

Data Supplement for Sullivan et al., A Population-Based Cohort Study Examining the Incidence and Impact of Psychotic Experiences From Childhood to Adulthood, and Prediction of Psychotic Disorder. Am J Psychiatry (doi: 10.1176/appi.ajp.2019.19060654)

Further Information on the PLIKS Interview at Age 24

The interviewers were psychology graduates trained in using the PLIKSi, and blind to previous PLIKS assessments. Interviewers had to score >0.9 agreement with ‘gold-standard’ ratings on 2 audio-recorded interviews before they were able to start collecting data for the study. At regular intervals, a psychiatrist rated samples of recorded interviews to ensure that the interviewers were rating experiences correctly.

In the revised version (PLIKSi-R; completed at age 24), olfactory and tactile hallucinations were also assessed. Ratings of olfactory hallucinations were not deemed to be adequately valid and were therefore excluded from all analyses. Although data on tactile hallucinations were deemed to be valid, these were not included in the manuscript as the main purpose of this study was to compare equivalent experiences over time. Data on tactile hallucinations are reported only in the Supplement Table ST2.

To test inter-rater reliability, interviewers audio-recorded interviews at approximately 9, 18, and 24 months after the start of the age-24 clinic (15 raters; 70 interviews). The kappa statistic for the rating of any PE rated as suspected or definitely present was 0.61 (n=402), and the ICC was 0.81 (95% CI 0.68, 0.89). Test-retest reliability was undertaken using data from 103 individuals who were re-interviewed after approximately 5 weeks (mean 43 days, SD 12.5 days; range 27 to 77 days). Only 20 individuals were interviewed by the same interviewer on both occasions, and thus our test-retest reliability estimates are likely to be under-estimates (10). Test-retest agreement for any PE was 94% (kappa 0.64; ICC 0.9, 95%CI 0.83, 0.95).

Frequency & distress:

After each structured stem-question, the interviewers asked about:

i) frequency of experiences in the previous 6 months. The possible ratings were “Not at all, only once or twice, quite often (about monthly), often (about weekly), most of the time (most days), daily”.

ii) distress caused by each experience when at its worst. The possible ratings were “not at all distressing, a bit distressing, quite distressing, very distressing”.

Further Information on Sociodemographic Variables

Data on gender were collected from birth records. Data on parental social class, maternal marital status, financial difficulty, housing type, and parental education were collected from parental questionnaires completed prior to birth of the study participant.

Coding: Gender: coded as male (0) or female (1). Parental social class (highest of both parents): coded as I (highest) to V (lowest). Maternal marital status (nominal variable): coded as married (0), partner (1), or single (2). Financial difficulty (receipt of income support): coded as no (0) or yes (1). Housing type (nominal variable): coded as mortgaged or owned (0), privately rented (1), or council rented (2). Parental education: coded as 4-levels, ranging from the lowest UK school-leaving qualifications (1) to degree level (4).

Multiple Imputation

For multiple imputation of missing data, we used flexible additive imputation models as implemented in the `aregImpute` function in the R statistical package, with estimates averaged over 100 imputed data sets using Rubin’s rules. We included auxiliary variables that could inform psychotic experience or missingness status, making missingness at random conditional on these factors a plausible assumption. Auxiliary variables included other measurements of psychotic or psychotic-like experiences during childhood and adolescence (self-reported PEs at ages 11, 13, 14, 16, and 22 years of age), sociodemographics at birth (maternal age and education attained, socio-economic class, housing and marital status, gender), cognitive measures, and measures of other childhood psychopathology (Moods and Feelings Questionnaire and Strength and Difficulties Questionnaire scores at age 12 years). Imputation was performed for the subsample who participated in either of the interviews at age 12, age 18 or age 24 (N=7,919).

CAARMS and SIPS Definitions

CAARMS 2015		PLIKS equivalent
ARMS vulnerability group	<p>(1st degree relative with psychotic disorder</p> <p>OR</p> <p>Schizotypal PD)</p> <p>PLUS</p> <p>30% drop in SOFAS or SOFAS <51 for at least past 1 year</p>	<p>Data available on parent/grandparent history of schizophrenia, and on other relatives in smaller sample</p> <p>OR</p> <p>No measure of this</p> <p>PLUS</p> <p>Decreased functioning from social/occupational function questionnaire: worse friends/partner/family/studies/work/training</p> <p>Too few events to rate anyone</p>
ARMS Attenuated Psychosis Group (a)	<p>Global Rating Scale Score of 3-5 on Unusual Thought Content subscale, 3-5 on Non-Bizarre Ideas subscale,</p> <p>3-4 on Perceptual Abnormalities subscale,</p> <p>or 4-5 on Disorganised Speech subscales of the CAARMS</p> <p>AND</p> <p>Frequency Scale Score of 3-6 on these subscales</p> <p>AND</p> <p>For at least a week</p>	<p>Suspected PE (definite could include score of 5, but omitting definite rating from this, therefore ARMS group may be under-represented)</p> <p>As above</p> <p>Or Rating of 2 or 3 on PL6 (staff rating of speech coherence). BUT no data on frequency of this so cannot use it (i.e. may underestimate)</p> <p>AND</p> <p>(monthly or weekly & >1hour) or (most days & any duration of time)</p> <p>AND</p> <p>Experience lasted >1 week</p>
ARMS Attenuated Psychosis Group (b)	<p>Global Rating Scale Score of 6 on Unusual Thought Content, 6 on Non-Bizarre Ideas, 5-6 on Perceptual Abnormalities or 6 on Disorganised Speech subscales</p>	<p>Definite PE</p>

	<p>AND</p> <p>Frequency Scale Score of 3 on these subscales</p>	<p>AND</p> <p>(monthly or weekly & >1hour) or (most days & <1hour)</p> <p>Anything more frequent/longer duration is excluded</p>
<p>ARMS Attenuated Psychosis Group</p>	<p>a or b (as above)</p> <p>AND</p> <p>Symptoms present in past year</p> <p>AND</p> <p>30% drop in SOFAS score from premorbid level, sustained for a month, occurred within past 12 months</p> <p>OR SOFAS score of 50 or less for past 12 months or longer</p>	<p>a or b (as above)</p> <p>AND</p> <p>Frequencies above are all in past 6 months, so therefore in past year (though will miss those if not in past 6 months)</p> <p>AND</p> <p>Decreased functioning from social/occupational function questionnaire: worse friends/partner/family/studies/work/training</p> <p>Or No friends Or NEET (at 24) Or problems in 1 or more of friends/family/partner and in 1 or more of education/work/training (e.g. don't fit in, don't get on with others, difficulty keeping up with studies or work)</p>
<p>ARMS BLIPS Group</p>	<p>Global Rating Scale Score of 6 on Unusual Thought Content subscale, 6 on Non-Bizarre Ideas, 5 or 6 on Perceptual Abnormalities subscale or 6 on Disorganised Speech subscales</p> <p>AND</p> <p>Frequency Scale Score of 4-6 on these subscales</p> <p>AND</p> <p>Each episode of symptoms is present for less than one week</p>	<p>Definite PE</p> <p>AND</p> <p>Most days & >1hour, or daily (any duration)</p> <p>AND</p> <p>No episode > 1week</p>

	<p>AND</p> <p>Symptoms occurred during last year</p> <p>AND</p> <p>30% drop in SOFAS score from premorbid level, sustained for a month, occurred within past 12 months</p> <p>OR SOFAS score of 50 or less for past 12 months or longer</p>	<p>AND</p> <p>Frequencies above are all in past 6 months, so therefore in past year (though will miss those if not in past 6 months)</p> <p>AND</p> <p>Decreased functioning from social/occupational function questionnaire: worse friends/partner/family/studies/work/training</p> <p>Or No friends Or NEET (at 24) Or problems in 1 or more of friends/family/partner and in 1 or more of education/work/training (e.g. don't fit in, don't get on with others, difficulty keeping up with studies or work)</p>
Psychosis	<p>Severity Scale Score of 6 on Unusual Thought Content subscale, 6 on Non-Bizarre Ideas, 5 or 6 on Perceptual Abnormalities subscale and/or 6 on Disorganised Speech subscales</p> <p>AND</p> <p>Frequency Scale Score of greater than or equal to 4 on these subscales</p> <p>AND</p> <p>Symptoms present for longer than one week</p>	<p>Definite PE</p> <p>Or</p> <p>Rating of 1 on PL6 (staff rating of speech coherence) BUT no data on frequency of this so cannot use it (though no-one rated as 1)</p> <p>AND</p> <p>Most days & >1hour, or daily (any duration)</p> <p>AND</p> <p>Symptoms present for longer than one week</p>
SIPS (v4.0)^a		PLIKS equivalent
Current Psychosis (POPS)	Psychotic symptom (rating 6) (= psychotic + affects functioning or influences thinking feeling or behaviour)	Definite psychotic symptom (+ affects functioning)

	<p>In past month</p> <p>AND</p> <p>≥1 hour per day</p> <p>4 days per week</p> <p>For 1 month or more</p> <p>OR</p> <p>Symptom seriously disorganizing or dangerous</p>	<p>Occurred in past month</p> <p>AND</p> <p>≥1 hour per day</p> <p>Most days past month (if yes must be ≥4 days per week)</p> <p>1) Q's are about past 6 months (if someone has symptoms for 1 hour/day on 4 days/week it seems fairly reasonable to assume the 1 month or more criteria would be met)</p> <p>2) Have data on when symptoms started (< or > 3 months), and whether symptoms occurred in past month – therefore: if started >3months ago and present in past month then meets criteria for >1month: If started <3months ago may not meet criteria for >1month (although again, if someone has symptoms for 1 hour/day on 4 days/week it seems fairly reasonable to assume the 1 month or more criteria would be met)</p> <p>OR</p> <p>Very negative effect on social/occupational functioning = 'seriously disorganizing'?</p>
<p>Brief intermittent psychotic symptom prodromal syndrome (BIPS)</p>	<p>Psychotic symptom (rating 6) (= psychotic + affects functioning or influences thinking feeling or behaviour)</p> <p>In past 3 months</p> <p>Several minutes per day</p> <p>At least once per month</p>	<p>Definite psychotic symptom (+ affects functioning)</p> <p>In past 6 months / in past 1 month</p> <p>≥2 minutes per day</p> <p>At least once per month</p>
<p>Attenuated positive symptom prodromal syndrome (APSS)</p>	<p>Positive symptom (rating 3-5)</p> <p>Started in past year, or worse in past year</p>	<p>Suspected PLIKS (i.e. interviewer unable to determine that definitely psychotic, but enough info to rate as suspicious – seems comparable to SIPS ratings 3-5)</p> <p>Started in past year</p>

	At least once per week in past 1 month	(and can use information from PLIKS 16 questionnaire to identify if symptoms more frequent or more distressing since then) About weekly (4 times or more) in past 1 month
Genetic risk and deterioration prodromal syndrome	Schizotypal personality disorder AND/OR 1 st degree relative with psychotic disorder AND ≥30% drop in past-month GAF compared to 12 months ago	No measure of this AND/OR Data available on parent/grandparent history of schizophrenia, and on other relatives in smaller sample AND Decreased functioning from social/occupational function questionnaire: worse friends/partner/family/studies/work/training Too few events to rate anyone

^aNote that Version 5 of SIPS/SOPS has an additional criterion for BIPS/APSS: Are all otherwise qualifying symptoms better explained by another DSM-IV disorder (Axis 1 or 2)? This cannot reasonably be judged from the PLIKSi

TABLE S1. Proportion of people with missing data at age 24 years in relation to sociodemographic characteristics

	Participated at age 24	Missing at age 24	OR 95% CI	P-value^a
Sex				
Male	1233 (37.2%)	2080 (62.78%)		
Female	1911 (55.8%)	1514 (44.2%)	0.47 (0.43, 0.52)	≤ 0.001
Social class				
I	565 (59.6%)	383 (40.4%)		
II	1302 (49.3%)	1340 (50.7%)		
III	881 (42.7%)	1181 (57.3%)		
IV	70 (32.7)	144 (67.3%)		
V	5 (16.1%)	26 (83.9%)	1.41 (1.32, 1.51)	≤ 0.001
Maternal education				
CSE/vocational	256 (30.6%)	582 (69.5%)		
O Level	725 (42.4%)	987 (57.7%)		
A Level	1024 (48.3%)	1095 (51.7%)		
Degree	950 (59.7%)	642 (40.3%)	0.69 (0.65, 0.72)	≤ 0.001
PE at age 12				
None	2729 (46.9%)	3093 (53.1%)		
Suspected	240 (44.5%)	299 (55.5%)		
Definite, not frequent	91 (48.4%)	97 (51.6%)		
Definite, frequent	84 (43.3%)	110 (56.7%)	1.03 (0.96, 1.12)	0.355
PE at age 18				
None	2014 (61.7%)	1251 (38.3%)		
Suspected	112 (56.0%)	88 (44.0%)		
Definite, not frequent or distressing	65 (66.3%)	33 (33.7%)		
Definite, frequent or distressing	50 (56.2%)	39 (43.8%)		
Definite, frequent and distressing	18 (47.4%)	20 (52.6%)	1.09 (1.02, 1.16)	0.008

^ap-values and ORs for all variables except sex are for linear trend across ordered categories

TABLE S2. Number (%) rated for each type of psychotic experiences between ages 12 and 24 years

	None		Suspected		Definite	
Auditory hallucinations	3619	(93.8%)	75	(1.9%)	163	(4.2%)
Tactile hallucinations	3635	(94.1%)	87	(2.3%)	142	(3.7%)
Visual hallucinations	3616	(93.7%)	75	(1.9%)	170	(4.4%)
Delusions (spied on)	3767	(97.6%)	45	(1.2%)	49	(1.3%)
Delusions (persecution)	3809	(98.7%)	22	(0.6%)	28	(0.7%)
Delusions (thoughts read)	3840	(99.4%)	7	(0.2%)	15	(0.4%)
Delusions (reference)	3835	(99.3%)	10	(0.3%)	17	(0.4%)
Delusions (control)	3851	(99.8%)	<5 ^b	-	5	(0.1%)
Delusions (grandiosity)	3836	(99.4%)	8	(0.2%)	17	(0.4%)
Thought broadcast	3846	(99.6%)	10	(0.3%)	5	(0.1%)
Thought insertion	3848	(99.6%)	6	(0.2%)	8	(0.2%)
Thought withdrawal	3858	(99.9%)	<5	-	<5	-
Any hallucination	3365	(86.7%)	212	(5.5%)	306	(7.9%)
Any delusion^a	3725	(95.9%)	87	(2.2%)	71	(1.8%)
Any psychotic experience^c	3287	(84.5%)	210	(5.4%)	393	(10.2%)

^aIncluding thought interference items; ^bDue to ALSPAC regulations to ensure anonymity we are not allowed to present detail for cell counts of <5 individuals; ^cIncluding tactile hallucinations

TABLE S3. Inconsistency in responses from assessments at ages 12 & 18 to assessment at age 24

	Interviewer rating	% saying no to all stem questions at age 24 ^a
Age 12	Suspected	52.1
	Definite	41.1
	Suspected or definite	47.5
Age 18	Suspected	28.6
	Definite	29.3
	Suspected or definite	29.0

^aStem questions asked about experiences 'ever since age 12'

TABLE S4. Incidence and cumulative incidence estimates at the beginning and end of each age year when suspected or definite PEs were observed along with the number of events occurring during each year

Year of Age	Suspected/definite PEs	Incidence	95% CI		Cumulative Incidence	95% CI	
^a 12	8	0.0020	[0.0019	0.0022]	0.0031	[0.0022	0.0044]
13	75	0.0035	[0.0031	0.0040]	0.0058	[0.0045	0.0076]
14	≤5	0.0060	[0.0051	0.0072]	0.0109	[0.0089	0.0134]
16	7	0.0177	[0.0141	0.0222]	0.0406	[0.0355	0.0465]
17	102	0.0192	[0.0152	0.0243]	0.0452	[0.0398	0.0514]
18	117	0.0210	[0.0143	0.0308]	0.0674	[0.0608	0.0747]
19	79	0.0117	[0.0059	0.0232]	0.0907	[0.0824	0.0998]
20	65	0.0081	[0.0030	0.0215]	0.1064	[0.0971	0.1165]
21	24	0.0081	[0.0030	0.0213]	0.1164	[0.1066	0.1272]
22	13	0.0084	[0.0033	0.0214]	0.1253	[0.1148	0.1369]
23	45	0.0086	[0.0034	0.0219]	0.1324	[0.1215	0.1443]
24	51	0.0089	[0.0034	0.0230]	0.1412	[0.1300	0.1533]
25	24	0.0091	[0.0034	0.0242]	0.1509	[0.1391	0.1637]
26	≤5	0.0093	[0.0035	0.0251]	0.1601	[0.1471	0.1743]
Total	619						

^aDue to some variation in the age at which participants attended the age-12, age-18 and age-24 assessments it was possible for participants from the latter assessments to report PE starting at age 12 even though no PE were rated at the age-12 assessment

TABLE S5. Incidence and cumulative incidence estimates at the beginning and end of each age year when definite PEs were observed along with the number of events occurring during each year

Year of Age	Definite PEs	Incidence	95% CI		Cumulative Incidence	95% CI	
^a 12	≤5	0.0012	[0.0011	0.0014]	0.0019	[0.0013	0.0030]
13	45	0.0020	[0.0018	0.0024]	0.0036	[0.0025	0.0050]
14	≤5	0.0034	[0.0027	0.0042]	0.0064	[0.0049	0.0084]
16	≤5	0.0088	[0.0065	0.0120]	0.0220	[0.0184	0.0263]
17	50	0.0095	[0.0069	0.0130]	0.0243	[0.0204	0.0288]
18	56	0.0120	[0.0079	0.0175]	0.0351	[0.0305	0.0404]
19	51	0.0092	[0.0049	0.0174]	0.0475	[0.0419	0.0539]
20	39	0.0062	[0.0024	0.0161]	0.0585	[0.0517	0.0662]
21	15	0.0049	[0.0015	0.0161]	0.0667	[0.0592	0.0750]
22	9	0.0047	[0.0013	0.0161]	0.0723	[0.0644	0.0811]
23	37	0.0051	[0.0016	0.0161]	0.0763	[0.0681	0.0854]
24	34	0.0060	[0.0021	0.0171]	0.0818	[0.0734	0.0912]
25	17	0.0067	[0.0024	0.0190]	0.0887	[0.0799	0.0986]
26	≤5	0.0072	[0.0025	0.0205]	0.0957	[0.0856	0.1071]
Total	366						

^aDue to some variation in the age at which participants attended the age-12, age-18 and age-24 assessments it was possible for participants from the latter assessments to report PE starting at age 12 even though no PE were rated at the age-12 assessment

TABLE S6. Estimates of psychotic experiences and disorder at age 24 using imputed data

PLIKS		Observed	95% CI		Imputed	95%CI		FMI
		Mean %			Mean %			
Age 18	12 core items	N = 4679			N = 7919			
	Since age 12	None	0.909	[0.901 0.917]	0.908	[0.897 0.920]	0.693	
		Suspected	0.043	[0.037 0.049]	0.040	[0.030 0.051]	0.830	
		Definite	0.048	[0.042 0.055]	0.052	[0.040 0.063]	0.826	
	Current	None	0.939	[0.931 0.945]	0.942	[0.931 0.952]	0.750	
		Suspected	0.029	[0.025 0.035]	0.026	[0.014 0.038]	0.911	
		Definite	0.032	[0.027 0.037]	0.032	[0.022 0.042]	0.855	
Age 24	12 core items	N = 3866			N = 7919			
	Since age 12	None	0.873	[0.862 0.883]	0.873	[0.855 0.892]	0.847	
		Suspected	0.046	[0.040 0.053]	0.047	[0.038 0.056]	0.732	
		Definite	0.081	[0.073 0.090]	0.080	[0.065 0.094]	0.823	
	Current Psychotic Disorder	None	0.987	[0.983 0.990]	0.986	[0.979 0.993]	0.860	
		Yes	0.012	[0.009 0.016]	0.014	[0.007 0.021]	0.860	
	Psychotic Disorder Ever	None	0.971	[0.965 0.976]	0.971	[0.959 0.982]	0.892	
		Yes	0.029	[0.024 0.035]	0.029	[0.018 0.041]	0.892	
	Current at-risk mental state	None	0.991	[0.987 0.993]	0.989	[0.982 0.995]	0.876	
		Yes	0.009	[0.006 0.013]	0.011	[0.005 0.018]	0.876	

Note: FMI denotes the estimate for the Fraction of Missing data indicator

FIGURE S1. Sex-specific Incidence rates and cumulative incidence of psychotic experiences from ages 12 to 24 years

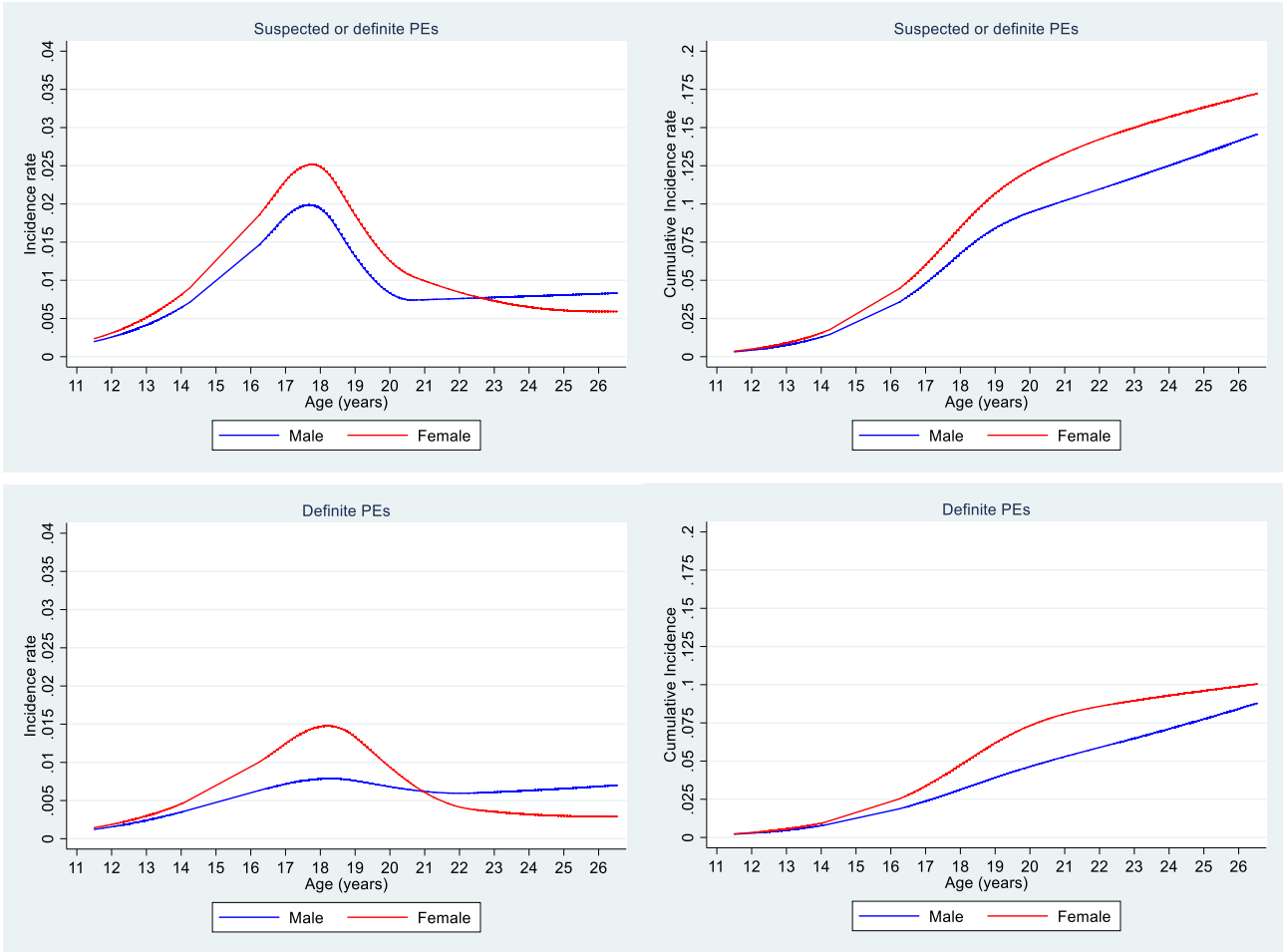
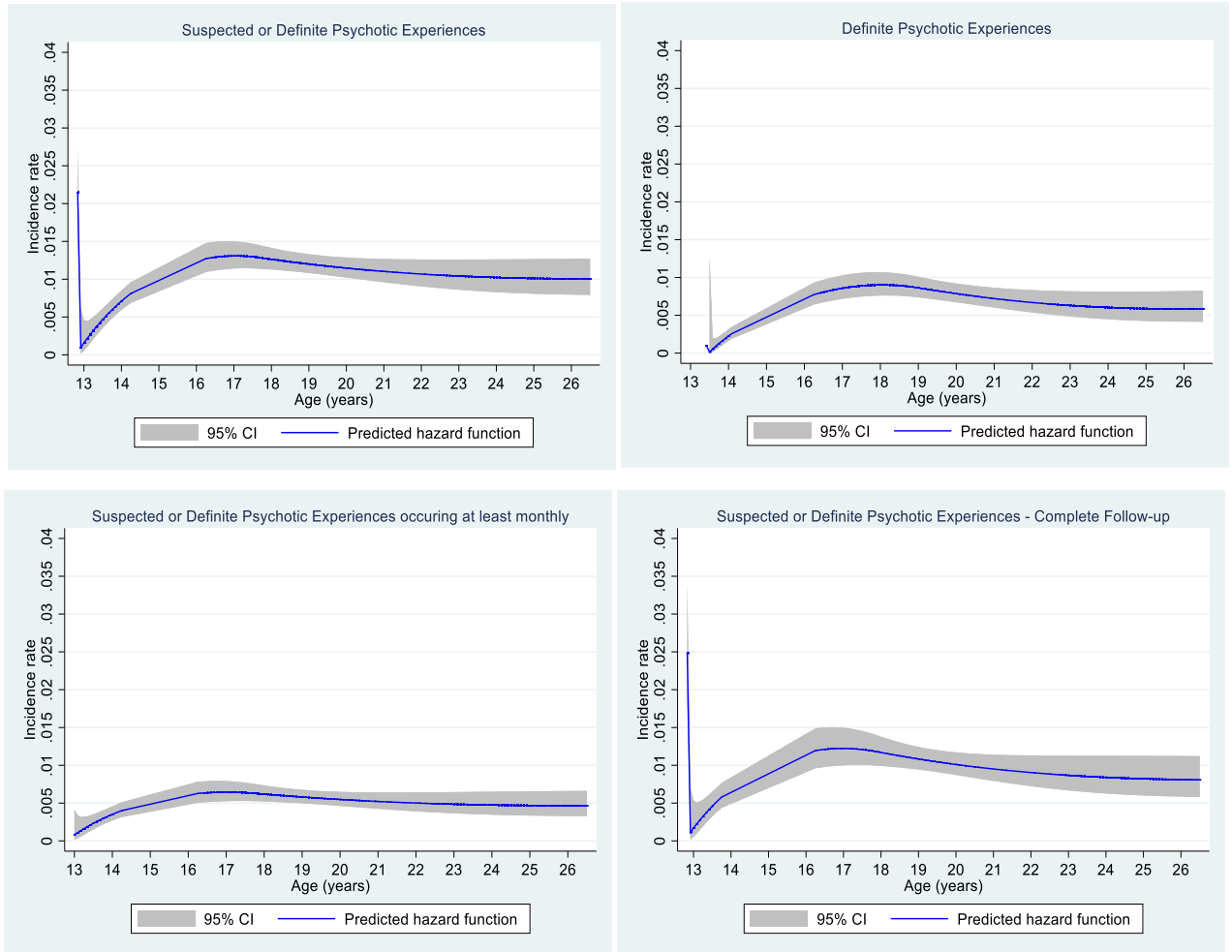


FIGURE S2. Incidence rates of psychotic experiences from ages 13 to 24 years, assuming that, for individuals who had a suspected of definite PE rated at the age 12 interview: i) the period of risk for developing a psychotic experience started at age 6, and ii) the hazard is constant from ages 6 to 12



a) Suspected or definite psychotic experiences; b) Definite psychotic experiences; c) Suspected or definite psychotic experiences occurring at least monthly; d) Suspected or definite psychotic experiences restricting to individuals who participated in all assessments