

SUPPLEMENTARY MATERIAL

Socio-Economic Differences in Children's Growth Trajectories from Infancy into Early Adulthood: Evidence from four European countries

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DESCRIPTION OF THE COHORTS

Generation 21 (G21) comprises a cohort of 8647 newborns recruited in 2005–2006 in the Porto Metropolitan Area, in northern Portugal. Recruitment occurred at the 5 public maternity units, which are responsible for 95% of all births in the region (remaining births occurred at private hospitals) ¹. During the hospital stay, women delivering live births were invited to participate, and 92% of mothers agreed. All who agreed were invited to be re-evaluated at 4 years of age (2009-2011) and then again at 7 years of age (2012-2014). Of the original enrolments, 7459 participants (86.3%) participated at the second wave and 5841 participants with measured height remained in the study at wave 3 (67.5%). The study was approved by the University of Porto Medical School/ Hospital S. João Ethics Committee and signed informed consent was required for all participants. Further information concerning the study is available in Correia et al. ¹

The Growing Up in Ireland Study (GUI) comprises two cohorts. The infant cohort comprises a nationally representative sample of 11,134 children who were aged 9 months upon recruitment into the study in 2008-2009 and were re-evaluated at 3 years (2010-2011) and 5 years of age (2013). The child cohort comprises a nationally representative sample of 8,568 children who were aged 9 years upon recruitment into the survey (2007-2008) and were re-evaluated at 13 years of age (2011-2012). The younger cohort were sampled from the Child Benefit Register whilst the older cohort was a two-stage sample with schools randomly sampled from the national sampling frame and the nine year old children randomly sampled in schools. The study has good retention rates with 9793 (88.0%) and 9001 (80.8%) of the original sample of the infant cohort consenting to participate at Waves 2 and 3 respectively; and 7525 (87.8%) of the child cohort consenting to participate in the second wave. Ethical approval for the Growing Up in Ireland child cohort was provided by the Health Research Board (HRB) of Ireland's standing Research Ethics committee. Ethical approval for the Growing Up in Ireland infant cohort was provided by a Research Ethics committee convened by the Department of Health and Children. Further details concerning the infant and child cohorts are provided in McCrory and Murray ² and McCrory & Layte ³ respectively.

The Millennium Cohort Study (MCS) is a longitudinal study of child health and development that tracks the progress of a national sample of the UK population born throughout the United Kingdom (England, Scotland, Wales and Northern Ireland) between September 2000 and January 2002. There have been five sweeps of data collection at ages 9 months, 3 (2003-2004), 5 (2006-2007), 7 (2008-2009), and 11 years of age (2012-2013). Of the original Wave 1 enrolment of 18,818 children, 15,808 (84.0%), 15,459 (82.2%), 14,043 (74.6%), and 13,187 (70.0%) remained in the study at waves 2, 3, 4, & 5 respectively. As with GUI, MCS was sampled from the Child Benefit Register with children from disadvantaged wards and from minority populations intentionally oversampled. Ethical approval for the study was provided by the NHS Research Ethics Committee (MREC). Informed consent is obtained from parents, as well as from the children themselves as they grow up. See Connelly & Platt⁴ for more detail.

The EPITeen study - Epidemiological Health Investigation of Teenagers in Porto, is a random sample of 2159 thirteen-year-olds enrolled at public and private schools in Porto, Portugal during 2003-2004⁵. Wave two was completed in 2007-2008 when participants were aged 17 years of age, and a third evaluation in 2011-2013 when participants were aged 21 years of age. Of the 2159 original enrolments, 1716 participants (79.5%) participated at the second wave and 1318 participants (61.0%) remained in the study at the third wave. The Ethics Committee of the Hospital S. João and the Ethics Committee of the Institute of Public Health from the University of Porto approved this project, and appropriate standard procedures were developed to guarantee data confidentiality and protection. Written informed consent was obtained from parents, or legal guardians, and participants at 13 and 17 years, and from participants at 21 years. See Ramos et al.⁵ for more detail.

The Cardiovascular Risk in Young Finns Study (YFS) collected data on 4320 children and adolescents aged 3, 6, 9, 12, 15 and 18 years at baseline who were randomly chosen from the population register of five Finnish cities with universities with medical schools to produce a representative sample of Finnish children. Of those invited (n=4320), 3596 (83%) participated in the

first cross-sectional study in 1980. Between 1980 and 1992, these cohorts were followed up at 3-year intervals. The follow-up field studies were performed for the whole study population in 1983 and 1986, when 2991 (83.2%) and 2799 (78.3%) subjects participated. In 1989 and 1992 questionnaires were sent to every individual, but only a subset of individuals had their height measured in these survey years so we omit these observations from the analysis. In 2001, 2283 subjects (63.5%) of the original cohort participated in clinical examinations. A detailed description of the sample can be found elsewhere ⁶. Participants gave written informed consent and the study was approved by local ethics committees. Further information concerning the study is reported in Raitakari et al.⁶

Supplementary Table 1: Coding Schema Used to Derive the 3-Level Maternal Educational Variable within Each Cohort and Country and Percentage of the Sample within each Educational Grouping

	MCS	GUI-Infant	GUI-Child	G21	EPITeen	Young Finns
Primary	(1) GCSE grades D-G (2) O level / GCSE grades A-C (56.9%)	(1) No formal education (2) Primary (3) Lower secondary (11.7%)	(1) Primary or less (2) Lower secondary (17.6%)	(1) First cycle of basic education (4 th year) (2) Second cycle of basic education (6 th year) (3) Third cycle of basic education (9 th year) (56.6%)	(1) 0-9 years formal schooling (54.9%)	(1) Primary school (2) Primary school unfinished (61.9%)
Secondary	(3) A / AS / S levels (14.1%)	(4) Upper secondary (5) Technical or vocational qualification (6) Both upper secondary and technical/vocational qualification (32.7%)	(3) Upper secondary (31.5%)	(4) Secondary school (12 th grade) (20.9%)	(3) 10-12 years of formal schooling (23.4%)	(3) Secondary school finished / High school unfinished (4) Graduated from high school (16.9%)
Tertiary	(5) Diplomas in higher education (6) First degree (7) Higher degree	(7) Non-degree (8) Degree (9) Professional qualification (10) Degree and professional qualification (11) Postgraduate diploma	(4) Diploma / Certificate (5) Primary degree (6) Postgraduate / Higher degree	(5) Bachelor degree (6) Degree (7) Masters degree (8) Doctorate	(4) 13+ years of formal schooling	(5) Vocational degree (6) Higher education degree

	(29.0%)	(12) Postgraduate Masters degree (13) Doctorate (55.6%)	(50.9%)	(22.5%)	(21.8%)	(21.2%)
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Supplementary Table 2: Number of Height Measurements at Each Wave and Retention Rates by Maternal Educational Status.

Generation 21				
	Primary <i>N (%)</i>	Secondary <i>N (%)</i>	Tertiary <i>N (%)</i>	Total <i>N (%)</i>
Birth	4827 (100.0)	1792 (100.0)	1933 (100.0)	8552 (100.0)
4 years	3097 (64.2)	1309 (73.0)	1519 (78.6)	5925 (69.3)
7 years	2951 (61.1)	1302 (72.7)	1573 (81.4)	5826 (68.1)
Growing Up in Ireland				
	Primary <i>N (%)</i>	Secondary <i>N (%)</i>	Tertiary <i>N (%)</i>	Total <i>N (%)</i>
Infant cohort				
9 months	1279 (100.0)	3588 (100.0)	6101 (100.0)	10968 (100.0)
3 years	1037 (81.1)	3085 (86.0)	5457 (89.4)	9579 (87.3)
5 years	934 (73.0)	2822 (78.7)	5138 (84.2)	8894 (81.1)
Child Cohort				
9 years	1431 (100.0)	2571 (100.0)	4155 (100.0)	8157 (100.0)
13 years	1192 (83.3)	2330 (90.6)	3851 (92.7)	7373 (90.4)
Millennium Cohort Study				
	Primary <i>N (%)</i>	Secondary <i>N (%)</i>	Tertiary <i>N (%)</i>	Total <i>N (%)</i>
9 months*	10516 (100.0)	2611 (100.0)	5372 (100.0)	18499 (100.0)
3 years	7460 (70.9)	2007 (76.9)	4377 (81.5)	13844 (74.8)
5 years	7453 (70.9)	2003 (76.7)	4377 (81.5)	13833 (74.8)
7 years	6985 (66.4)	1937 (74.2)	4264 (79.4)	13186 (71.3)
11 years	6674 (63.5)	1841 (70.5)	4088 (76.1)	12603 (68.1)
EPIteen				
	Primary <i>N (%)</i>	Secondary <i>N (%)</i>	Tertiary <i>N (%)</i>	Total <i>N (%)</i>
13 years	1064 (100.0)	456 (100.0)	424 (100.0)	1944 (100.0)
17 years	839 (78.9)	395 (86.6)	378 (89.2)	1612 (82.9)
21 years	591 (55.5)	333 (73.0)	327 (77.1)	1251 (64.4)
Young Finns				
	Primary <i>N (%)</i>	Secondary <i>N (%)</i>	Tertiary <i>N (%)</i>	Total <i>N (%)</i>
3 at baseline				
1980 (3 years)	255 (100.0)	132 (100.0)	147 (100.0)	534 (100.0)
1983 (6 years)	240 (94.1)	121 (91.7)	128 (87.0)	489 (91.6)
1986 (9 years)	233 (91.4)	124 (93.9)	127 (86.4)	484 (90.6)
6 at baseline				
1980 (6 years)	278 (100.0)	115 (100.0)	157 (100.0)	550 (100.0)
1983 (9 years)	251 (90.3)	108 (93.9)	153 (97.5)	512 (93.0)
1986 (12 years)	248 (89.2)	92 (80.0)	139 (88.5)	479 (87.1)
9 at baseline				
1980 (9 years)	384 (100.0)	87 (100.0)	127 (100.0)	598 (100.0)
1983 (12 years)	357 (93.0)	84 (96.6)	118 (92.9)	559 (93.5)
1986 (15 years)	300 (78.1)	73 (83.9)	105 (82.7)	478 (79.9)

12 at baseline				
1980 (12 years)	398 (100.0)	81 (100.0)	99 (100.0)	578 (100.0)
1983 (15 years)	363 (91.2)	76 (93.8)	89 (89.9)	528 (91.3)
1986 (18 years)	270 (67.8)	59 (72.8)	69 (69.7)	398 (68.9)
15 at baseline				
1980 (15 years)	340 (100.0)	70 (100.0)	83 (100.0)	493 (100.0)
1983 (18 years)	291 (85.6)	61 (87.1)	72 (86.7)	424 (86.0)
1986 (21 years)	221 (65.0)	45 (64.3)	45 (54.2)	311 (63.1)
18 at baseline				
1980 (18 years)	302 (100.0)	47 (100.0)	59 (100.0)	408 (100.0)
1983 (21 years)	244 (80.8)	34 (72.3)	41 (69.5)	319 (78.2)

*Length / Height was not measured at baseline (i.e. 9 months of age) in the Millennium Cohort Survey

Supplementary Table 3: Expected Length/Height in Centimetres at each age across Categories of Maternal Education by Cohort (Boys Only) - UNWEIGHTED

	Column A	Column B	Column C	Column D	Column E
	Primary	Secondary	Tertiary	Difference (Primary vs Tertiary)	Difference (Primary vs Tertiary)
	<i>Mean (95% CI)</i>	<i>Mean (95% CI)</i>	<i>Mean (95% CI)</i>	<i>Mean (95% CI)</i>	<i>Log height</i>
G21 (n=4377)					
Birth (2005/2006)	48.93 [48.83, 49.03]	49.18 [49.02, 49.34]	48.99 [48.83, 49.14]	-0.06 [-0.24, 0.13]	-0.12%
4 years (2009/2011)	102.45 [102.28, 102.62]	102.85 [102.58, 103.11]	102.93 [102.67, 103.18]	-0.48 [-0.78, -0.17]	-0.68%
7 years (2012/2014)	123.44 [123.19, 123.70]	123.63 [123.25, 124.01]	123.73 [123.37, 124.09]	-0.29 [-0.73, 0.16]	-0.16%
GUI (n=9782)					
9 months (2008/2009)	72.05 [71.79, 72.31]	72.26 [72.09, 72.43]	72.35 [72.21, 72.49]	-0.30 [-0.58, -0.02]	-0.42%
3 years (2010/2011)	93.16 [92.93, 93.39]	93.59 [93.44, 93.73]	93.74 [93.63, 93.86]	-0.59 [-0.84, -0.33]	-0.62%
5 years (2013)	110.35 [110.08, 110.63]	110.98 [110.81, 111.16]	111.18 [111.05, 111.31]	-0.83 [-1.13, -0.53]	-0.77%
9 years (2007/2008)	140.34 [139.96, 140.72]	141.37 [141.12, 141.62]	141.61 [141.42, 141.80]	-1.27 [-1.69, -0.85]	-0.99%
13 years (2011/2012)	164.44 [163.84, 165.05]	165.88 [165.46, 166.30]	166.10 [165.78, 166.42]	-1.66 [-2.33, -0.99]	-1.11%
MCS (n=8294)					
3 years (2003/2004)	94.93 [94.81, 95.05]	95.19 [94.96, 95.42]	95.54 [95.38, 95.70]	-0.61 [-0.81, -0.41]	-0.64%
5 years (2006/2007)	109.21 [109.08, 109.34]	109.64 [109.39, 109.89]	110.14 [109.96, 110.31]	-0.93 [-1.14, -0.71]	-0.83%
7 years (2008/2009)	122.26 [122.11, 122.41]	122.79 [122.49, 123.08]	123.42 [123.21, 123.62]	-1.16 [-1.41, -0.90]	-0.95%
11 years (2012/2013)	144.65 [144.44, 144.85]	145.16 [144.77, 145.56]	146.02 [145.75, 146.30]	-1.38 [-1.72, -1.03]	-0.95%
EPITeen (n=931)					
13 years (2003/2004)	157.55 [156.82, 158.29]	159.11 [158.05, 160.17]	159.54 [158.45, 160.62]	-1.99 [-3.30, -0.67]	-1.28%
17 years (2007/2008)	173.41 [172.78, 174.04]	174.26 [173.36, 175.15]	174.48 [173.57, 175.40]	-1.07 [-2.19, 0.04]	-0.63%
21 years (2011/2013)	176.10 [175.43, 176.77]	176.86 [175.95, 177.76]	176.94 [176.03, 177.85]	-0.84 [-1.97, 0.29]	-0.48%

Supplementary Table 4: Expected Length/Height in Centimetres at each age across Categories of Maternal Education by Cohort (Girls Only) - UNWEIGHTED

	Column A	Column B	Column C	Column D	Column E
	Primary	Secondary	Tertiary	Difference (Primary vs Tertiary)	Difference (Primary vs Tertiary)
	<i>Mean (95% CI)</i>	<i>Mean (95% CI)</i>	<i>Mean (95% CI)</i>	<i>Mean (95% CI)</i>	<i>Log height</i>
G21 (n=4201)					
Birth (2005/2006)	48.20 [48.10, 48.30]	48.30 [48.12, 48.47]	48.24 [48.08, 48.40]	-0.04 [-0.23, 0.15]	-0.09%
4 years (2009/2011)	101.28 [101.10, 101.46]	101.94 [101.66, 102.23]	101.38 [101.13, 101.64]	-0.11 [-0.42, 0.21]	-0.27%
7 years (2012/2014)	122.36 [122.11, 122.62]	123.12 [122.71, 123.52]	122.38 [122.01, 122.74]	-0.01 [-0.46, 0.43]	0.04%
GUI (n=9798)					
9 months (2008/2009)	70.09 [69.82, 70.36]	70.52 [70.35, 70.69]	70.65 [70.51, 70.79]	-0.56 [-0.84, -0.27]	-0.79%
3 years (2010/2011)	91.82 [91.59, 92.04]	92.25 [92.10, 92.40]	92.53 [92.41, 92.65]	-0.71 [-0.96, -0.46]	-0.76%
5 years (2013)	109.33 [109.08, 109.58]	109.78 [109.62, 109.95]	110.18 [110.05, 110.31]	-0.85 [-1.13, -0.57]	-0.77%
9 years (2007/2008)	139.28 [138.96, 139.61]	139.83 [139.60, 140.05]	140.42 [140.24, 140.59]	-1.13 [-1.49, -0.77]	-0.80%
13 years (2011/2012)	162.48 [162.00, 162.96]	163.17 [162.81, 163.52]	163.89 [163.61, 164.18]	-1.42 [-1.96, -0.87]	-0.87%
MCS (n=7917)					
3 years (2003/2004)	93.81 [93.69, 93.94]	94.07 [93.83, 94.32]	94.27 [94.11, 94.44]	-0.46 [-0.66, -0.25]	-0.49%
5 years (2007/2008)	108.11 [107.98, 108.24]	108.46 [108.20, 108.72]	108.87 [108.70, 109.05]	-0.77 [-0.99, -0.55]	-0.70%
7 years (2008/2009)	121.49 [121.34, 121.65]	121.88 [121.57, 122.19]	122.45 [122.23, 122.66]	-0.95 [-1.21, -0.69]	-0.80%
11 years (2012/2013)	145.57 [145.35, 145.78]	145.83 [145.40, 146.27]	146.51 [146.22, 146.81]	-0.95 [-1.31, -0.58]	-0.65%
EPITeen (n=1012)					
13 years (2003/2004)	156.47 [155.96, 156.98]	157.65 [156.82, 158.48]	158.93 [158.07, 159.80]	-2.46 [-3.47, -1.45]	-1.59%
17 years (2007/2008)	160.45 [159.95, 160.94]	161.45 [160.65, 162.25]	162.98 [162.14, 163.81]	-2.53 [-3.50, -1.55]	-1.59%
21 years (2011/2013)	161.20 [160.70, 161.70]	162.18 [161.38, 162.98]	163.65 [162.81, 164.49]	-2.45 [-3.43, -1.48]	-1.53%

Supplementary Table 5: Expected Length/Height in Centimetres at each age across Income Tertiles by Cohort (Boys Only)

	Column A	Column B	Column C	Column D	Column E
	Lowest Tertile	Intermediate Tertile	Highest Tertile	Difference (Lowest vs Highest)	Difference (Lowest vs Highest)
	<i>Mean (95% CI)</i>	<i>Mean (95% CI)</i>	<i>Mean (95% CI)</i>	<i>Mean (95% CI)</i>	<i>Log height</i>
G21 (n=3788)					
Birth (2005/2006)	48.91 [48.78, 49.04]	49.13 [49.01, 49.24]	48.92 [48.72, 49.13]	-0.02 [-0.26, 0.23]	-0.05%
4 years (2009/2011)	102.34 [102.08, 102.59]	102.87 [102.66, 103.09]	102.79 [102.41, 103.16]	-0.45 [-0.91, 0.00]	-0.63%
7 years (2012/2014)	123.17 [122.83, 123.51]	123.78 [123.49, 124.06]	123.54 [123.04, 124.03]	-0.37 [-0.97, 0.23]	-0.28%
GUI (n=9060)					
9 months (2008/2009)	71.91 [71.71, 72.12]	72.24 [72.06, 72.42]	72.17 [71.98, 72.36]	-0.26 [-0.50, -0.02]	-0.33%
3 years (2010/2011)	93.23 [93.04, 93.41]	93.50 [93.33, 93.66]	93.64 [93.48, 93.81]	-0.42 [-0.64, -0.19]	-0.43%
5 years (2013)	110.64 [110.43, 110.85]	110.83 [110.64, 111.01]	111.14 [110.96, 111.32]	-0.50 [-0.77, -0.23]	-0.49%
9 years (2007/2008)	141.14 [140.86, 141.42]	141.06 [140.80, 141.32]	141.66 [141.42, 141.91]	-0.52 [-0.89, -0.16]	-0.51%
13 years (2011/2012)	165.86 [165.31, 166.41]	165.39 [164.88, 165.90]	166.21 [165.73, 166.69]	-0.35 [-1.06, 0.36]	-0.41%
MCS (n=7612)					
3 years (2003/2004)	94.73 [94.56, 94.90]	95.17 [95.02, 95.32]	95.46 [95.30, 95.61]	-0.73 [-0.96, -0.50]	-0.76%
5 years (2007/2008)	108.94 [108.76, 109.13]	109.63 [109.46, 109.80]	110.05 [109.88, 110.23]	-1.11 [-1.37, -0.85]	-1.01%
7 years (2008/2009)	121.93 [121.71, 122.16]	122.81 [122.61, 123.01]	123.32 [123.10, 123.53]	-1.38 [-1.69, -1.07]	-1.15%
11 years (2012/2013)	144.25 [143.96, 144.53]	145.31 [145.05, 145.57]	145.83 [145.56, 146.10]	-1.59 [-1.98, -1.20]	-1.09%
EPITeen (n=554)					
13 years (2003/2004)	158.36 [156.31, 160.42]	157.89 [156.63, 159.15]	159.06 [157.94, 160.18]	-0.70 [-3.04, 1.64]	-0.49%
17 years (2007/2008)	173.90 [172.54, 175.27]	172.81 [171.89, 173.73]	174.23 [173.35, 175.11]	-0.33 [-1.95, 1.29]	-0.18%
21 years (2011/2013)	176.41 [174.94, 177.88]	175.53 [174.57, 176.49]	176.80 [175.89, 177.71]	-0.39 [-2.11, 1.34]	-0.21%

Supplementary Table 6: Expected Length/Height in Centimetres at each age across Income Tertiles by Cohort (Girls Only)

	Column A	Column B	Column C	Column D	Column E
	Lowest Tertile	Intermediate Tertile	Highest Tertile	Difference (Lowest vs Highest)	Difference (Lowest vs Highest)
	<i>Mean (95% CI)</i>	<i>Mean (95% CI)</i>	<i>Mean (95% CI)</i>	<i>Mean (95% CI)</i>	<i>Log height</i>
G21 (n=3612)					
Birth	48.04 [47.90, 48.18]	48.39 [48.27, 48.50]	48.35 [48.14, 48.56]	-0.31 [-0.56, -0.06]	-0.67%
4 years	101.20 [100.95, 101.46]	101.66 [101.42, 101.90]	101.49 [101.12, 101.85]	-0.28 [-0.73, 0.16]	-0.47%
7 years	122.29 [121.96, 122.63]	122.70 [122.39, 123.00]	122.50 [122.03, 122.97]	-0.21 [-0.78, 0.37]	-0.18%
GUI (n=9059)					
9 months	70.37 [70.17, 70.58]	70.48 [70.28, 70.69]	70.68 [70.50, 70.85]	-0.30 [-0.53, -0.08]	-0.46%
3 years	92.15 [91.96, 92.35]	92.29 [92.12, 92.45]	92.48 [92.32, 92.65]	-0.33 [-0.57, -0.09]	-0.47%
5 years	109.71 [109.49, 109.93]	109.88 [109.70, 110.07]	110.11 [109.92, 110.30]	-0.40 [-0.69, -0.11]	-0.48%
9 years	139.73 [139.48, 139.99]	140.01 [139.77, 140.25]	140.40 [140.17, 140.63]	-0.67 [-1.00, -0.33]	-0.52%
13 years	162.96 [162.54, 163.39]	163.40 [163.05, 163.76]	164.07 [163.71, 164.43]	-1.11 [-1.62, -0.60]	-0.59%
MCS (n=7279)					
3 years	93.52 [93.35, 93.69]	93.96 [93.80, 94.12]	94.28 [94.13, 94.43]	-0.76 [-0.98, -0.53]	-0.80%
5 years	107.83 [107.65, 108.01]	108.37 [108.19, 108.55]	108.92 [108.75, 109.10]	-1.09 [-1.34, -0.84]	-1.01%
7 years	121.23 [121.01, 121.46]	121.83 [121.61, 122.04]	122.49 [122.28, 122.70]	-1.26 [-1.56, -0.95]	-1.06%
11 years	145.33 [145.03, 145.63]	145.85 [145.55, 146.14]	146.43 [146.14, 146.71]	-1.10 [-1.52, -0.68]	-0.76%
EPITeen (n=571)					
13 years	157.10 [156.03, 158.18]	156.67 [155.75, 157.59]	158.51 [157.60, 159.42]	-1.41 [-2.81, 0.00]	-0.92%
17 years	160.72 [159.71, 161.73]	160.78 [159.95, 161.62]	162.35 [161.47, 163.22]	-1.62 [-2.96, -0.29]	-1.02%
21 years	161.46 [160.43, 162.49]	161.59 [160.75, 162.43]	163.02 [162.15, 163.89]	-1.55 [-2.90, -0.20]	-0.97%

Supplementary References

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