STATISTICAL ANALYSIS PLAN

Embedding mentors with lived experience in schools to reduce violent offending amongst children and young people: Randomised controlled efficacy trial of the SOS+ embedded mentoring programme.

National Centre for Social Research (NatCen)

Principal investigator: Emma Jones

YOUTH ENDOWMENT FUND

Embedding mentors with lived experience in schools to reduce violent offending amongst children and young people: Randomised controlled efficacy trial of the SOS+ embedded mentoring programme.

Statistical analysis plan

Evaluating institution: National Centre of Social Research
Principal investigator(s): Emma Jones

Project title	Embedding mentors with lived experience in schools to reduce violent offending amongst children and young people: randomised controlled efficacy trial of the SOS+ embedded mentoring programme
Developer (Institution)	St. Giles
Evaluator (Institution)	National Centre for Social Research (NatCen)
Principal investigator(s)	Emma Jones
SAP author(s)	Terry Ng-Knight, Nandita Upadhyay, Ekaterina Stoilova
Trial design	Two-armed individual-level multisite randomised controlled trial, stratified by school setting
Trial type	Efficacy
Evaluation setting	Schools in England and Wales (18 secondary schools and 1 alternative provision setting)

Target group	Children and young people (CYP) aged 11 to 18 years old who have experienced incidents connected to criminal activities, youth violence, or exploitation
Number of participants	960 children and young people , with 50:50 allocation in each group (i.e., 480 in SOS+ mentoring and 480 in Pastoral Care as Usual)
Primary outcome and data source	Self-reported offending measured via the volume score (estimated minimum total number of offending behaviours committed) of the Self-Reported Delinquency Scale (SRDS)
Secondary outcome and data source	1. Conduct/behavioural problems measured with the Conduct Problems subscale of the Strengths and Difficulties Questionnaire (SDQ) 2. Prosocial behaviour measured with the Prosocial Behaviour subscale of the SDQ 3. School/setting attendance and exclusions measured via education-setting attendance and exclusion data 4. Mentor/teacher-CYP relationship measured with the Youth Strength of Relationship (YSoR) scale

SAP version history

Version	Date	Changes made and reason for revision
1.2		
1.1	25.04.2025	Correction of the statistical model for the compliance analysis.

1.0	31.07.2024	

Table of contents

SAP version history 2

Table of contents 3

Introduction 4

Design overview 4

Changes since publishing the protocol 6

Sample size calculations overview 7

Analysis 9

Table 1. Power calculations 9

Figure 1. Causal Mediation Model 14

Introduction

This statistical analysis plan (SAP) sets out the planned analyses for the multi-site efficacy trial of the St Giles' SOS+ Embedded Mentoring Model (hereafter 'SOS+'). The SOS+ mentoring programme offers targeted assistance to children and young people (CYP) of secondary school age involved in crime, youth violence, or exploitation, and is delivered in education settings by mentors who have lived experience with the criminal justice system.

CYP are eligible for the programme if they meet at least one of the following criteria:

1. Known involvement with the police
2. Multiagency involvement due to involvement in criminal activity, youth violence or exploitation
3. Having a linked statutory worker due to involvement in criminal activity, youth violence or exploitation
4. Self-reported involvement in criminal activity, youth violence or exploitation.

Participating education settings were asked to refer 48 eligible CYP to take part in the evaluation (split into three cohorts of 16 CYP). St Giles is the delivery partner, liaising with education settings and SOS+ mentors. Mentors conduct one-to-one and face-to-face sessions on a weekly basis taking place in the education setting, each lasting about one hour over a period of six months. St Giles aims to deliver 23 sessions to each CYP. Each cohort consists of CYP spanning the eligible age range, with the same group of mentors delivering the intervention to each cohort (subject to staff turnover). More details on the intervention are available in the study protocol (Magić et al., 2023).

The evaluation will be conducted as a multisite two-arm randomised controlled efficacy trial with randomisation at pupil level. The primary outcome is self-reported offending among CYP measured with the Self-Reported Delinquency Scale (SRDS). Secondary outcomes are CYP conduct problems, prosocial behaviour, education setting attendance, unauthorised absences, and exclusions (permanent and fixed-term), and the relationship between mentor/teacher and the CYP. More information about the outcome measures and evaluation design can be found in the study protocol (Magić et al., 2023).

Design overview

Trial design, including number of arms	Two-arm multi-site trial with randomisation at the individual level

Unit of randomisation		Individuals (children and young people)
Stratification variables (if applicable)		Education settings, which includes schools and alternate provision settings
Primary outcome	Variable	Self- reported offending behaviour
	measure (instrument, scale, source)	The Self-Reported Delinquency Scale (SRDS) volume of the offending score1
Secondary outcome(s)	variable(s)	1. Conduct/ behaviour problems 2. Prosocial behaviour 3. Education setting attendance and unauthorised absences 4. Education setting permanent and fixed-term exclusions 5. Mentor-mentee relationship
	measure(s) (instrument, scale, source)	1– 2. Strengths and Difficulties Questionnaire (SDQ) scores on respective subscales, self-reported by CYP 3. School/setting attendance and unauthorised absences from school records 4. School/setting permanent and fixed-term exclusions from school records 5. Youth Strength of Relationship (YSoR) scale scores, self-reported by CYP
	Variable	Externalising behaviour problems

1 Generally, CYP within one school start and end the programme at the same time within each school. Measures are taken before and after the programmes en masse.

Baseline for primary outcome	measure (instrument, scale, source)	Strengths and Difficulties Questionnaire (SDQ) score for externalising behaviour, self-reported by CYP
Baseline for secondary outcomes	**Variables**	1. Conduct/behavioural problems 2. Prosocial behaviour 3. School/setting attendance and unauthorised absences 4. School/setting prior history of permanent and fixed-term exclusions 5. Mentor-mentee relationship
	measures (instrument, scale, source)	1– 2. Strengths and Difficulties Questionnaire (SDQ) scores on respective subscales, self-reported by CYP 3. School/setting attendance and unauthorised absences from school records 4. School/setting prior history of permanent and fixed-term exclusions from school records 5. Youth Strength of Relationship (YSoR) scale scores, self-reported by CYP

Changes since publishing the protocol

Some variations in the implementation of the evaluation have occurred in the time between finalising the study protocol and writing the SAP. These changes are:

- One setting (an alternative provision) aims to recruit additional CYP to the evaluation due to the larger number of eligible CYP attending. Instead of 48 CYP, it will recruit 96 CYP over the evaluation period. This resulted in 19 settings being recruited instead of the initially planned 20.

- Six schools did not refer the target of 16 CYP in the first cohort[2]. These changes are reflected in the power calculations below.
- Of the 6 schools not meeting the target of 16 CYP, 3 schools recruited an odd number of CYP in the first cohort. To maximise use of mentor capacity, the allocation ratio was amended in these schools so that the additional CYP was allocated to SOS+ rather than PCAU. These changes are also reflected in the power calculations.

Sample size calculations overview

We have used PowerUp![3] (Dong & Maynard, 2013) to perform all sample size calculations. Details on randomisation are available in the study protocol (Magić et al., 2023).

Planned sample size

The evaluation protocol anticipated the following sample sizes:

- The delivery partners aimed to recruit 20 education settings to the trial.
- Each education setting aimed to refer 16 CYP per cohort and 48 CYP in total, leading to a total of 320 CYP per cohort and 960 CYP in total.
- Within each setting, half of pupils were to be randomly allocated to SOS+ mentoring. The other half were allocated to the control group to receive pastoral care as usual (PCAU).

Power calculations in the protocol assumed an alpha level of 0.05 and a power of 0.8. The proportion of variance explained by the included covariates (R^2) was estimated at 0.16, based on a pre-test and post-test correlation of 0.4. This correlation estimate was based on a review of multiple studies and is at the lower range of previously reported correlations between the SDQ[4] and SRDS (see study protocol, Magić et al., 2023)[5]. The sample was equally divided

2 The evaluator believes that the eligibility criteria were made clear to schools and was informed by the delivery team that school leads complied with the eligibility criteria. The evaluator judges this to be a high eligibility bar. Schools could not meet the targets because it was such a high bar.

3 The model corresponding to the study design and planned analysis is Model 2.1: MDES Calculator for 2-Level Constant Effects Blocked Individual Random Assignment Designs (BIRA2_1c)—School Intercepts Only.

4 During the set-up phase the evaluator, delivery team and YEF agreed to only use the SRDS at endline. This was due to the SRDS: (1) being perceived as highly intrusive for a school setting; (2) covering multiple questions about criminal activities that would require disclosure and safeguarding action on behalf of the evaluator.

5 In essence, the estimate is based on the Reframe efficacy trial: https://youthendowmentfund.org.uk/wp-content/uploads/2023/07/Reframe-Evaluation-protocol.pdf Several other studies were included in the review

between the treatment and control groups with an allocation of 480 individuals per group. With no attrition and non-response this would result in a minimum detectable effect size of 0.166.

This sampling strategy was designed with expectations of attrition and endline survey non-response rates informed by previous YEF trials. We estimated endline response rates of 70% (see study protocol for rationale, Magić et al., 2023)[6]. Taking into account this level of attrition and endline survey non-response, we anticipated that the sampling strategy outlined in the protocol was likely to result in a minimum sample size of approximately 680 CYP across the three cohorts. Under these assumptions a Minimum Detectable Effect Size (MDES) of 0.203 standard deviations would be achieved.

Achieved sample size at time of writing SAP

In cohort 1 St Giles were able to recruit 19 education settings, where one of the education settings aimed to achieve twice the number of referrals, i.e., 32 referrals instead of 16, due to the larger number of CYP eligible for SOS+ at this setting. Out of these 19 education settings 13 completed referral targets as planned, and 6 settings did not. Of these 6 settings, three had even referral numbers and were allocated on 1:1 basis to SOS+ and PCAU. This reduced the planned sample from 360 to 306 CYPs in the first cohort. Of the 6 settings, three schools had odd numbers of referrals. It was considered more ethical and practical to assign more pupils to the SOS+ group than to the PCAU group, optimizing the use of mentors' time. Therefore, in three schools, allocation rates were 53:47 rather than 50:50. Overall across the whole of cohort 1, the allocation rate was 51:49.

We ran two new power calculations updated based on achieved sample for cohort 1. These new calculations multiply the achieved sample by three to estimate potential recruitment across the three cohorts. An additional calculation is run for our estimated attrition rate of 30%. These calculations are presented in Table 1.

to estimate the effect size, these are all included in the protocol. The Reframe trial's population was deemed to be most similar to the population in this trial.

6 Based on a review of response rates in YEF trials with similar populations (Empire Fighting Chance, Out and Reframe) with response rates of 62-88%.

Table 1. Power calculations

		Protocol	Randomisation	Accounting for attrition and non-response at endline
Minimum Detectable Effect Size (MDES)		0.166	0.170	0.203
Pre-test/ post-test correlations	level 1 (participant)	0.40	0.40	0.40
Alpha		0.05	0.05	0.05
Power		0.8	0.8	0.8
One-sided or two-sided?		Two	Two	Two
Number of participants	intervention	480	462	323
	control	480	450	315
	total	960	918	643

Analysis

Primary outcome

The primary outcome analysis will use an intention-to-treat (ITT) approach to estimate the impact of SOS+ mentoring on CYP self-reported offending, as measured by the SRDS volume score. This analysis addresses research question 1:

- RQ1: What is the impact of a 6-month 1:1 mentoring programme delivered by a mentor with lived experience on self-reported offending among CYP involved in incidents related to criminal activity, youth violence or exploitation, compared to pastoral care as usual?

Given the study is an efficacy trial, findings will not be generalised beyond the sample of education settings involved in the trial (i.e., "conditional inference"; YEF Analysis Guidance, 2021). A fixed-effects model will be used to estimate the conditional inference. Effects will be estimated using a single-level OLS model including the following variables:

- Baseline SDQ externalising score
- A binary variable indicating allocation to the SOS+ mentoring group (1) or PCAU group (0).
- A set of binary variables representing education settings.

In all models, standard errors will be adjusted to account for the clustering of CYP within education settings. Robust standard errors will be used to adjust for this clustering using the vce(robust) option in Stata.

The basic form of the fixed effect model is:

$$SRDS\ volume\ score_{ij} = \beta_0 + \beta_1 Baseline\ SDQ\ externalising\ score_{ij} + \beta_2 Intervention_{ij} + \beta_3 Education\ setting_j + \varepsilon_{ij}$$

where CYP i attends school j. The intervention effect is estimated by β_2, while β_1 represents the relationship between the baseline externalising score on the SDQ and self-reported offending. $\beta_3 Education\ setting_j$ represents the binary variables denoting school strata at randomisation and ε_{ij} is the error term.

In line with YEF analysis guidance (2021), no further covariates will be added.

Secondary outcomes

The secondary outcome analysis will explore the following research questions:

- RQ2: What is the impact of a 6-month 1:1 mentoring programme delivered by a mentor with lived experience on conduct problems among CYP involved in incidents related to criminal activity, youth violence or exploitation, compared to pastoral care as usual?
- RQ3: What is the impact of a 6-month 1:1 mentoring programme delivered by a mentor with lived experience on prosocial behaviour among CYP involved in incidents related to criminal activity, youth violence or exploitation, compared to pastoral care as usual?
- RQ4: What is the impact of a 6-month 1:1 mentoring programme delivered by a mentor with lived experience on education-setting attendance and absences

among CYP involved in incidents related to criminal activity, youth violence or exploitation, compared to pastoral care as usual?

- RQ5: What is the impact of a 6-month 1:1 mentoring programme delivered by a mentor with lived experience on education-setting exclusions (permanent and fixed-term) among CYP involved in incidents related to criminal activity, youth violence or exploitation, compared to pastoral care as usual?
- RQ6: What is the impact of a 6-month 1:1 mentoring programme delivered by a mentor with lived experience on the mentor/teacher-YP relationship among CYP involved in incidents related to criminal activity, youth violence or exploitation, compared to pastoral care as usual?

For RQ2, the intended measure is the SDQ conduct problems subscale score. Analysis for RQ2 will follow the same method as the primary analysis, on an ITT basis, implementing a single-level OLS model including baseline SDQ conduct problems score, a binary variable indicator of SOS+ or PCAU allocation and a set of binary variables representing fixed effects of schools.

For RQ3, the intended measure is the SDQ prosocial behaviour subscale score. Analysis for RQ3 will follow the same method as outlined for RQ2, estimating an OLS model including baseline SDQ prosocial behaviour score, a binary variable indicator of SOS+ or PCAU allocation and a set of binary variables representing fixed effects of schools.

The basic form of the fixed effect models for RQ2 and RQ3 is:

$$SDQ\ subscale\ score_{ij} = \beta_0 + \beta_1 Baseline\ SDQ\ subscale\ score_{ij} + \beta_2 Intervention_{ij} + \beta_3 Education\ setting_j + \varepsilon_{ij}$$

As further secondary outcomes, we will assess CYP education-setting attendance, unauthorised absences and exclusions (permanent and fixed-term), using data obtained from education setting records, as well as the relationship between mentor/teacher and the CYP, using the Youth Strength of Relationship (YSoR) scale. For CYP in the control group, we will assess the quality of their relationships with teachers, social workers, or youth workers involved in providing pastoral care as usual (PCAU).

For outcomes that are count data, poisson or negative binomial regression models will be estimated to assess the impact of SOS+ mentoring. The exact form of these regressions will depend on the distribution of the data, for example zero-inflated negative binomial models may be required if there are many zeros in the data. These outcome variables are school attendance (number of school sessions attended), unauthorised absences (number of schools sessions missed without school authorisation), and fixed term exclusions (number of days excluded from school). The models will include baseline attendance/absences/exclusions as

a covariate, a binary indicator of SOS+ or PCAU allocation and a school-level fixed effect. Models follow this form:

$$\ln(attendance_{ij}) = \beta_0 + \beta_1 Attendance\ at\ baseline_{ij} + \beta_2 Intervention_{ij} + \beta_3 Education\ setting_j + \varepsilon_{ij}$$

$$\ln(absences_{ij}) = \beta_0 + \beta_1 Absences\ at\ baseline_{ij} + \beta_2 Intervention_{ij} + \beta_3 Education\ setting_j + \varepsilon_{ij}$$

$$\ln(days\ excluded_{ij}) = \beta_0 + \beta_1 Days\ excluded\ baseline_{ij} + \beta_2 Intervention_{ij} + \beta_3 Education\ setting_j + \varepsilon_{ij}$$

For permanent exclusions, a logistic regression model will be estimated to assess the impact of SOS+ mentoring on the probability that the CYP is subject to a permanent exclusion from the education setting (binary outcome, where 1 = excluded, 0 = not excluded). The model will include previous history of permanent exclusions at baseline, a binary indicator of SOS+ or PCAU allocation and a school-level fixed effect. The basic form of the model is:

$$logit[P(Y_{ij} = 1)] = \beta_0 + \beta_1 Previous\ permanent\ exclusion_{ij} + \beta_2 Intervention_{ij} + \beta_3 Education\ setting_j + \varepsilon_{ij}$$

Where $Y_{ij} = 1$ is the outcome of having been permanently excluded.

As YSoR score is a continuous variable, an OLS regression model will be estimated to assess the impact of SOS+ mentoring on the relationship between mentor/teacher and the CYP. The model will include a binary indicator of SOS+ or PCAU allocation and a school-level fixed effect, with no baseline measure. The basic form of the fixed effect model is:

$$YSoR\ score_{ij} = \beta_0 + \beta_1 Intervention_{ij} + \beta_2 Education\ setting_j + \varepsilon_{ij}$$

Subgroup analyses

To contribute to the race, ethnicity, disability, and intersectionality (REDI) analysis and interpretation, exploratory subgroup analyses will be conducted to examine the impact of the intervention across various demographic categories. These subgroups will include gender (male versus female), Special Educational Needs and Disabilities (SEND; SEND versus no

SEND[7]), and ethnicity groups (plotting each Census 2021 category separately, as long as our sample contains 5 or more CYP in each group in both SOS+ and in PCAU groups). For these analyses, the primary outcome models will be run for each sub group separately. Data regarding these subgroups will be collected from referral forms disseminated by St Giles and filled out by education settings.

It's important to note that these subgroup analyses may have limited statistical power to detect small-to-medium effects due to smaller sample sizes within each subgroup. As a result, the findings from these analyses will be considered exploratory in nature. To enhance the interpretation of the results, we will aim to present the findings graphically. Additionally, we will represent the uncertainty associated with smaller group sizes by incorporating error bars or similar visual aids.

Additional analyses

Mediation analysis will be conducted to explore whether the quality of the relationship between mentor/teacher and CYP mediates (partially or wholly) the potential effect of SOS+ mentoring on self-reported offending as the primary outcome of interest. Mentor/teacher-CYP relationship is measured as a secondary outcome using the Youth Strength of Relationship (YSoR) scale (see Secondary outcome analysis).

This analysis will follow the causal mediation approach laid out in Imai, Keele, & Tingley (2010) and Chi et al. (2022) and decompose the intention-to-treat estimate (for the effect of SOS+ on self-reported offending) into a direct effect (i.e., the effect of the programme that cannot be attributed to differences in the mentor/teacher-CYP relationship) and an indirect effect (i.e., the proportion of the effect that can be attributed to differences in the mentor/teacher-CYP relationship). The causal model explored for this analysis is shown in **Error! Reference source not found.** below.

The mediation analysis comprises estimating two models as the following steps, key parameters of interest are a, b, and c' (see Figure 1):

1. Regressing the mentor/teacher-CYP relationship on SOS+ versus PCAU allocation (path a):

$$YSoR\ score_{ij} = \beta_0 + aIntervention_{ij} + \beta_1 Education\ setting_j + \varepsilon_{ij}$$

[7] SEND was captured in referral forms completed by teachers and defined as present if any of the following list of educational and/or support needs were endorsed: autistic spectrum disorder; speech and language difficulties; general learning ability; specific learning difficulty; ADHD; social, emotional and mental health; hearing impairment, visual impairment, medical diagnosis.

The slope a tells us how much the mentor/teacher-CYP relationship differs between those allocated to SOS+ and those allocated to PCAU.

2. Regressing self-reported offending on SOS+ versus PCAU allocation and on the mentor/teacher-CYP relationship (path c' and b):

$$SRDS\ volume\ score_{ij} = \beta_0 + c'Intervention_{ij} + bYSoR\ score_{ij} + \beta_1 Baseline\ SDQ\ externalising\ score_{ij} + \beta_2 Education\ setting_j + \varepsilon_{ij}$$

Where the slope c' provides the average direct effect (ADE) of the intervention, and the slope b tells us how much self-reported offending changes for a unit increase in the quality of the relationship between mentor/teacher and CYP.

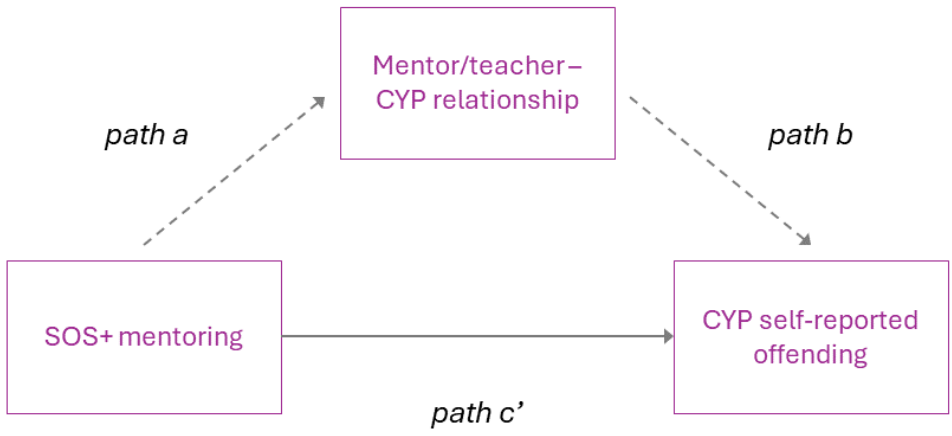
Across the two models, $a * b$ gives us the average causal mediation effect (ACME).

3. Estimating the ACME and the proportion mediated effect (i.e., the magnitude of the mediated effect relative to the total effect).

$$\boldsymbol{Proportion\ mediated} = \frac{\boldsymbol{Mediated\ effect}}{\boldsymbol{Total\ effect}} = \frac{\boldsymbol{a * b}}{\boldsymbol{a * b + c'}}$$

For all steps, we will present the unstandardised model coefficients, p-values, and 95% confidence intervals (CI). The presence of a mediated effect ($a * b$) will be determined using bias-corrected bootstrap CIs which account for the non-normality of the mediator and outcome (Chi et al., 2022; MacKinnon et al., 2004). The primary effect size that we will interpret is the proportion mediated effect and its confidence interval.

Figure 1. Causal Mediation Model



Further analyses

As a further analysis, we will explore differences in PCAU provision across schools using a tracker developed by NatCen and administered to schools by St Giles. We will explore data collected via this measure with the aim of developing a typology of PCAU provision, in order to group education settings in terms of their PCAU provision type. As our sample of education settings is small (n = 20), this will be done qualitatively by categorising settings into, for instance, high versus low provision. Depending on the variability observed between settings, we will repeat our primary analysis for each subgroup of settings separately to explore the extent to which any effects observed might differ for different PCAU provision.

Imbalance at baseline

We will explore potential imbalance at baseline in gender and baseline measures. Individual characteristics, such as gender or differences in baseline scores, could impact outcomes of interest including self-reported offending. We will examine variation in pupil characteristics for the 'as analysed' and 'as randomised' samples to explore potential imbalance resulting from randomisation or attrition.

At pupil level, the comparison will include the following factors:

- Gender
- Baseline SDQ externalising score
- Baseline SDQ conduct problems score
- Baseline SDQ prosocial behaviour score
- Baseline attendance and absences
- Baseline exclusions (permanent and fixed-term)

Potential imbalance for gender will be checked with cross-tabulations, including a count and percentage for SOS+ and PCAU group allocation. Differences of 5% or more will be considered as an indication of possible imbalance. Baseline SDQ subscale scores, attendance and exclusions will be summarised with descriptive statistics (n, mean, standard deviation, range, median and effect sizes) by SOS+ and PCAU group allocation and differences in test scores will be reported as Hedges' g effect sizes. The criteria for possible imbalance will be set at an effect size greater than 0.05. Where imbalance is indicated, we will estimate an additional model including pre-treatment characteristics that show imbalance as predictors, as a sensitivity analysis.

Missing data

As a first step, we will explore the extent of missing data in the primary outcome and baseline covariates descriptively with cross-tabulations including counts and percentages in each

category. We will then assess the pattern of missing data by using a single-level logistic regression analysis to examine which variables in the data are predictive of missingness. We will establish which covariates (gender, baseline SDQ externalising, conduct problems, and prosocial behaviour scores, baseline attendance and exclusions, school/setting) are predictive of missingness. This will be estimated using the melogit command in Stata 17.

In line with YEF analysis guidance (2021), for missingness at 5% or less from randomisation to final analysis, a complete case analysis will be employed. For more than 5% missing data overall, our approach will depend on the pattern of missingness.

If data is missing in a way that is not correlated with other observed variables in the dataset, then complete case analysis will be used. If only the outcome variable in a substantive model is considered missing at random conditional on covariates, then the covariates will be included in the model and results compared to the model without covariates. If a covariate in the substantive model is considered missing at random conditional on other covariates, then we will use multiple imputation for that covariate and present results alongside headline impact estimates for comparison. Multiple imputation by chained equations (MICE) will be implemented (using the mi suite of commands in Stata v17).

Compliance

ITT analysis may underestimate the effect of an intervention if some CYP do not attend all or any of their mentoring sessions. As a result, additional analysis will be conducted to take account of any non-compliance amongst those who were allocated to receive SOS+ mentoring.

A measure of compliance will be constructed to reflect CYP attendance to the 23 planned mentoring sessions. Attendance data will be collected by mentors in each education setting using a St Giles register. For the purpose of this analysis, compliance will be defined as attending at least 20 sessions[8].

We will estimate the Complier Average Casual Effect (CACE) using a two-stage least squares (2SLS) method (Angrist and Imbens, 1995) with allocation to SOS+ mentoring as the instrumental variable for the compliance measure. The first stage of the IV estimation estimates whether assignment to SOS+ mentoring programme encourages pupils to attend mentoring sessions (i.e., the first stage regresses compliance on assignment to SOS+). The first stage will control for baseline SDQ scores and setting.

8 This was defined in discussions with the delivery partner at set up.

$$Comply_{ij} = \beta_0 + \beta_1 Baseline\ SDQ\ externalising\ score_{ij} + \beta_2 Intervention_{ij} + \beta_3 Education\ setting_j + \varepsilon_{ij}$$

From the first stage of the analysis, we will report the results of the 2SLS alongside the correlation between the instrument and the endogenous variable and their associated F-test.

The predicted values from the first stage equation, $\widehat{Comply}_\iota$, will then be used in the estimation of the second stage equation, as follows:

$$SRDS\ volume\ score_{ij} = \beta_0 + \beta_1 \widehat{Comply}_\iota + \beta_2 Baseline\ SDQ\ externalising\ score_{ij} + \beta_3 Education\ setting_j + \omega_{ij}$$

The second stage of the IV estimation predicts the outcome (self-reported offending) by adding the compliance rate estimated in the first regression to the model used to estimate the primary outcome. It will produce an estimate of the Complier Average Causal Effect (CACE), which is the effect of receiving SOS+ mentoring on self-reported offending, among those whose compliance was influenced by programme assignment, while controlling for baseline SDQ scores and differences at the education setting level. Stata 17 will be used to conduct the IV regression analyses using the command **xtivreg**. Endogeneity tests will be used to assess whether allocation to SOS+ mentoring is suitable for the purposes of applying instrumental variable techniques (Wooldridge, 1995[9]), and F-statistics and p-values will be reported.

Intra-cluster correlations (ICCs)

Although the evaluation uses a one-level model, we will also run a two-level model to derive an estimate of the intra-cluster correlation (ICC) for the purposes of informing future research. The unconstrained ICC will be calculated separately to the analysis model by running a multilevel model, including only allocation to SOS+ or PCAU as a covariate and a random effect for education setting. The ICC ρ will be estimated with the post-estimation command **estat icc** in Stata 17, using the following formula:

$$\rho = \frac{\sigma_B^2}{\sigma_B^2 + \sigma_W^2}$$

[9] Wooldridge, J. M. 1995. `Score diagnostics for linear models estimated by two stage least squares'. In `Advances in Econometrics and Quantitative Economics: Essays in Honor of Professor C. R. Rao', ed. G. S. Maddala, P. C. B. Phillips, and T. N. Srinivasan, 66-87. Oxford: Blackwell

Where σ_B^2 is the between-school variance, σ_W^2 is the within-school variance. Values of ρ range from 0 to 1, where values closer to 0 imply that the within-cluster variance is much greater than the between cluster variance.

Presentation of outcomes

In line with YEF guidance, estimates for the primary and secondary outcomes will be reported as standardised effect sizes using Hedges' g with 95% confidence intervals. To help make effect sizes meaningful for the general reader, we will also report unstandardised estimates for all outcomes, and describe them in plain language where the scale has a meaningful interpretation.

The Hedges' g effect size will be estimated following Hedges' (2007) formulae for the effect size g_t for designs with unequal sample sizes, standardising it with unconditional variance in the denominator:

$$g_t = J \times \left(\frac{\beta_1}{S_{pooled}}\right)$$

Where β_1 is the model coefficient for the treatment effect (the difference in means between the SOS+ and PCAU groups).

The remaining terms are calculated as follows:

The correction factor J is defined as:

$$J = 1 - \left(\frac{3}{4(N^T + N^C - 2) - 1}\right)$$

For the anticipated sample size, the correction factor will be close to 1.

The pooled within group standard deviation, S_{pooled} is defined as:

$$S_{Pooled} = \sqrt{\frac{(n_1 - 1)S_1^2 + (n_2 - 1)S_2^2}{n_1 + n_2 - 2}}$$

The variance term is calculated as follows:

$$v_g = \left(\frac{g * \beta_1}{se_{\beta_1}}\right)^2$$

For binary outcomes (i.e., permanent exclusion), we will report a relative risk ratio, percentage point increases, and marginal effects. For count data outcomes (e.g., attendance) we will report rate ratios and predicted (marginal) counts.

References

Chi, W. E., Huang, S., Jeon, M., Park, E. S., Melguizo, T., & Kezar, A. (2022). A practical guide to causal mediation analysis: Illustration with a comprehensive college transition program and nonprogram peer and faculty interactions. In *Frontiers in Education* (Vol. 7, p. 886722). Frontiers Media SA.

Imai, K., Keele, L., & Tingley, D. (2010). A general approach to causal mediation analysis. *Psychological methods*, *15*(4), 309–334. https://doi.org/10.1037/a0020761

Magić, J., Ng-Knight, T., Papaioannou, K., Stoilova, E., Chalker, C., David, M., Upadhyay, N., & Hudson, N. (2023). Embedding mentors with lived experience in schools to reduce violent offending amongst young people: randomised controlled efficacy trial of the SOS+ programme. Available at: https://youthendowmentfund.org.uk/wp-content/uploads/2024/03/St-Giles-Evaluation-Protocol-Mar-24.pdf

MacKinnon, D. P., Lockwood, C. M., & Williams, J. (2004). Confidence Limits for the Indirect Effect: Distribution of the Product and Resampling Methods. *Multivariate Behavioral Research*, *39*(1), 99–128. https://doi.org/10.1207/s15327906mbr3901_4

YOUTH ENDOWMENT FUND

Impetus

Home Office

youthendowmentfund.org.uk

hello@youthendowmentfund.org.uk

@YouthEndowFund

The Youth Endowment Fund Charitable Trust

Registered Charity Number: 1185413