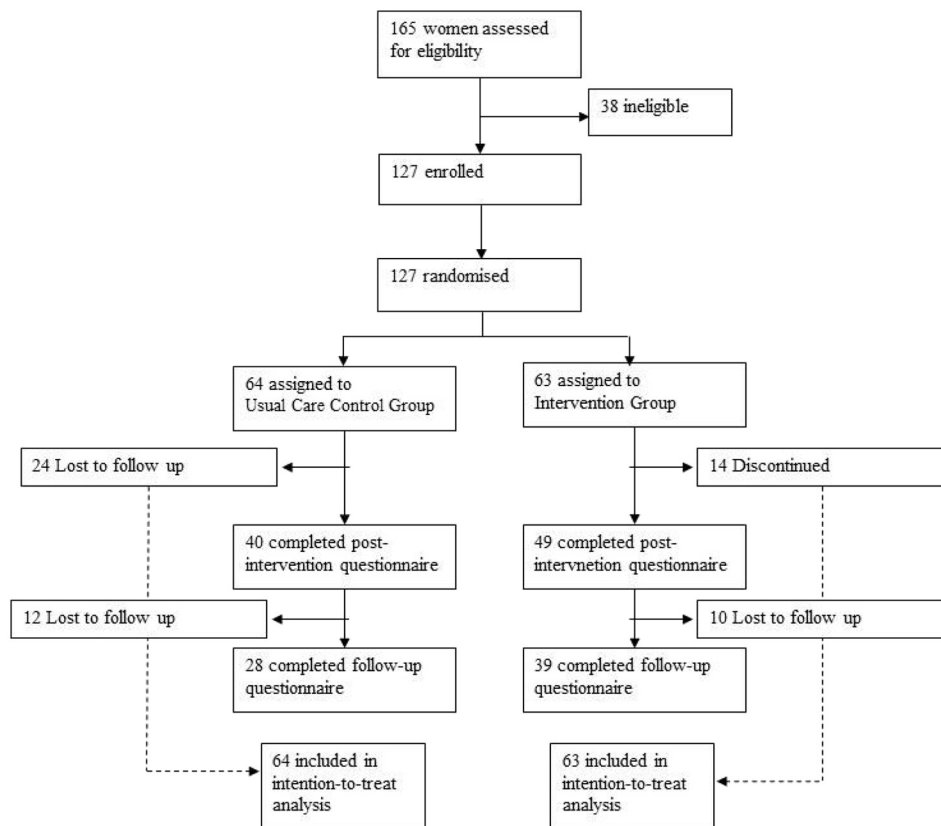


Fig. 2. Flowchart of the RCT.

behavioural strategies targeted thinking processes, emotional experiences and behaviours were used to modify maladaptive thoughts through learning, guided discovery and reflection. Social learning principles facilitated individuals' learning through their peers to express emotions, deal with situations more effectively, and apply their strengths through interactions with the facilitator and other group members.

Participants who were assigned to the control group received standard services provided by the NGOs, including outreach visits, offering of HIV/STI testing, and, according to their personal preferences, social activities. Participants were advised not to join any psychological programmes during the study period or they would need to leave the trial.

2.4. Outcome evaluation

This RCT was evaluated using the Complex Intervention Evaluation Framework for developing and evaluating complex interventions (Medical Research Council, 2006), and included both process and effectiveness evaluation. The primary outcome measure was the rate of consistent condom use during participants' last vaginal sexual intercourse with clients. The secondary outcomes were the scores on the Connor-Davison Resilience Scale (Connor and Davidson, 2003), Rosenberg's self-esteem scale (Rosenberg, 1965), the Generalized self-efficacy scale (Schwarzer et al., 1997), Brief COPE (Carver, 1997), psychological distress as measured by General Health Questionnaire (GHQ) (Goldberg, 1992), as well as sexual health behaviours such as condom use during oral sex and with partners, and uptake of HIV/STI testing. As for process evaluation, intervention feedback was collected from eight meetings with the contacting staff from the participating NGOs throughout the intervention period. A focus group discussion with 12 FSWs was conducted to explore the barriers and perceived benefits after the intervention. These provided supplementary information to

understand how individual resilience influenced their psychological health and HIV risk behaviours.

2.5. Data analysis

The baseline demographics of the intervention and control were compared using independent sample *t*-tests for continuous variables and *chi*-square for categorical variables. The intention-to-treat approach was adopted, with missing values replaced by the last observed values. Repeated measures ANOVA was used to detect any change in sexual health risk behaviour and psychological outcome measures (scores on self-esteem, self-efficacy, coping, resilience and GHQ) over time between the two groups. The data collected from the focus group discussion was transcribed, coded with open coding and categorised into sub-themes and themes.

The second objective of the study was to explore the mechanism of how individual resilience factors i.e. higher self-esteem, self-efficacy and coping, could influence the effect of the intervention on psychological outcomes in FSWs. A multiple-mediator model was tested using the techniques proposed by Preacher and Hayes (Preacher and Hayes, 2004). The data was resampled 5000 times using bootstrapping and the results for indirect effect were interpreted for significance by determining whether zero was contained within the 95% CI. The treatment outcome tested was the change in the scores of GHQ and improvement in condom use at follow-up. All statistical analyses were conducted using SPSS 23.0, and a macro designed for multiple-mediation models was used to test the fitness-to-fit to the model (Preacher and Hayes, 2008).

The qualitative data obtained from the meeting and focus group discussion were audiotaped and transcribed. The data were coded with open coding and categorized into themes and subthemes using a thematic analysis (Braun and Clarke, 2006). The quotations were directly translated from Chinese to English.

Table 1
Demographic information of participants.

Demographic variable	Control n = 64	Intervention n = 63	Total N = 127	p
	n (%)	n (%)	N (%)	
Age (mean ± SD)	38.2 ± 6.7	42.1 ± 6.6	40.2 ± 6.9	< .01**
Years working (mean ± SD)	2.0 ± 2.1	2.8 ± 2.9	2.4 ± 2.5	.09
Work settings (n, %)				.05
One-woman apartment	25 (39.7%)	27 (45.0%)	52 (42.3%)	
Nightclub	10 (15.9%)	5 (8.3%)	15 (12.2%)	
Massage parlour	15 (23.8%)	6 (10.0%)	21 (17.1%)	
Street	13 (20.6%)	22 (36.7%)	35 (28.5%)	
Education level				.79
No formal education	1 (1.6%)	2 (3.2%)	3 (2.4%)	
Primary	10 (15.6%)	10 (15.9%)	20 (15.7%)	
Junior	32 (50.0%)	35 (55.6%)	67 (52.8%)	
Senior	18 (28.1%)	15 (23.8%)	33 (26.0%)	
Tertiary	3 (4.7%)	1 (1.6%)	4 (3.1%)	
Marital status				.27
Single	7 (11.1%)	2 (3.2%)	9 (7.1%)	
Married	24 (38.1%)	28 (44.4%)	52 (41.3%)	
Separated/divorced	25 (39.7%)	30 (47.6%)	55 (43.7%)	
Cohabiting	4 (6.3%)	2 (3.2%)	6 (4.8%)	
Widowed	3 (4.8%)	1 (1.6%)	4 (3.2%)	
Residence				.01*
Hong Kong permanent resident	9 (45.0%)	11 (42.3%)	20 (43.5%)	
< 7 years	3 (15.0%)	13 (50.0%)	16 (34.8%)	
Travel visa	8 (40.0%)	2 (7.7%)	10 (21.7%)	
Individual income				.13
< 10,000	25 (39.6%)	31 (49.2%)	56 (44.4%)	
10,000–19,999	21 (33.3%)	24 (23.8%)	45 (35.6%)	
≥ 20,000	17 (27.1%)	8 (12.8%)	25 (23.8%)	

* p < .05

** p < .01

3. Results

A total of 165 FSWs were assessed for eligibility between December 2012 and April 2014 (Fig. 2); 38 were excluded because they did not fulfil the inclusion criteria ($n = 15$) or declined to participate ($n = 23$). FSWs were from one-woman apartments, the streets, nightclubs and massage parlours. Among them, 63 (49.61%) participants joined the intervention group and 64 (50.39%) the control. 70.10% (89/127) completed both pre- and post-intervention questionnaires, and 52.76% (67/127) completed the 3-month follow-up questionnaire. Participants dropped out from the study mostly because of “failure to contact or moved elsewhere”; three “withdrawals” from the intervention; three “change of occupation” and hence refused to remain in the study.

During the data-collection period, about 20 social gatherings were organised, including seminars on general health issues and festival gatherings for the control. Table 1 summarises the demographic characteristics of both intervention and control participants at baseline. The mean age of the participants was 40.15 years ($SD = 6.9$) and the average duration of working as FSWs was 2.41 years ($SD = 2.5$). There was no significant between-group difference in their years working in the sex industry, work setting, education level, marital status or individual monthly income.

At baseline, no significant difference was found in FSWs' resilience, psychological distress, self-esteem, self-efficacy; but maladaptive coping was significantly more reported in the intervention group ($t(113) = -2.19, p = .03$). In addition, > 90% of the participants in both groups reported using a condom at their last transaction. Chi-square tests showed no significant difference in sexual health behaviours, including condom use with clients and sexual partners and testing for HIV and other STIs (Table 2).

Table 2
Comparison of sexual health behaviours between intervention and control groups at baseline.

	Control n (%)	Intervention n (%)	p
Condom use in last transaction (vaginal)			.43
Yes	58 (93.55%)	58 (96.67%)	
No	4 (6.45%)	2 (3.33%)	
Condom use in last transaction (oral)			.96
Yes	43 (72.88%)	42 (72.41%)	
No	16 (27.12%)	16 (27.59%)	
Condom use in transaction (last week)			.27
Always	44 (68.75%)	47 (81.03%)	
Sometimes	19 (29.69%)	10 (17.24%)	
Never	1 (1.56%)	1 (1.72%)	
Partner condom use (vaginal)			.19
Yes	31 (50.82%)	37 (62.71%)	
No	30 (49.18%)	22 (37.29%)	
Partner condom use (oral)			.41
Yes	23 (41.82%)	25 (49.02%)	
No	32 (58.18%)	25 (49.02%)	
HIV testing			.79
Yes	52 (81.25%)	50 (79.37%)	
No	12 (18.75%)	13 (20.63%)	
Syphilis testing			.55
Yes	29 (76.56%)	51 (80.95%)	
No	15 (23.44%)	12 (19.05%)	
Gonorrhoea testing			.60
Yes	43 (67.19%)	45 (71.43%)	
No	21 (32.81%)	18 (28.57%)	
Chlamydia testing			.12
Yes	37 (57.81%)	44 (70.97%)	
No	27 (42.19%)	18 (29.03%)	
Pap smear testing			.56
Yes	47 (74.60%)	49 (79.03%)	
No	16 (25.40%)	13 (20.97%)	
Hepatitis B testing			.41
Yes	42 (67.74%)	44 (74.58%)	
No	20 (32.26%)	15 (25.42%)	

3.1. Feedback from NGOs and focus group

Eight meetings with NGO staff were held and changes made were documented by way of audit trails throughout the study, although they were minimal after the first three meetings. In general, staff members agreed that the content of the intervention was relevant. The language used was appropriate but more colloquial language and visual aids for communication were recommended. Half of the participants had Putonghua as the first language; hence, some content had to be adapted.

A focus group discussion was held with 12 participants after completion of the study. They identified availability as the main barrier to attending, for family matters or awaiting business. One raised the fear that disclosing their identity as sex workers could bar them from attending other NGO-organised programme. Perceived benefits such as improved mood, changes in mindset, and social connections were important factors to remain in the programme. As for safe sex practice, one participant stated, “I had to love and protect myself”, so she refused clients who requested not to use a condom. Some participants found that they became more flexible at solving problems and the intervention had provided them with some unique experience e.g. expressing themselves freely, being listened to and cared for, as well as connecting with support network and resources.

3.2. Outcome evaluations

Significant improvement ($F_{1,75, 218.55} = 13.25$, partial eta square = 0.10, $p < .001$) in resilience score from pre- to post-intervention ($p < .01$) was demonstrated with a significant time × group

Table 3
Scores on psychological outcome measures at pre-intervention, post-intervention, and 3-month follow-up.

	Pre-intervention		Post-intervention		Follow-up	
	Control (n = 64) Mean (SD)	Intervention (n = 63) Mean (SD)	Control (n = 64) Mean (SD)	Intervention (n = 63) Mean (SD)	Control (n = 64) Mean (SD)	Intervention (n = 63) Mean (SD)
GHQ-12	14.63 (4.39)	14.80 (6.57)	13.63 (4.72)	10.48 (6.59)	13.57 (4.23)	11.26 (6.40)
PSS-4	7.20 (2.32)	6.60 (2.72)	6.80 (2.26)	6.21 (2.38)	6.67 (2.27)	5.86 (2.78)
CD-RISC	23.16 (5.51)	22.75 (6.92)	23.80 (5.42)	25.67 (6.79)	23.78 (5.16)	26.27 (6.54)
Self-esteem	16.78 (3.26)	15.86 (3.21)	17.09 (3.14)	17.62 (3.83)	17.16 (3.01)	17.84 (3.30)
Self-efficacy	24.13 (5.91)	24.40 (6.42)	24.66 (6.03)	26.40 (6.09)	24.81 (5.73)	26.17 (5.53)
Brief COPE (adaptive)	38.76 (6.70)	39.86 (8.61)	40.06 (7.55)	43.67 (8.45)	40.28 (8.70)	44.82 (8.47)
Brief COPE (maladaptive)	24.24 (5.31)	26.67 (6.87)	23.95 (4.71)	25.84 (5.16)	23.84 (5.52)	25.34 (6.03)

interaction found ($F_{1.75, 218.55} = 6.13$, partial eta square = 0.05, $p < .01$), indicating that the between-group improvement had changed over time. Similarly, significant improvement was also observed in the scores of self-esteem ($F_{1.98, 247.21} = 12.74$, partial eta square = 0.09, $p < .001$) from pre- to post-intervention ($p < .01$) and at 3-month follow-up ($p < .01$) where the time \times group interaction was also significant ($F_{1.98, 247.21} = 6.04$, partial eta square = 0.05, $p < .01$) (Table 3).

Significant main effects of group ($F_{1,119} = 5.82$, partial eta square = 0.05, $p < .05$) and time ($F_{1,89, 214.25} = 12.49$, partial eta square = 0.10, $p < .001$) were found for adaptive coping style as measured by Brief COPE. The result indicated that participants had reported more adaptive coping at post-intervention ($p < .001$) and 3-month follow-ups ($p < .001$), and those in the intervention had a higher level of adaptive coping than those in the control group. The baseline difference observed in maladaptive coping style in the two groups continued at post-intervention and 3-month follow-up ($F_{1,121} = 4.97$, partial eta square = 0.04, $p < .05$).

As for psychological distress measured by GHQ-12, a significant time \times group interaction was identified ($F_{1,81, 214.25} = 6.01$, partial eta square = 0.05, $p < .01$). There were also significant main effects of group ($F_{1,118} = 5.00$, partial eta square = 0.04, $p < .05$) and time ($F_{1,81, 213.25} = 14.36$, partial eta square = 0.11, $p < .001$), whereby the intervention group showed a bigger drop in psychological distress than that of the control.

Despite the fact that the intervention group had a higher score in self-efficacy, the between-group difference was not significant ($F_{1, 125} = 1.56$, partial eta square = 0.01, $p = .21$). There was no significant time \times group intervention ($F_{1,88, 235.16} = 1.27$, partial eta square = 0.01, $p = .28$). In addition, participants in both groups reported lower perceived stress over time ($F_{1,79, 224.24} = 4.22$, partial eta square = 0.03, $p < .05$), but no significant difference was found between groups ($F_{1,125} = 3.57$, partial eta square = 0.03, $p = .06$) and time-group interaction ($F_{1,79, 224.24} = 0.16$, partial eta square = 0.001, $p = .83$).

3.3. Effects on sexual health

Although the results showed no significant difference in consistent condom use immediately after the intervention, the intervention participants reported a trend of increasing condom use during transactions in the previous week and STI testing at post-intervention (Table 4). At the 3-month follow-up, the consistent condom-use rate during transactions improved among participants in the intervention group ($\chi^2 = 4.35$, $p < .05$). Participants in the intervention group also showed an increase in the rate of HIV, syphilis, gonorrhoea and chlamydia testing at 3-month follow-up when compared to the baseline (Table 5).

The mediation analyses explored the indirect, direct and total effects of intervention on change in psychological distress from pre-intervention to follow-up through the five proposed psychological

Table 4
Sexual health behaviours between intervention and control at post-intervention.

	Control	Intervention	p
	n (%)	n (%)	
Condom use in last transaction (vaginal)			.41
Yes	60 (93.75%)	61 (96.83%)	
No	4 (6.25%)	2 (3.17%)	
Condom use in last transaction (oral)			.75
Yes	46 (73.02%)	43 (70.49%)	
No	17 (26.98%)	18 (29.51%)	
Condom use in transaction (last week)			.11
Always	46 (71.88%)	52 (86.67%)	
Sometimes	17 (26.56%)	8 (13.33%)	
Never	1 (1.56%)	0 (0.00%)	
Partner condom use (vaginal)			.26
Yes	33 (53.23%)	38 (63.33%)	
No	29 (46.77%)	22 (36.67%)	
Partner condom use (oral)			.27
Yes	24 (40.68%)	28 (50.91%)	
No	35 (59.32%)	27 (49.09%)	
HIV testing			.08
Yes	58 (90.63%)	50 (79.37%)	
No	6 (9.38%)	13 (20.63%)	
Syphilis testing			.41
Yes	57 (89.06%)	53 (84.13%)	
No	7 (10.94%)	10 (15.87%)	
Gonorrhoea testing			.96
Yes	49 (76.56%)	48 (76.19%)	
No	15 (23.44%)	15 (23.81%)	
Chlamydia testing			.45
Yes	45 (70.31%)	48 (76.19%)	
No	19 (29.69%)	15 (23.81%)	
Pap smear			.76
Yes	50 (78.13%)	47 (75.81%)	
No	14 (21.88%)	15 (24.19%)	
Hepatitis B			.41
Yes	44 (69.84%)	39 (62.90%)	
No	19 (30.16%)	23 (37.10%)	

mediators (Fig. 3). The total effect of intervention on follow-up psychological distress was significant (coefficient = -2.49 , SE = 1.19, $t = -2.10$, $p < .05$). After controlling the mediators, the direct effect of intervention on follow-up psychological distress was insignificant (coefficient = -0.44 , SE = 1.07, $t = -0.41$, $p = .68$). With the bootstrapping, the total indirect effect of intervention through all proposed mediators was significant, with the estimates being -2.09 and the 95% biased corrected CI ranging from -4.19 to -0.50 . The mediation model accounted for 33.2% of the variance of the effect of intervention on psychological distress with the set of mediators (Table 6).

Self-esteem and resilience scores were significant mediators. As for self-esteem, the specific indirect effect was estimated to be -0.98 with a 95% bias-corrected confidence interval of -2.97 to -0.001 . Self-esteem was positively associated with being in the intervention group

Table 5
Sexual health behaviours between intervention and control at 3-month follow-up.

	Control	Intervention	<i>p</i>
	N (%)	N (%)	
Condom use in last transaction (vaginal)			.71
Yes	60 (93.75%)	60 (95.24%)	
No	4 (6.25%)	3 (4.76%)	
Condom use in last transaction (oral)			.10
Yes	45 (70.31%)	52 (82.54%)	
No	19 (29.69%)	11 (17.46%)	
Condom use in transaction (last week)			.03*
Always	44 (68.75%)	53 (88.33%)	
Sometimes	19 (29.69%)	7 (11.67%)	
Never	1 (1.56%)	0 (0.00%)	
Partner condom use (vaginal)			.18
Yes	35 (55.56%)	41 (67.21%)	
No	28 (44.44%)	20 (32.79%)	
Partner condom use (oral)			.17
Yes	26 (42.62%)	33 (55.00%)	
No	35 (57.38%)	27 (45.00%)	
HIV testing			.08
Yes	60 (93.75%)	53 (84.13%)	
No	4 (6.25%)	10 (15.87%)	
Syphilis testing			.21
Yes	60 (93.75%)	55 (87.30%)	
No	4 (6.25%)	8 (12.70%)	
Gonorrhoea testing			.52
Yes	51 (79.69%)	53 (84.13%)	
No	13 (20.31%)	10 (15.87%)	
Chlamydia testing			.31
Yes	47 (73.44%)	51 (80.95%)	
No	17 (26.56%)	12 (19.05%)	
Pap smear			.93
Yes	52 (81.25%)	50 (80.65%)	
No	12 (18.75%)	12 (19.35%)	
Hepatitis B			.90
Yes	41 (65.08%)	41 (66.13%)	
No	22 (34.92%)	21 (33.87%)	

* *p* < .05

(*coefficient* = 1.65, *SE* = 0.57) which, in turn, negatively related to psychological distress (*coefficient* = −0.53, *SE* = 0.20). In addition, overall resilience showed significant indirect effects and was estimated to be −0.67 with a 95% bias-corrected CI of −1.96 to −0.07. Similarly, being in the intervention group was positively related to higher increases in resilience (*coefficient* = 2.29, *SE* = 1.34), and in turn inversely associated with psychological distress (*coefficient* = −0.31, *SE* = 0.12). Examination of the specific indirect effects

Table 6
Indirect effects of intervention assignment on follow-up change in psychological distress.

Mediators	Parameter estimates	SE	95% biased corrected CI	
			Lower	Upper
Total	−2.09	0.93	−4.19	−0.50
ΔSelf-esteem (pre-post)	−0.98	0.76	−2.97	−0.001
ΔSelf-efficacy (pre-post)	−0.21	0.33	−1.32	0.14
ΔResilience (pre-post)	−0.67	0.46	−1.96	−0.07
ΔBrief COPE–adaptive (pre-post)	−0.09	0.38	−0.87	0.69
ΔBrief COPE–maladaptive (pre-post)	−0.14	0.22	−0.96	0.10

showed no significant difference.

4. Discussion

Women engaging in sex work have higher risk of contracting HIV and experience higher emotional risks as a result of their complex environmental, social and personal milieu. We posit that effective HIV prevention programmes should take into consideration FSWs' psychological health because their stress may affect their self-perceived risk and protection strategies, adversely impacting upon the success of any HIV preventive efforts. In this study, significantly greater improvements in psychological outcomes, including resilience, self-esteem and psychological distress were made in the intervention group compared to those of the control, and the effects were sustained at 3-months. Psychological interventions for enhancing resilience have been studied extensively in adolescents and college students, but they are being examined for the first time in HIV prevention and among FSWs (Gillham et al., 2006). The results of the multiple mediation show significant total and specific indirect effects of intervention on psychological distress through self-esteem and resilience.

The findings from the focus group discussions echoed the improvements in psychological health observed in the intervention group. FSWs reported that they recognised more readily how their thoughts could have affected them psychologically. Recognition and changing one's perception of the situation was shown to be associated with adaptation to the situation. Some reported they had become more positive about themselves and felt more self-worth after the intervention. They also reported more empowered and confident to refuse clients who paid them more for unprotected sex.

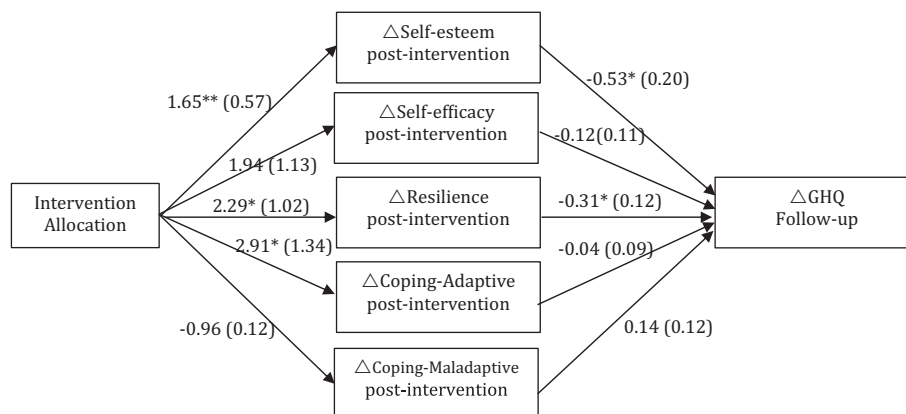


Fig. 3. Multiple-mediation model of intervention allocation and follow-up change in psychological distress.

Total (non-mediated *c* path) effect = −2.49 (1.19)*.

Direct (controlling mediators *c'* path) effect = −0.44 (1.07).

Values presented are coefficients and standard errors. **p* < .05, ***p* < .01.

The present study also hypothesised the rate of HIV-risk reduction behaviours would be significantly different between the two groups after intervention which was only partially supported. This may be related to the fact that the percentages of condom use with clients for both groups were over 90% at baseline, leaving them very small room for improvement. Despite this, the intervention group had a significantly higher rate of “always” using condoms than the control at 3-month follow-up. They also reported an increasing trend of undergoing testing for syphilis, gonorrhoea, and chlamydia post-intervention and at follow-ups. These changes in the intended direction suggest that psychological intervention appears to have an effect on changing sexual behaviour, yet the current sample size may not be large enough to detect the difference due to the high condom use at baseline.

The multiple-mediation analyses show a significant total indirect effect, indicating that the proposed resilience factors as a whole mediate the effect of intervention on psychological distress, which is consistent with some literature suggesting that interventions targeting improving resilience and protective factors are effective in reducing the intensity of psychological distress (Steinhardt and Dolbier, 2008; Ruini et al., 2009). Our findings also indicate that change in self-esteem and resilience would mediate the reduction in psychological distress at 3-month follow-up, in line with the negative association between self-esteem and psychological disorder symptoms (Dumont and Provost, 1999). A recent meta-analysis of 60 studies reported a medium effect size of the association between resilience and some important mental health indicators (Hu et al., 2015). However, our mediation analyses were particularly important because they explain how intervention exerts its effect on psychological attributes through individual resilience mediators, further examination of the complex inter-relationship among individual, familial and social resilience factors could be conducted, and such investigation could potentially extend to other high-risk populations.

The current study has several limitations. Firstly, similar to other studies with hard-to-reach populations, absolute random sampling for this project was not feasible. It was possible that our participants would be more health conscious than those did not participate because they had more regular contacts with NGOs. Secondly, the presence of incentive might have affected the FSWs' decision to participate in the project; hence influencing the generalisability of the results. Thirdly, given sex workers were highly mobile, this study had a follow-up period of only three months and the longer term effects of the intervention could not be assessed. Since the study was conducted in Hong Kong, the findings may not be generalisable to other social settings in other regions of China and globally. Furthermore, data collected were based on self-reported questionnaires. Social desirability and bias in recall are two issues often reported in human research. We collected information from different sources to allow triangulation of the findings. Lastly, the multiple-mediation analyses only included psychological health but not condom-use outcomes. Nevertheless, the current research supported a paradigm shift of considering the holistic health of the sex workers, future research could consider adding condom use, other risk behaviours, or other objective measures of health outcomes, to the model to further explore the association of physical and psychological health. Additionally, research on prevention intervention could adopt a community-based participatory approach (Weeks et al., 2010) to include FSWs as peer leaders in order to better understand their needs and barriers, to empower them and to improve the participants' engagement in the project. Despite these limitations, the current study has important implications for setting up HIV prevention and health programmes for FSWs locally, as in elsewhere. Hong Kong's current healthcare services for sex workers is largely weighted towards medically-defined sexual health, despite a growing body of evidence on FSWs' poor mental health and need for psychological services. As demonstrated in previous studies, emotional states, such as depressive symptoms, are associated with behaviour that increases risk of HIV, and they may be obstacles to behavioural changes, lowering the effectiveness of traditional HIV

prevention efforts (Lau et al., 2010). Scholars have argued that the goal of HIV prevention programmes should be in promoting harm reduction while simultaneously empowering FSWs and the general communities in which they live (Pardasani, 2005). Therefore, government's funding for research and services should not be limited to supporting HIV education and clinical service, but rather take a more holistic approach towards one's well-being to achieve sustainable changes in health and personal behaviour. Previous research has shown that community-based organisations play a pivotal role in promoting health among sex workers and that they are one of the environmental factors which affects their self-efficacy in practicing safe sex behaviours (Cheng and Mak, 2010). Therefore, it is important for the policy makers, experts from medical and public health sectors to collaborate with the local community-based organisations. Through partnership, for example, the clinics at NGOs could expand to women's wellness clinics which allows the provision of integrated care and treatment for both sexual and mental health problems. Furthermore, by improving the mental health knowledge, staff members at the organisations will be more sensitive in identifying high-risk individuals and screen for appropriate health services.

5. Conclusions

WHO and local guidelines on HIV prevention for key populations (World Health Organization, 2014) have acknowledged the mental health risks facing FSWs and other key populations highlighting the principles of upholding human rights and providing integrated services for these populations. We maintain that government authorities and legislators should review their policies on health services for FSW, based on the principle of human rights and public health considerations. By making mental health service accessible to all FSWs without discrimination, it is likely to benefit individuals and maximise the public health impact, while reducing their vulnerability to HIV infection.

Contributors

WW, WY, CT, EH and DF were responsible for the original proposal, development of the intervention, provided input on methodology and secured funding for the trial. WW was the principal investigator and had full access to all the data in the study as well as the final responsibility for the management of the study. WY conducted the literature search, delivered the intervention and conducted the data analysis. DF provided support for the data analyses. WY and WW prepared the initial draft and final report based on comments from other authors. All authors have seen and approved the final manuscript.

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Declaration of interests

We declare no competing interests.

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Appendix A. Outline of the resilience-promoting programme

Session topic	Goals	Activities
1. Starting out	<ul style="list-style-type: none"> To get to know each other Goal-setting To understand and identify different emotions (Psychoeducation) 	<ul style="list-style-type: none"> A game to get to know the facilitator and members Discussion and sharing of intervention goal (Discussion) Asked participants to name different emotions. Played a card game to share an event and emotions in relation to it (Didactic teaching & reflection)
2. Empowering interpretation	<ul style="list-style-type: none"> To understand the link among events, thoughts and emotions To identify negative thoughts and generate more helpful thoughts 	<ul style="list-style-type: none"> Use of an emotion thermometer to express their thoughts and emotions (Modelling & empathetic responses) A game to illustrate how thoughts influence emotions and motivate them to change (Modelling & reflection) Role play alternative responses to case scenarios (Guided practice, reframing & role-playing)
3. Effective coping	<ul style="list-style-type: none"> To explore strategies to manage stress effectively To generate coping strategies and identify more adaptive ones To empower their coping ability and improve their self-efficacy 	<ul style="list-style-type: none"> Brainstorming and discussion (Discussion) Practicing problem-solving with case scenarios (Guided practice & role-playing) An exercise to introduce encouraging phrase and relate to their life circumstances (Teaching, reflection & feedback)
4. Who am I?	<ul style="list-style-type: none"> To recognise different roles they play at home/work To introduce the importance of self-care and self-affirmation 	<ul style="list-style-type: none"> An activity to interview group members regarding their roles and discuss the challenges and gains (Discussion) To brainstorm self-care activities through a cut-and-stick activity (Active learning)
5. The unique self	<ul style="list-style-type: none"> To identify their personal strengths 	<ul style="list-style-type: none"> To use affirmation statements and show encouragement to other group members (Modelling) To choose their strengths from the cards (Reflection) To discuss how they apply these strengths in their daily life (Discussion & feedback) To highlight the importance of these strengths and affirm their abilities to deal with challenges (Teaching & reframing)
6. Preparing for the future	<ul style="list-style-type: none"> To revisit the key points learnt To prepare for the challenges ahead 	<ul style="list-style-type: none"> Question-and-answer game Identify obstacles and resources available (Role-playing & modelling) Practical advice (Teaching)

Appendix B. Supplementary data

Supplementary data to this article can be found online at <https://doi.org/10.1016/j.pmedr.2018.12.007>.

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