**Mediation Pathways for Reduced Substance Use Among Parents and Their Children: A Randomized Controlled Trial of Parenting Intervention**

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**Abstract**

**Background:** Substance use is a major public health concern worldwide. Alcohol and drug use have risen over recent decades in many low and middle-income countries, with South Africa among the highest globally.

Despite the existing evidence on the effectiveness of family-based interventions in reducing substance use among parents\caregivers and adolescents in low-income countries, yet little is known about the mechanism of change that contributes to substance reduction. This study investigated mediators of change in a parenting programme (Parenting for Lifelong Health -PLH) on reduction of substance use among parents and their children through three potential mediators: parental depression, parenting stress and family poverty.

**Methods:** The current study draws on a pragmatic cluster randomized controlled trial design; the total sample comprised 552 parents\caregiver and adolescent dyads (parents\caregivers M = 49.37; SD = 14.69 and adolescents M = 13.84; SD = 2.38) who were recruited from 40 communities in South Africa’s Eastern Cape.Participants completed a structured confidential self-report questionnaire, at baseline and follow-up test (5–9 months following the intervention). Structural equation modeling (SEM) was conducted to investigate direct and indirect effects.

**Results:** analyses indicated that PLH intervention impact on parental substance use reduction among parents was mediated by improvement in parental mental health (reduction in parental depression levels). There were no pathways from PLH intervention to parental substance use through parenting stress or family poverty. Furthermore, findings showed a significant positive correlation between parental substance use and adolescents' substance use.

**Conclusions:** The findings of the study highlight the fact that PLH parenting intervention has a significant effect on secondary outcomes, including substance use and depression among parents\caregivers in LMIC. These findings emphasize the need for creating supportive environments and systems for parents who suffer from emotional strain and mental health problems, in particular among families in adversity. Improving parental mental health as part of a parenting programme serves as a significant pathway that contribute for substance use reduction among parents\caregivers.

**Trial registration:** Pan-African Clinical Trials Registry PACTR201507001119966. Registered on 27 April 2015. It can be found by searching for the key word ‘Sinovuyo’ on their website or via the following link: <http://www.pactr>. org/ATMWeb/appmanager/atm/atmregistry?\_nfpb=true&\_windowLabel=BasicSearchUpdateController\_1&BasicSearchUpdateController\_1\_actionOverride=%2Fpageflows%2Ftrial%2FbasicSearchUpdate%2FviewTrail&BasicSearchUpdateController\_1id=1119

**Keywords: parental substance use; poverty; parental depression; adolescents**

**Background**

Substance use is a major public health concern worldwide [1, 2]. Whilst there is a significant variation in substance use levels globally, alcohol and drug use has increased over recent decades in many low-income countries [1, 2, 6]. The prevalence of alcohol misuse in the general adult population is estimated at 4% globally and 3% in Africa (Kuteesa et al., 2019). A study conducted among 1115 adult men in Cape Town, South Africa, have shown that most of the participants (75%) reported that they had cannabis and heavy alcohol drinking at least once during the last week (Arfer et al., 2018). Empirical studies have shown that substance use among adults (including problematic alcohol, tobacco and drug use) is associated with physical, mental and social problems [3, 4], in addition to the involvement in high risky behaviors such as sexual behaviors [Chawla & Sarkar, 2019]. Substance use is also a major concern among adolescents. A cross-sectional survey conducted among 20,227 adolescents in South Africa found that the prevalence of past month reported problematic alcohol use was 23% [7]. Previous studies have shown that substance use have adverse effects on adolescents, such as involvement in criminal activities (Aebi, Bessler, & Steinhausen, 2021), poor sleep health (Miller, Janseen, & Jackson, 2017) and risk for school dropout and poor academic performance (Finch et al., 2017). These findings emphasize the need for investigating the effectiveness of intervention programs that aim at reducing substance use (including problematic alcohol, tobacco and drug use) among adults and adolescents, particularly among low and middle income countries.

Existing evidence from low and middle income countries emphasized the effectiveness of family-based interventions on the reduction of substance use among adolescents and caregivers. For example, A mixed-method randomized controlled study conducted among 61 HIV-affected caregivers in post-genocide Rwanda found that a family-based intervention (The Family Strengthening Intervention for HIV-affected Families – FSI HIV) that addresses intimate family violence among IHV-affected families, was found effective in reducing alcohol use among caregivers (Chaudhury et al., 2016).

Similarly, findings of a first known randomized controlled trial of a parenting programme that combine parenting and economic strengthening components and address child-maltreatment in Africa, (Parenting for Lifelong Health programme - Sinovuyo Teen PLH) was found as effective in reducing susbstance use among parents\caregivers and adolescents. The trial conducted among 552 families for adolescents (aged 10-18) in Cape-Town, South Africa. At 5-9 months post-intervention, the intervention was associated with lower levels of substance use among both parents\caregivers and adolescents [10].

Despite the existing evidence on the effectiveness of family-based interventions in reducing substance use among parents\caregivers and adolescents in low-income countries, yet little is known about the mechanism of change that contributes to substance reduction. To the best of our knowledge no research has yet examined mechanisms of substance reduction among parents\caregivers and adolescents for family-based interventions that combine parenting and economic strengthening components.

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An understanding of factors related to substance use will assist our understanding of the mechanism of reducing substance use among parents\caregivers and adolescents who participated in the PLH intervention (Sinovuyo Teen PLH). Therefore, the aim of the current study is to investigate the mechanism of substance use reduction among parents\caregivers and adolescents through three potential mediators: parenting stress, parental depression and family poverty.

Parenting stress has been identified as a strain on parents as a result of everyday challenges associated with child rearing, especially when the parents' responsibilities as caregivers cannot be met with the resources available to them (Cousino & Hazen, 2013; [Pereira et al., 2012](https://www.sciencedirect.com/science/article/pii/S0190740916301293" \l "bb0125)). The findings of previous studies have indicated that parenting stress increases the vulnerability to substance use in adults as a coping mechanism because of increased stress (Patrick, Wigtham, Schoeni, & Schulenberg, 2012; Rutherford & Mayes, 2019). Similarly, a growing body of evidence highlights that substance use and heavy consumption of alcohol among adults has been associated with stressful life experiences as many may tend to consume excessive alcohol as act of coping with negative feelings [14, 15]. Another study has found that mothers with substance use disorder can benefit from interventions that aiming at decreasing parenting stress (Short et al., 2017). Therefore, we assume that improved in parenting stress would countribute to substance use reduction among parents\caregivers.

In investigating the association between parental depression and substance previous studies have found a significant positive relationship between depressed mood with substance and alcohol use among adults [11-13]. One possible explanation for the relationship of depression and substance use is that substance use is a mechanism of coping with dysphoric moods (Rappeneau & Berod, 2017). . For example, a study conducted among 1910 African American adults have shown that turning to substance use is a means to alleviate depression stemming from stressful life events (Clark, 2014). Following these findings, we assume that improvement in parental mental health (lower levels of depression) would contribute to parental substance use reduction.

Lastly, previous studies have shown that lower socio-economic status has been linked to increased adolescents substance use (Lee et al., 2017). In a similar vein, a study conducted among 1357 young adult people in South Africa, has indicated that economic hardship and food insecurity are more likely to be related to high levels of alcohol and drug use (Gibbs, Jewkes, Willian, & Washington, 2018). Disadvantaged Kenyan fathers who participated in a qualitative study reported that supporting their families financially was a motivator to attempt quitting from alcohol abuse and problem drinking (Patel et al., 2020). Therefore, we assume that improving the household economic-status would contribute to reduction in substance use among parents\caregivers and adolescents.

The current study investigates the mechanism of a parenting programme (PLH) on reduction of substance among parents\caregivers and their children through three potential mediators: parenting stress, parental depression and family poverty. Based on the model shown in Figure 1, we hypothesized that: (1) PLH intervention would reduce parenting stress, parental depression and family poverty, (2) parenting stress, parental depression and family poverty would mediate the association between PLH intervention and reduction of substance use among parents\caregivers and children.

**Methods**

Study design and sample

In this pragmatic cluster randomized controlled trial, the total sample compromised 552 dyads of adolescents and their parents\caregivers (parents\caregivers M = 49.37; SD = 14.69 and adolescents M = 13.84; SD = 2.38) who were recruited from 40 communities (located in 34 rural villages and three large peri-urban townships) in South Africa’s Eastern Cape. Due to high levels of orphaning and fostering in South Africa, there were no requirements for a biological relationship between adolescent and primary caregiver but they had to reside in the same dwelling for at least four nights per week. Further information about the study design and sample and inclusion, exclusion criteria is available in Cluver et al. [10].

Randomization was stratified by urban location and conducted after baseline using a random number generator by an independent, blinded statistician (CL). Complete randomization within strata used a ratio of 1:1 intervention: control. The sample included 270 families in the intervention arm and 282 families in the control arm (M = 14 families per cluster, SD = 1.9). Blinding of participants and program providers was not feasible for parenting programs.

Ethical approval was given by the University of Oxford (SSD/CUREC2/11-40), University of Cape Town (PSY2014-001), and government Departments of Social Development and Education.

Procedure and data collection

Parents\caregivers and adolescents completed a structured self-report questionnaire at three points in time: pre-test (Baseline), 1 month post-intervention (with a limited sub-set of items) and 5–9 months post-intervention. Programme implementation and post-test data collection were delayed by extended political and civil violence. The final data collection stage was originally intended to be at 12 months, but due to violence was shifted to 3 months. However, due to ongoing election violence, this was only able to begin at 5 months post-intervention and took 5 full months to be completed as study areas were often unsafe and volatile.

The analyses of the current study were conducted based on the data at baseline and follow-up tests.

Intervention group

Dyads (parent\caregiver and adolescent) in the intervention group received a 14-session parenting programme called “Parenting for Lifelong Health/Sinovuyo Teen”. Each session lasted for 1–1:30 hours a week. All sessions took place in public and community places such as churches, community halls, schools and under trees.

Based on Social Learning Theory [28], the program was built from a set of 14 psycho-social sessions designed to improve the parent-child relationship, family cohesion and harmony, to promote non-violent discipline, and to encourage the family members to spend quality time together. In addition to the parent-child relationship, the program also emphasized certain parenting principles as important to maintaining healthy family relationships, such as complimenting each other, engaging in joint problem-solving, implementing rules and routines, responding to crises together, establishing clear communication strategies and exploiting mindfulness practices to reduce stress and anger levels. For example, mindfulness practices included taking a pause – a brief breath awareness activity – and a body relaxation exercise in which participants bring focused attention to each part of their body, and aiming at reducing stress. Participants practiced mindful movement exercises at the beginning of each session.

All sessions used collaborative problem-solving techniques (not didactic methods), traditional stories, role-play, modelling and stress reduction activities. In addition to its psycho-social elements, the program also included three core economic components designed to improve families’ financial status that included: (1) encouraging families to save some of their earnings by presenting a short play that addresses common financial challenges; (2) teaching fundamental financial skills such as budgeting and saving through visual budgeting exercises; and (3) motivating mental commitment to saving by clearly defining family saving goals and by making a practical family financial plan.The programme was designed for low-resource settings with no technology (such as video) or literacy requirements. (For further details about the programme, please see Cluver, L., Lachman, J. M., Ward, C., Gardner, F., Petersen, T., Meinck, F., Hutchings, J., Mikton, C., Tsoanyane, S., Doubt, J., & Boyes, M. (2016)).

Participants were encouraged to engage in home practice in the week following each session. For participants unable to attend sessions due to illness or disability, catch-up meetings were arranged to give brief session content at home or in the hospital. A simple lunch was included at the beginning of each session as many participants found difficulty in concentrating due to hunger. The programme was delivered by local community members, who were trained by a local NGO, Clowns Without Borders South Africa, and supported through weekly supervision.

Control group

Dyads in the control group received a one session (five hours) of hygiene programme called “SinoSoap”. The control condition was not related to parenting practices, it included hygiene and sanitation washing hand activities that used to increase the likelihood of retention in the control groups. This control activity was unlikely to influence any primary or secondary outcomes.

The programme was implemented by the NGO “Clown without Borders” in South Africa, and involved drama-based skills-building on safe water conservation and hand washing for children. The session was delivered through performance and activities. All children received a soap which – when used – had a small toy inside.

Measurements

Parents\caregivers and adolescents completed self-report questionnaires, using tablets at baseline, 1 month post-intervention and 5–9 months following the intervention. All questionnaires were pre-piloted with local adolescents and parents\caregivers. All measurements were translated into isiXhosa, one of the 11 official languages spoken in South Africa, and back-translated.

Alcohol and substance use among parents\caregivers was assessed by using the adapted version of the WHO Alcohol Use Disorders Identification Test (AUDIT) [29] and the WHO Global School-based Health Survey. This variable was reported by parents\caregivers (4 items; α = .529; e.g., “In the past month, have you had a drink?”; “Did you take any drugs to help you relax?”). Responses were: 0 = No and 1 = Yes. One overall score was derived by computing the sum of the items.

Alcohol and substance use among adolescents was measured by using three items from the Child Behavior Checklist Scale [30]. This variable was reported by adolescents (3 items; α = .547; e.g., “During the past month, I drank alcohol without the permission of my caregivers’ approval”; “I smoke cigarettes”; “I use drugs like dagga (marijuana) or other drugs”). Responses ranged from 0 = Not true to 2 = Very true.

Parenting stress was measured using 18 items (α = .770; e.g., “I feel overwhelmed by the responsibility of being a parent”; “Caring for my children sometimes takes more time and energy than I have to give”) from the Parental Stress Scale [31]. Items were measured on a five-point Likert type scale, ranging from 0 (Strongly disagree) to 4 (Strongly agree). One overall score was derived by computing the sum of the items. Eight items from the scale were reverse coded: ("I am happy in my roles as a parent; I am satisfied as a parent; I find my child(ren) enjoyable; I enjoy spending time with my child(ren); My child(ern) is an important source of affection for me; Having children gives me a more certain and optimistic view for the future; I feel close to my child(ren); There is little or nothing I wouldn't do for my child(ren) if it was necessary").

Parental depression was assessed by using 20 items (α = .876; e.g., “I felt very sad even with help from my family and friends”; “I didn’t feel like eating”; “My appetite was poor”) from the Centre for Epidemiological Studies Depression Scale [32]. Items were measured on a five-point Likert type scale, ranging from 0 (Not at all or less than one day) to 4 (Nearly every day). One overall score was derived by computing the sum of the items. Four items from the scale were reverse coded: ("I enjoyed life; I was happy; I felt hopeful about the future; I felt I was just as good as other people").

Family poverty was measured as monthly consistent access to necessities including food, electricity, communication, and transport [33]. This variable was assessed by using 9 items (α = .683; e.g., “Afford 3 meals a day”; “Afford the costs of the school”; “Afford enough warm clothes”). Responses were: 0 = No and 1 = Yes. One overall score was derived by computing the sum of the items.

Covariates. Parents and adolescents were asked to provide information about their age, gender, and rural/urban location. All variables (mediators and outcomes) were measured at baseline and 5-9 months follow-up after the intervention was completed. Mediators were not measured at 1 month follow-up, and were measured at 5-9 months of follow-up only.

Data analyses

Analyses used intention-to-treat (ITT) for all clusters and families irrespective of intervention uptake and included families who were no longer living together at follow-up (n=53). Independent sample t-tests were conducted to compare means of outcomes and mediator differences at baseline and follow-up between intervention and control groups.

A linear Structural Equation Modeling (SEM) was used with AMOS21 statistics program. The SEM procedure combined measurement modeling (Confirmatory Factor Analyses – CFA) and structural equation modeling. Items that were theoretically and empirically perceived as describing the variable were used in the measurement model.

Goodness of fit for the final model was assessed using the Comparative Fit Index (CFI – acceptable fit for CFI is >= .90) and the Root Mean Standard Error of Approximation (RMSEA – acceptable fit for RMSEA is < .06). We also report χ2 fit statistics but acknowledge that the test is inflated by sample size of the study.

**Results**

Descriptive statistics

T-test results for baseline and follow-up outcomes and mediating variables (intervention and control group) are shown in Table 1. Pearson correlations between the study variables are shown in Table 2.

Direct and indirect effects

We examined mediators of PLH intervention on reduction of substance use among parents\caregivers and their children, through three potential mediators: parenting stress, parental depression, and family poverty, at follow-up test (5–9 months following the intervention).

Table 3 shows total, direct and indirect effect of each mediator on the outcome of the study. At the first step of the analyses, each mediator was tested individually. At the second step, all mediators were tested in a Structural Equation Model (SEM) simultaneously.

The results of the measurement fit model were χ2 = 284.89, df = 142, P < .000, as the values of CFI = .931 and RMSEA = .043 showed a good model fit. Structural equation modeling was also used to test the direct and indirect (mediation) effects of the PLH intervention and the potential mediators on substance use among parents\caregivers and their children. The model shown in Figure 1 represents the model fit for all the variables of the study. The results of the theoretical model were χ2 = 369.28, df = 159, P < .000, as the values of the CFI = .904 and RMSEA = .049 showed a good model fit.

The results of the SEM have shown that PLH intervention has a significant effect on reducing parental substance use (ß = -.167, P < .001) and adolescent substance use (ß = -.090, P < .05) at follow-up test (5–9 months). In addition, findings showed that PLH intervention has a significant effect on reducing parental depression (ß = -.255, P < .001), parenting stress (ß = -.151, P < .05) and family poverty (ß = -.288, P < .001), at follow-up test.

Mediation analyses was examined using Bootstrap in AMOS. The results presented in Figure 1 indicate that the PLH intervention effect on parental substance use reduction among parents\caregivers ran through one indirect pathway: reduction in parental depression. At follow-up test (5–9 months) PLH intervention had contributed to reduction in parental depression (ß = -.255, P <.001 CI [-.11,-.01]). There was no pathway from PLH intervention to parental substance use through parenting stress or family poverty. In other words, parenting stress and family poverty do not serve as mediators in the association between PLH intervention and reduced parental substance use. Furthermore, there were no pathways from PLH intervention to adolescent substance use through parenting stress, parental depression or family poverty.

**Discussion**

The current study investigated the role of parental depression, parenting stress and family poverty as potential mediators of a parenting programme (PLH) on reduction of substance use among parents\caregivers and their children in South Africa. The findings of the study help us to understand the mechanism behind the reduction of substance use among parents by showing that reduction in parental depression serves as a mediator between PLH intervention effect and parental substance use. In other words, improving parental mental health – reducing depression – contribute to reduction in substance use among parents\caregivers. We can understand this mediation process in light of The General Strain Theory of Agnew [34]. According to this theory, substance use among adults is a coping mechanism to relieve negative feelings, such as stress, frustration and depression. With limited support and skills, parents may resort to substance use to escape their pain, negative feelings and cope with the problems they face. These findings suggest that PLH intervention provides parents with skills and support that help them to cope in effective ways and avoid ineffective coping mechanisms, such as problematic alcohol use and drug use. In addition, the PLH intervention serves as a supportive environment for vulnerable parents, which contributes positively to their mental health by providing emotional and instrumental support as part of the intervention (such as stress reduction activities that included deep breath awareness activity and body relaxation exercises in which participants bring attention to each part of their body). This finding is consistent with previous studies that have shown that mindfulness practices are effective approaches in reducing substance use by reducing depressive symptoms (Chiesa & Serretti, 2014). One explanation for the effectiveness of mindfulness practices in reducing substance use is that mindfulness practices increase the awareness for the physical, emotional and cognitive states. This increase in awareness would contribute to a decrease in the need to alleviate discomfort feelings with substance use and encourage skillful ways to deal with emotional difficulties (Bowen et al., 2009).

Contrary to our hypotheses, the findings of the study showed that parenting stress and family poverty did not serve as mediators of PLH intervention on reduction in substance use among parents\caregivers. Based on these findings we can conclude that despite the improvement in household economic status and the reduction in parenting stress levels, they do not necessarily contribute to substance use reduction among parents\caregivers. These findings indicate that what really matters to substance use reduction among parents\caregivers is the parents' mental health, specifically reduction in depressive symptoms.

Furthermore, the potential mediators (parental mental health, parenting stress and poverty) did not explain the reduction in substance use among adolescents. It seems parental (parental mental health; parenting stress) and familial factors (family poverty) can't explain the substance use reduction among adolescents. It is recommended that future studies investigate potential pathways for the reduction in substance use among adolescents, particularly variables that related to the child, such as adolescents' mental health.

To the best of our knowledge, the current study is among the first to investigate mediation pathways for reduction in substance use among parents and their children in LMIC. Findings indicate that parenting intervention has a significant effect on high risk behaviors (substance use) among parents and their children and parental mental health, despite working with vulnerable families. Strengths of the study include the pragmatic randomized trial method which provides high external validity. Furthermore, standardized measurement and intention-to-treat were used.

However, limitations also need to be acknowledged. First, mediation analyses were conducted at one time point only (5–9 months follow-up). Although a 1-month follow-up was conducted it was not included in the mediation analyses. Mediators were not measured at 1-month follow-up, and they were measured at 5-9 post-intervention only.

A longer-term follow-up with multiple post-intervention assessments would have enabled us to examine potential effects and potential reverse causality between parental depression and reduction of parental substance use. Hence, future studies should conduct mediation analyses at more than one point in time, which would enable the hypothesized mediator to be measured before the outcome. Second, based on the findings of the study, causal inferences of intervention components cannot be made. The findings of the study have shown that improvement in parental mental health (less depression) mediates parental substance use. However, we cannot recognize which intervention components are responsible for this mediation effect. Therefore, it is recommended that future studies use other methods of identifying essential components, such as relaxation and coping skills with negative feelings, which might provide further insight into active core ingredients for parenting programs. This includes evidence from randomized micro-trials on the efficacy of discrete parenting techniques [35], and factorial experiment trials that test different components in relation to each other [36]. Furthermore, the reliability of the substance use and poverty measurement were low. Substance use measurement (AUDIT) did not measure a construct rather use of different forms of substances that might not be related and therefore we do not expect a high value of Cronbach's Alpha. However, based on previous studies AUDIT measurement is widely used in general populations as a method to measure substance use and it is suggested as a reliable measurement (Myer, L., Smit, J., Roux, L. L., Parker, S., Stein, D. J., & Seedat, S. (2008). Similarly, the family poverty scale measured different aspects of family necessities (food, electricity, clothing and transport) and not a construct. Therefore, it explain the low value of reliability.

Lastly, the current study contributes by filling the gap regarding the pathways to effects of parenting intervention in reducing high risk behaviors among parents for adolescents in vulnerable communities. Nevertheless, we recommend that future researches examine the mechanism of reducing substance use among parents\caregivers in other settings in LMIC.

Conclusion

The findings of the current study emphasize the importance of understanding the challenges that vulnerable families face which negatively affect their mental health and increase the likelihood of involvement in high-risk behaviors, such as substance use. These findings highlight the fact that we need to create supportive environments and systems for parents who suffer from emotional strain and mental health problems. Professionals need to adopt an empathic approach toward vulnerable families which would contribute towards better understanding for their needs and challenges. An empathic approach would contribute to building effective psycho-social interventions and prevention programs that target families at risk.

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**Table 1**Baseline and follow-up characteristics, for intervention and control groups

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | **Baseline**  **Mean (SD)** | | **Follow-Up**  **Mean (SD)** | |
| **Variable** | **Treatment** | **Control** | **Treatment** | **Control** |
| **Parental substance use** | 0.44  (.85) | 0.56  (.93) | 0.34\*  (0.75) | 0.60  (1.02) |
| **Adolescent's substance use** | 0.60  (1.08) | 0.65  (1.12) | 0.14\*  (0.44) | 0.27  (0.71) |
| **Parental depression** | 23.13  (11.79) | 24.90  (12.08) | 11.30\*  (9.78) | 16.82  (11.13) |
| **Parenting stress** | 33.13  (8.68) | 33.39  (8.18) | 23.75\*  (8.24) | 27.05  (7.32) |
| **Family poverty** | 0.04 (1.68) | -.004 (1.64) | 0.29 (1.60)\* | -0.28 (1.49) |
| **N** | 270 | 282 | 264 | 278 |

Note: \*P < .05 statistically significant differences in means between the groups (treatment and control groups).

**Table 2** Pearson correlations of the study’s variables (N = 548)

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Variable | 1 | 2 | 3 | 4 | 5 |
| 1. Parental substance use | 1 |  |  |  |  |
| 1. Teen Substance use | .174\* | 1 |  |  |  |
| 1. Parental depression | .266\*\* | .009 | 1 |  |  |
| 1. Parenting stress | .117\*\* | .170\*\* | .266\*\* | 1 |  |
| 1. Family poverty | -.029 | -.024 | -.111\* | -.169\*\* | 1 |

\*P < .05; \*\*P < .000

**Table 3**Total, direct and indirect effects of mediators on the outcomes of the study (substance use among parents and teens)

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
|  | **Parental substance use** | | | **Teen substance use** | | |
| **Mediators** | **Total Effect** | **Direct Effect** | **Indirect Effect** | **Total Effect** | **Direct Effect** | **Indirect Effect** |
| 1. Parental depression | -.246  [-.39,-.10] | -.201  [-.35,-.05] | -.044  [-.11,-.01] | -.138  [-.24,-.03] | -.149  [-.25,-.04] | -.011  [-.01,.03] |
| 1. Family poverty | -.205  [-.33,-.07] | -.208  [-.39,-.09] | .001  [-.03,.03] | -.138  [-.24,-.03] | -.139  [-.24,-.03] | .000  [-.02,.02] |
| 1. Parenting stress | -.250  [-.40,-.09] | -.217  [-.37,-.06] | -.033  [-.07,-.00] | -.120  [-.22,-.02] | -.083  [-.18,.01] | -.037  [-.06,-.01] |

PLH intervention group

Parental depression

Parenting stress

Family poverty

Parental substance use

Adolescent substance use

-.151\*\*

n.s.

-.255\*

.236\*

n.s.

-.288\*

n.s.

\*P < .000; \*\*P < .05

**Fig. 1**Study model and structural equation model results

Note: All the paths were predicted; those represented by a dotted line were statistically insignificant. χ2 = 396.28, df = 159, P < .000; CFI = .904, and RMSEA = .049.

Note: Mediators and outcome were measured at the same time-point (5-9 months follow-up test).

**Abbreviations**

LMIC, low- and middle-income country, PLH, Parenting for Lifelong Health; RCT, randomised controlled trial.

**Declarations**

**Ethics approval and consent to participate** Ethical protocols were approved by the Faculty of Humanities Ethics Review Committee, University of Cape Town (PSY2014-001) and the Social Sciences and Humanities Inter-divisional Research Ethics Committee, University of Oxford (SSD/CUREC2/11-40), the European Research Council (ERC-2012-StG 313421-PACCASA) and South African provincial Departments of Social Development and Basic Education. The study and all methods were performed in accordance with the declaration of Helsinki. Consent for participation was obtained. Written voluntary informed consent was obtained from all participants (parents and adolescents) and consent procedures are read aloud for those with limited literacy. Confidentiality is maintained, except if participants are at risk of significant harm or request assistance.

**Availability of data and materials** Sinovuyo Teen manuals and programme materials will be made freely available online, and UNICEF has sponsored free printed versions. All research materials (i.e. questionnaires, study process materials and qualitative toolkit) will be made freely available on UNICEF and WHO websites. The study data will be made available on open-access websites such as the South African Data Archive and the European Clinical Trials database.Further information about the protocol study is available at Cluver et al., 2016. DOI 10.1186/s13063-016-1452-8.

**Competing interests** LC and JML are co-developers of the PLH for Adolescents programs, which are licensed under a Creative Commons 4.0 Non-commercial No Derivatives license. JML is also the Executive Director of Clowns without Borders South Africa, a non-profit institution responsible for the dissemination of the program. JML also receives occasional fees for providing training and supervision to facilitators and coaches. JML and LC have participated (and are participating) in a number of research studies involving the programme, as investigators, and the Universities of Oxford, Glasgow and Cape Town receive research funding for these. Conflict is avoided by declaring this potential conflict of interests; and by conducting and disseminating rigorous, transparent and impartial evaluation research on both this and other similar parenting programs. AM, FM, JD, YS and OG have no competing interests or other interests that might be perceived to influence the results of the study.

No profit or financial gain will be made from this programme.

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**Authors' contribution** AM contributed to the conception, design, statistical analyses and drafted the manuscript for publication. LC contributed for revising critically for important intellectual content of the manuscript. LC, YS, JML, FM contributed towards conceptualizing, designing and implementation of the experiment. All authors provided feedback and approved the final manuscript.

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