

Supplementary Materials

Burden of liver cancer in adolescents and young adults aged 15-49 years in China: a comprehensive analysis based on the Global Burden of Disease study (1990-2021)

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Supplementary Table 1. Age-specific percentage changes, incidence cases, and deaths for liver cancer in young adults aged 15- 49 years in China, 1990-2021

Age group (years)	Incidence Cases (95% UI)			Deaths (95% UI)		
	1990	2021	Change, %	1990	2021	Change, %
Total	30185 (24839-36227)	38509 (30544-50232)	27.58 (-15.69-102.23)	27360 (22538-32769)	28127 (22351-36519)	2.80 (-31.79-62.03)
15-19	349 (290-427)	130 (105-167)	-62.75 (-75.41--42.41)	340 (282-417)	103 (83-133)	-69.71 (-80.10--52.84)
20-24	790 (646-968)	308 (224-409)	-61.01 (-76.86--36.69)	799 (654-974)	254 (183-339)	-68.21 (-81.21--48.17)
25-29	1623 (1335-2000)	1175 (936-1458)	-27.60 (-53.20-9.21)	1500 (1235-1850)	885 (705-1104)	-41.00 (-61.89--10.61)
30-34	3243 (2674-3891)	3880 (3037-5021)	19.64 (-21.95-87.77)	2956 (2442-3583)	2895 (2267-3736)	-2.06 (-36.73-52.99)
35-39	6170 (5074-7525)	6368 (4849-8334)	3.21 (-35.56-64.25)	5335 (4394-6482)	4516 (3428-5903)	-15.35 (-47.12-34.34)
40-44	8586 (6933-10545)	9556 (7306-12537)	11.30 (-30.72-80.83)	7740 (6231-9496)	6891 (5270-9107)	-10.97 (-44.50-46.16)
45-49	9424 (7528-11470)	17092 (12848-22303)	81.37 (12.01-196.27)	8690 (6933-10581)	12583 (9471-16473)	44.80 (-10.49-137.60)

Supplementary Table 2. Age-specific percentage changes, incidence and mortality rates for liver cancer in young adults aged 15- 49 years in China, 1990-2021

Age group (years)	Incidence Rate, % (95% UI)			Mortality Rate, % (95% UI)		
	1990	2021	Change, %	1990	2021	Change, %
Total	10.58 (8.94-12.43)	9.52 (7.72-11.78)	-10.02 (-37.89-31.77)	10.75 (9.12-12.61)	8.35 (6.8-10.29)	-22.33 (-46.07-12.83)
15-19	0.28 (0.23-0.34)	0.17 (0.14-0.22)	-39.29 (-58.82--4.35)	0.27 (0.22-0.33)	0.14 (0.11-0.18)	-48.15 (-66.67--18.18)
20-24	0.60 (0.49-0.73)	0.42 (0.31-0.56)	-30.00 (-57.53-14.29)	0.61 (0.50-0.74)	0.35 (0.25-0.46)	-42.62 (-66.22--8.00)
25-29	1.48 (1.21-1.82)	1.36 (1.08-1.69)	-8.11 (-40.66-39.67)	1.37 (1.12-1.68)	1.02 (0.82-1.28)	-25.55 (-51.19-14.29)
30-34	3.68 (3.03-4.41)	3.20 (2.51-4.14)	-13.04 (-43.08-36.63)	3.35 (2.77-4.06)	2.39 (1.87-3.08)	-28.66 (-53.94-11.19)
35-39	6.76 (5.56-8.24)	6.01 (4.58-7.87)	-11.09 (-44.42-41.55)	5.84 (4.81-7.10)	4.26 (3.24-5.57)	-27.05 (-54.37-15.80)
40-44	12.8 (10.33-15.72)	10.44 (7.98-13.7)	-18.44 (-49.24-32.62)	11.54 (9.29-14.15)	7.53 (5.76-9.95)	-34.75 (-59.29-7.10)
45-49	18.26 (14.58-22.22)	15.49 (11.65-20.22)	-15.17 (-47.57-38.68)	16.83 (13.43-20.5)	11.41 (8.59-14.93)	-32.20 (-58.10-11.17)

Supplementary Table 3. Age-specific percentage changes, disability-adjusted life-years (DALYs), years of life lost due to premature mortality (YLLs), and years lived with disability (YLDs) for liver cancer in young adults aged 15- 49 years in China, 1990-2021

Age group (years)	DALYs, person-years (95% UI)			YLLs, person-years (95% UI)			YLDs, person-years (95% UI)		
	1990	2021	Change, %	1990	2021	Change, %	1990	2021	Change, %
Total	1375710(1134928-1647716)	1363072 (1083216-1769074)	-0.92 (-34.26-55.88)	1368310(1128696-1637077)	1353375 (1074476-1756180)	-1.09 (-34.37-55.59)	7400 (5003-10333)	9697 (6350-14132)	31.04 (-38.55-182.47)
15-19	24703 (20532-30323)	7521 (6020-9673)	-69.55 (-80.15--52.89)	24615 (20451-30196)	7488 (5994-9633)	-69.58 (-80.15--52.90)	88 (60-126)	33 (22-47)	-62.50 (-82.54--21.67)
20-24	54307 (44455-66182)	17254 (12411-23013)	-68.23 (-81.25--48.23)	54110 (44295-65950)	17175 (12349-22917)	-68.26 (-81.28--48.26)	197 (134-280)	78 (50-113)	-60.41 (-82.14--15.67)
25-29	94752 (77982-116848)	55728 (44435-69515)	-41.19 (-61.97--10.86)	94282 (77599-116281)	55377 (44129-69059)	-41.26 (-62.05--11.01)	469 (328-658)	351 (230-496)	-25.16 (-65.05-51.22)
30-34	170902 (141142-207005)	167746 (131353-216528)	-1.85 (-36.55-53.41)	170036 (140464-206090)	166685 (130519-215159)	-1.97 (-36.67-53.18)	867 (598-1235)	1060 (684-1530)	22.26 (-44.62-155.85)
35-39	283073 (233096-344228)	240213 (182401-314102)	-15.14 (-47.01-34.75)	281524 (231882-342116)	238581 (181136-311893)	-15.25 (-47.05-34.51)	1549 (1038-2196)	1632 (1077-2382)	5.36 (-50.96-129.48)
40-44	372632 (300121-457273)	331709 (253324-438612)	-10.98 (-44.60-46.15)	370618 (298395-454680)	329368 (251869-435293)	-11.13 (-44.61-45.88)	2014 (1381-2902)	2341 (1489-3391)	16.24 (-48.69-145.55)
45-49	375341 (299630-456907)	542903 (409195-711354)	44.64 (-10.44-137.41)	373125 (297679-454303)	538702 (405462-705264)	44.38 (-10.75-136.92)	2216 (1428-3128)	4200 (2732-6251)	89.53 (-12.66-337.75)

Supplementary Table 4. Age-specific percentage changes, disability-adjusted life-year (DALY) rates, year of life lost due to premature mortality (YLL) rates, and year lived with disability (YLD) rates for liver cancer in young adults aged 15- 49 years in China, 1990-2021

Age group (years)	DALY Rate, person-years per 100 000 persons (95% UI)			YLL Rate, person-years per 100 000 persons (95% UI)			YLD Rate, person-years per 100 000 persons (95% UI))		
	1990	2021	Change, %	1990	2021	Change, %	1990	2021	Change, %
Total	334.52 (281.08-393.14)	239.91 (191.98-299.37)	-28.28 (-51.17-6.51)	332.05 (279.18-389.6)	237.63 (190.4-296.93)	-28.44 (-51.13-6.36)	2.47 (1.69-3.4)	2.27 (1.53-3.15)	-8.10 (-55.00-86.39)
15-19	19.5 (16.21-23.94)	10.07 (8.06-12.95)	-48.36 (-66.33--20.11)	19.43 (16.15-23.84)	10.03 (8.03-12.9)	-48.38 (-66.32--20.12)	0.07 (0.05-0.10)	0.04 (0.03-0.06)	-42.86 (-70.00-20.00)
20-24	41.14 (33.68-50.14)	23.58 (16.96-31.45)	-42.68 (-66.17--6.62)	40.99 (33.56-49.96)	23.47 (16.88-31.32)	-42.74 (-66.21--6.67)	0.15 (0.10-0.21)	0.11 (0.07-0.15)	-26.67 (-66.67-50.00)
25-29	86.22 (70.96-106.33)	64.44 (51.38-80.38)	-25.26 (-51.68-13.28)	85.80 (70.62-105.82)	64.03 (51.03-79.85)	-25.37 (-51.78-13.07)	0.43 (0.30-0.60)	0.41 (0.27-0.57)	-4.65 (-55.00-90.00)
30-34	193.67 (159.95-234.58)	138.46 (108.42-178.72)	-28.51 (-53.78-11.73)	192.69 (159.18-233.54)	137.58 (107.73-177.59)	-28.60 (-53.87-11.57)	0.98 (0.68-1.40)	0.88 (0.56-1.26)	-10.20 (-60.00-85.29)
35-39	309.91 (255.2-376.87)	226.69 (172.14-296.43)	-26.85 (-54.32-16.16)	308.22 (253.87-374.56)	225.15 (170.94-294.34)	-26.95 (-54.36-15.94)	1.70 (1.14-2.40)	1.54 (1.02-2.25)	-9.41 (-57.50-97.37)
40-44	555.39 (447.31-681.54)	362.39 (276.76-479.18)	-34.75 (-59.39-7.12)	552.38 (444.74-677.67)	359.83 (275.17-475.55)	-34.86 (-59.39-6.93)	3.00 (2.06-4.33)	2.56 (1.63-3.70)	-14.67 (-62.36-79.61)
45-49	727.14 (580.46-885.15)	492.11 (370.91-644.80)	-32.32 (-58.10-11.08)	722.84 (576.69-880.11)	488.3 (367.53-639.28)	-32.45 (-58.24-10.85)	4.29 (2.77-6.06)	3.81 (2.48-5.67)	-11.19 (-59.08-104.69)

Supplementary Table 5. The annual percentage changes (APCs) of age-standardized incidence rate(ASIR), age-standardized mortality rate(ASMR), age-standardized disability-adjusted life-year (DALY) rate, age-standardized year of life lost due to premature mortality (YLL) rate and age-standardized year lived with disability (YLD) rate for liver cancer in young adults aged 15- 49 years by sex in Jointpoint Regression Analysis, 1990-2021

Trends		Age-standardized Incidence Rate		Age-standardized Mortality Rate		Age-standardized DALYs Rate		Age-standardized YLLs Rate		Age-standardized YLDs Rate	
		Year	APC (95%CI)	Year	APC (95%CI)	Year	APC (95%CI)	Year	APC (95%CI)	Year	APC (95%CI)
Male	Trend1	1990-2001	1.09(0.83-1.35)	1990-1994	-0.68(-2.95-1.64)	1990-2001	0.78(0.38-1.18)	1990-2001	0.78(0.38-1.18)	1990-2001	1.08(0.84-1.32)
	Trend2	2001-2005	-3.59(-4.81--2.36)	1994-2001	1.59(0.60-2.59)	2001-2005	-5.04(-7.02--3.02)	2001-2005	-5.05(-7.04--3.01)	2001-2005	-3.71(-5.25--2.14)
	Trend3	2005-2015	0.93(0.69-1.18)	2001-2005	-4.05(-6.34--1.71)	2005-2021	-0.46(-0.70--0.22)	2005-2021	-0.47(-0.71--0.23)	2005-2016	0.95(0.68-1.22)
	Trend4	2015-2021	-1.17(-2.08--0.25)	2005-2021	-0.33(-0.61--0.05)					2016-2021	-1.26(-2.12--0.40)
	AAPC	1990-2021	-0.02(-0.27-0.24)	1990-2021	-0.44(-0.91--0.04)	1990-2021	-0.63(-0.94--0.31)	1990-2021	-0.63(-0.95--0.32)	1990-2021	0.02(-0.24-0.29)
Female	Trend1	1990-2000	-0.28(-0.40--0.17)	1990-2001	-0.49(-0.87--0.10)	1990-2001	-0.61(-0.95--0.27)	1990-2001	-0.61(-0.96--0.27)	1990-2000	-0.22(-0.33--0.11)
	Trend2	2000-2005	-3.00(-3.33--2.66)	2001-2006	-3.32(-4.54--2.08)	2001-2005	-5.29(-6.98--3.58)	2001-2005	-5.31(-7.00--3.59)	2000-2005	-3.28(-3.68--2.88)
	Trend3	2005-2016	0.82(0.74-0.91)	2006-2017	0.53(0.14-0.93)	2005-2018	-0.51(-0.78--0.24)	2005-2018	-0.52(-0.79--0.25)	2005-2016	0.91(0.80-1.01)
	Trend4	2016-2021	-1.94(-2.34--1.54)	2017-2021	-3.47(-5.73--1.17)	2018-2021	-3.20(-6.72-0.45)	2018-2021	-3.20(-6.72-0.46)	2016-2021	-1.75(-2.07--1.42)
	AAPC	1990-2021	-0.60(-0.70--0.51)	1990-2021	-0.98(-1.37--0.59)	1990-2021	-1.44(-1.86--1.01)	1990-2021	-1.45(-1.87--1.02)	1990-2021	-0.57(-0.66--0.48)
Total	Trend1	1990-2001	0.61(0.41-0.81)	1990-2001	-0.49(0.09-0.90)	1990-2001	0.38(-0.01-0.76)	1990-2001	0.37(-0.01-0.76)	1990-2001	0.63(0.45-0.81)
	Trend2	2001-2005	-3.74(-4.68--2.80)	2001-2006	-3.54(-4.85--2.22)	2001-2005	-5.21(-7.13--3.26)	2001-2005	-5.22(-7.14--3.26)	2001-2005	-3.92(-5.14--2.68)
	Trend3	2005-2016	0.86(0.69-1.04)	2006-2016	0.23(-0.23-0.70)	2005-2021	-0.54(-0.77--0.31)	2005-2021	-0.55(-0.78--0.32)	2005-2016	0.95(0.74-1.16)
	Trend4	2016-2021	-1.73(-2.63--0.83)	2016-2021	-2.14(-3.98--0.27)					2016-2021	-1.41(-2.04--0.78)
	AAPC	1990-2021	-0.25(-0.45--0.05)	1990-2021	-0.68(-1.08--0.28)	1990-2021	-0.83(-1.13--0.53)	1990-2021	-0.84(-1.14--0.54)	1990-2021	-0.19(-0.39-0.02)

Supplementary Table 6. Age-period-cohort effects of liver cancer incidence in young adults aged 15- 49 years in China by sex, 1990-2021

Sex	Age Effect		Drifts	Period Effect		Cohort Effect	
	Age	Longitudinal Incidence Rate, %	Local Drifts with Net Drift, % per year	Period	Period Rate Ratio	Period	Cohort Rate Ratio
Male	17.5	0.46(0.38-0.56)	-2.54(-4.39--0.66)	1992.5	1.18(1.11-1.26)	1945	1.07(0.99-1.15)
	22.5	0.88(0.77-1.00)	-2.00(-2.98--1.02)	1997.5	1.15(1.09-1.21)	1950	1.11(1.05-1.17)
	27.5	2.36(2.19-2.55)	-1.36(-1.85--0.87)	2002.5	1.00(1.00-1.00)	1955	1.07(1.02-1.13)
	32.5	5.90(5.60-6.22)	-1.23(-1.57--0.90)	2007.5	0.82(0.78-0.87)	1960	1.04(0.99-1.09)
	37.5	10.58(10.14-11.03)	-1.10(-1.36--0.85)	2012.5	0.86(0.81-0.91)	1965	1.08(1.03-1.13)
	42.5	17.46(16.83-18.12)	-0.76(-0.96--0.56)	2017.5	0.91(0.85-0.98)	1970	1.00(1.00-1.00)
	47.5	25.15(24.32-26.02)	-0.26(-0.50--0.01)			1975	0.88(0.83-0.93)
						1980	0.82(0.76-0.88)
						1985	0.81(0.74-0.90)
						1990	0.77(0.66-0.89)
						1995	0.54(0.39-0.74)
						2000	0.46(0.25-0.87)
Female	17.5	0.25(0.21-0.28)	-3.34(-4.72--1.94)	1992.5	1.34(1.26-1.43)	1945	1.60(1.49-1.72)
	22.5	0.46(0.42-0.51)	-3.42(-4.16--2.67)	1997.5	1.26(1.19-1.32)	1950	1.51(1.43-1.59)
	27.5	0.77(0.72-0.82)	-3.07(-3.50--2.65)	2002.5	1.00(1.00-1.00)	1955	1.34(1.27-1.40)
	32.5	1.22(1.15-1.29)	-2.83(-3.15--2.50)	2007.5	0.76(0.72-0.80)	1960	1.19(1.13-1.25)
	37.5	1.75(1.67-1.83)	-2.68(-2.95--2.42)	2012.5	0.73(0.69-0.77)	1965	1.15(1.09-1.20)
	42.5	2.68(2.58-2.80)	-2.28(-2.50--2.07)	2017.5	0.73(0.68-0.77)	1970	1.00(1.00-1.00)
	47.5	4.32(4.16-4.48)	-1.86(-2.10--1.63)			1975	0.80(0.75-0.85)
						1980	0.67(0.62-0.72)
						1985	0.63(0.57-0.69)
						1990	0.53(0.46-0.60)
						1995	0.39(0.30-0.49)
						2000	0.35(0.22-0.56)
Total	17.5	0.35(0.29-0.42)	-2.73(-4.40--1.02)	1992.5	1.22(1.14-1.30)	1945	1.16(1.08-1.25)
	22.5	0.66(0.59-0.74)	-2.35(-3.24--1.46)	1997.5	1.17(1.12-1.23)	1950	1.18(1.12-1.24)
	27.5	1.59(1.48-1.71)	-1.75(-2.21--1.29)	2002.5	1.00(1.00-1.00)	1955	1.12(1.07-1.17)
	32.5	3.63(3.45-3.82)	-1.56(-1.88--1.24)	2007.5	0.81(0.77-0.85)	1960	1.06(1.01-1.12)
	37.5	6.29(6.04-6.56)	-1.40(-1.65--1.15)	2012.5	0.83(0.79-0.88)	1965	1.09(1.04-1.13)
	42.5	10.24(9.88-10.62)	-1.05(-1.24--0.85)	2017.5	0.87(0.82-0.93)	1970	1.00(1.00-1.00)
	47.5	14.94(14.45-15.44)	-0.59(-0.82--0.36)			1975	0.86(0.82-0.91)
						1980	0.79(0.73-0.84)
						1985	0.77(0.70-0.84)
						1990	0.70(0.61-0.81)
						1995	0.50(0.37-0.67)
						2000	0.44(0.25-0.78)

Supplementary Table 7. Age-period-cohort effects of liver cancer mortality in young adults aged 15- 49 years in China by sex, 1990-2021

Sex	Age Effect		Drifts	Period Effect		Cohort Effect	
	Age	Longitudinal mortality Rate, %	Local Drifts with Net Drift, % per year	Period	Period Rate Ratio	Period	Cohort Rate Ratio
Male	17.5	0.47(0.37-0.59)	-3.14(-5.36--0.86)	1992.5	1.18(1.09-1.28)	1945	1.34(1.23-1.47)
	22.5	0.89(0.77-1.03)	-2.57(-3.73--1.40)	1997.5	1.17(1.10-1.24)	1950	1.28(1.20-1.36)
	27.5	2.12(1.93-2.32)	-1.99(-2.58--1.39)	2002.5	1.00(1.00-1.00)	1955	1.20(1.14-1.28)
	32.5	5.03(4.72-5.36)	-1.78(-2.18--1.37)	2007.5	0.80(0.76-0.85)	1960	1.07(1.01-1.14)
	37.5	8.34(7.92-8.79)	-1.76(-2.08--1.44)	2012.5	0.76(0.71-0.82)	1965	1.12(1.06-1.18)
	42.5	14.03(13.41-14.69)	-1.49(-1.74--1.25)	2017.5	0.79(0.73-0.86)	1970	1.00(1.00-1.00)
	47.5	19.21(18.41-20.04)	-1.12(-1.41--0.84)			1975	0.84(0.78-0.89)
						1980	0.77(0.70-0.84)
						1985	0.74(0.66-0.84)
						1990	0.67(0.56-0.81)
						1995	0.46(0.31-0.68)
						2000	0.38(0.18-0.81)
Female	17.5	0.25(0.21-0.30)	-4.01(-5.70--2.29)	1992.5	1.37(1.27-1.48)	1945	1.91(1.75-2.09)
	22.5	0.47(0.42-0.52)	-4.12(-5.02--3.21)	1997.5	1.31(1.23-1.39)	1950	1.71(1.60-1.83)
	27.5	0.68(0.63-0.74)	-3.82(-4.35--3.30)	2002.5	1.00(1.00-1.00)	1955	1.47(1.38-1.57)
	32.5	1.03(0.96-1.10)	-3.50(-3.90--3.09)	2007.5	0.73(0.69-0.78)	1960	1.24(1.16-1.32)
	37.5	1.36(1.29-1.44)	-3.35(-3.68--3.02)	2012.5	0.65(0.61-0.70)	1965	1.20(1.13-1.27)
	42.5	2.14(2.04-2.25)	-2.94(-3.20--2.68)	2017.5	0.64(0.59-0.69)	1970	1.00(1.00-1.00)
	47.5	3.36(3.21-3.52)	-2.52(-2.81--2.24)			1975	0.76(0.71-0.82)
						1980	0.62(0.56-0.68)
						1985	0.56(0.50-0.63)
						1990	0.45(0.39-0.54)
						1995	0.32(0.24-0.43)
						2000	0.28(0.16-0.50)
Total	17.5	0.36(0.29-0.44)	-3.33(-5.39--1.22)	1992.5	1.22(1.13-1.32)	1945	1.45(1.32-1.58)
	22.5	0.67(0.59-0.77)	-2.95(-4.02--1.86)	1997.5	1.20(1.13-1.27)	1950	1.35(1.27-1.44)
	27.5	1.42(1.30-1.55)	-2.40(-2.97--1.83)	2002.5	1.00(1.00-1.00)	1955	1.25(1.18-1.32)
	32.5	3.09(2.91-3.29)	-2.12(-2.52--1.72)	2007.5	0.79(0.74-0.84)	1960	1.10(1.04-1.17)
	37.5	4.96(4.70-5.22)	-2.06(-2.37--1.75)	2012.5	0.74(0.69-0.79)	1965	1.13(1.07-1.19)
	42.5	8.23(7.86-8.61)	-1.77(-2.01--1.53)	2017.5	0.76(0.70-0.82)	1970	1.00(1.00-1.00)
	47.5	11.44(10.97-11.94)	-1.42(-1.70--1.14)			1975	0.82(0.77-0.88)
						1980	0.74(0.67-0.81)
						1985	0.70(0.63-0.79)
						1990	0.61(0.51-0.73)
						1995	0.42(0.29-0.61)
						2000	0.36(0.18-0.73)

Supplementary Table 8. Proportions of liver cancer DALYs attribute to four risk factors in young adults aged 15- 49 years in China, 1990-2021

Year	Risk factors Attribution to DALYs, %			
	Smoking	High Body-mass Index	High alcohol use	High fasting plasma glucose
1990	14.48(5.15-22.91)	1.93(0.89-3.09)	7.79(4.27-12.49)	0.50(0.05-1.03)
1991	14.59(5.35-23.65)	2.01(0.92-3.21)	7.88(4.34-12.45)	0.49(0.05-1.00)
1992	14.54(5.2-23.28)	2.08(0.96-3.33)	7.94(4.37-12.58)	0.49(0.05-0.99)
1993	14.57(5.20-23.05)	2.17(0.99-3.47)	7.98(4.37-12.59)	0.48(0.05-0.99)
1994	14.51(5.22-23.03)	2.25(1.02-3.60)	7.99(4.38-12.58)	0.48(0.05-0.99)
1995	14.47(5.24-23.11)	2.33(1.06-3.71)	7.99(4.40-12.58)	0.49(0.05-0.99)
1996	14.53(5.23-23.09)	2.43(1.10-3.91)	7.93(4.36-12.45)	0.50(0.05-1.03)
1997	14.56(5.15-23.37)	2.53(1.14-4.06)	7.80(4.32-12.23)	0.52(0.05-1.06)
1998	14.45(5.25-23.32)	2.65(1.19-4.29)	7.64(4.25-12.07)	0.54(0.06-1.12)
1999	14.43(5.18-22.86)	2.78(1.24-4.55)	7.52(4.21-11.81)	0.57(0.06-1.15)
2000	14.55(5.21-23.40)	2.91(1.30-4.72)	7.47(4.17-11.84)	0.58(0.06-1.19)
2001	14.61(5.30-23.45)	3.05(1.34-4.93)	7.46(4.17-11.83)	0.59(0.06-1.20)
2002	14.69(5.28-23.57)	3.20(1.40-5.26)	7.46(4.17-11.95)	0.60(0.06-1.22)
2003	14.84(5.23-23.80)	3.36(1.45-5.52)	7.47(4.18-11.93)	0.60(0.06-1.21)
2004	14.86(5.28-23.60)	3.52(1.50-5.78)	7.46(4.15-11.99)	0.61(0.07-1.21)
2005	14.92(5.26-23.64)	3.70(1.55-6.07)	7.48(4.15-11.94)	0.62(0.07-1.22)
2006	15.02(5.34-24.01)	3.89(1.62-6.42)	7.58(4.24-12.09)	0.62(0.07-1.23)
2007	15.11(5.41-24.17)	4.11(1.71-6.85)	7.79(4.39-12.48)	0.64(0.07-1.26)
2008	15.17(5.45-24.32)	4.33(1.80-7.28)	8.06(4.59-12.76)	0.65(0.07-1.30)
2009	15.17(5.46-24.32)	4.58(1.89-7.75)	8.31(4.77-13.02)	0.67(0.07-1.31)
2010	15.22(5.49-24.39)	4.84(1.97-8.22)	8.47(4.93-13.22)	0.69(0.07-1.37)
2011	15.27(5.48-24.85)	5.11(2.08-8.60)	8.58(5.01-13.37)	0.71(0.07-1.43)
2012	15.31(5.54-24.33)	5.40(2.20-9.04)	8.67(5.04-13.38)	0.72(0.08-1.48)
2013	15.23(5.51-24.54)	5.69(2.30-9.61)	8.72(5.01-13.56)	0.73(0.08-1.50)
2014	15.15(5.43-24.20)	5.99(2.40-10.06)	8.77(5.09-13.72)	0.74(0.08-1.53)
2015	15.08(5.50-24.13)	6.29(2.54-10.58)	8.81(5.04-13.77)	0.75(0.08-1.54)
2016	14.96(5.44-24.25)	6.59(2.66-10.98)	8.84(5.11-13.77)	0.76(0.08-1.56)
2017	14.84(5.34-24.27)	6.88(2.77-11.63)	8.87(5.15-13.83)	0.77(0.08-1.52)
2018	14.77(5.31-23.97)	7.19(2.88-12.17)	8.90(5.16-13.90)	0.78(0.08-1.57)
2019	14.70(5.16-24.07)	7.50(3.02-12.91)	8.90(5.17-13.87)	0.79(0.09-1.58)
2020	14.64(5.27-23.98)	7.80(3.13-13.35)	8.91(5.16-14.16)	0.79(0.09-1.60)
2021	14.60(5.12-23.5)	8.14(3.26-14.04)	8.96(5.14-14.09)	0.78(0.09-1.61)

Supplementary Table 9. Proportions of liver cancer DALYs attribute to smoking in young adults aged 15- 49 years by sex in China, 1990-2021

Year	Smoking Attribution to DALYs, %		
	Male	Female	Total
1990	17.58(6.40-27.96)	0.86(0.25-1.63)	14.48(5.15-22.91)
1991	17.65(6.40-28.07)	0.89(0.26-1.66)	14.59(5.35-23.65)
1992	17.57(6.35-27.94)	0.90(0.27-1.69)	14.54(5.20-23.28)
1993	17.58(6.40-27.89)	0.91(0.28-1.67)	14.57(5.20-23.05)
1994	17.56(6.38-27.90)	0.92(0.28-1.68)	14.51(5.22-23.03)
1995	17.47(6.31-27.85)	0.94(0.28-1.75)	14.47(5.24-23.11)
1996	17.48(6.30-27.88)	0.94(0.28-1.77)	14.53(5.23-23.09)
1997	17.46(6.29-27.89)	0.95(0.28-1.77)	14.56(5.15-23.37)
1998	17.33(6.30-27.79)	0.96(0.29-1.78)	14.45(5.25-23.32)
1999	17.26(6.26-27.67)	0.96(0.30-1.81)	14.43(5.18-22.86)
2000	17.32(6.27-27.79)	0.96(0.28-1.79)	14.55(5.21-23.40)
2001	17.30(6.30-27.77)	0.95(0.28-1.78)	14.61(5.30-23.45)
2002	17.33(6.22-27.75)	0.96(0.28-1.77)	14.69(5.28-23.57)
2003	17.39(6.23-27.94)	0.97(0.29-1.79)	14.84(5.23-23.80)
2004	17.39(6.16-27.88)	0.97(0.30-1.77)	14.86(5.28-23.60)
2005	17.42(6.20-27.88)	1.00(0.31-1.82)	14.92(5.26-23.64)
2006	17.50(6.25-28.07)	1.04(0.33-1.84)	15.02(5.34-24.01)
2007	17.55(6.29-28.09)	1.08(0.35-1.92)	15.11(5.41-24.17)
2008	17.60(6.30-28.19)	1.12(0.35-2.01)	15.17(5.45-24.32)
2009	17.61(6.30-28.10)	1.15(0.35-2.01)	15.17(5.46-24.32)
2010	17.64(6.35-28.11)	1.15(0.35-2.07)	15.22(5.49-24.39)
2011	17.70(6.39-28.33)	1.18(0.37-2.10)	15.27(5.48-24.85)
2012	17.70(6.39-28.31)	1.20(0.37-2.20)	15.31(5.54-24.33)
2013	17.56(6.34-28.10)	1.21(0.37-2.23)	15.23(5.51-24.54)
2014	17.41(6.30-27.89)	1.21(0.37-2.28)	15.15(5.43-24.20)
2015	17.29(6.28-27.78)	1.21(0.36-2.29)	15.08(5.50-24.13)
2016	17.19(6.25-27.74)	1.20(0.35-2.32)	14.96(5.44-24.25)
2017	17.04(6.11-27.61)	1.19(0.35-2.28)	14.84(5.34-24.27)
2018	16.92(6.07-27.37)	1.17(0.35-2.26)	14.77(5.31-23.97)
2019	16.82(6.00-27.39)	1.15(0.35-2.24)	14.70(5.16-24.07)
2020	16.73(5.92-27.16)	1.12(0.33-2.22)	14.64(5.27-23.98)
2021	16.67(5.87-26.97)	1.10(0.32-2.17)	14.60(5.12-23.50)

Supplementary Table 10. Proportions of liver cancer DALYs attribute to high body-mass index in young adults aged 15- 49 years by sex in China, 1990-2021

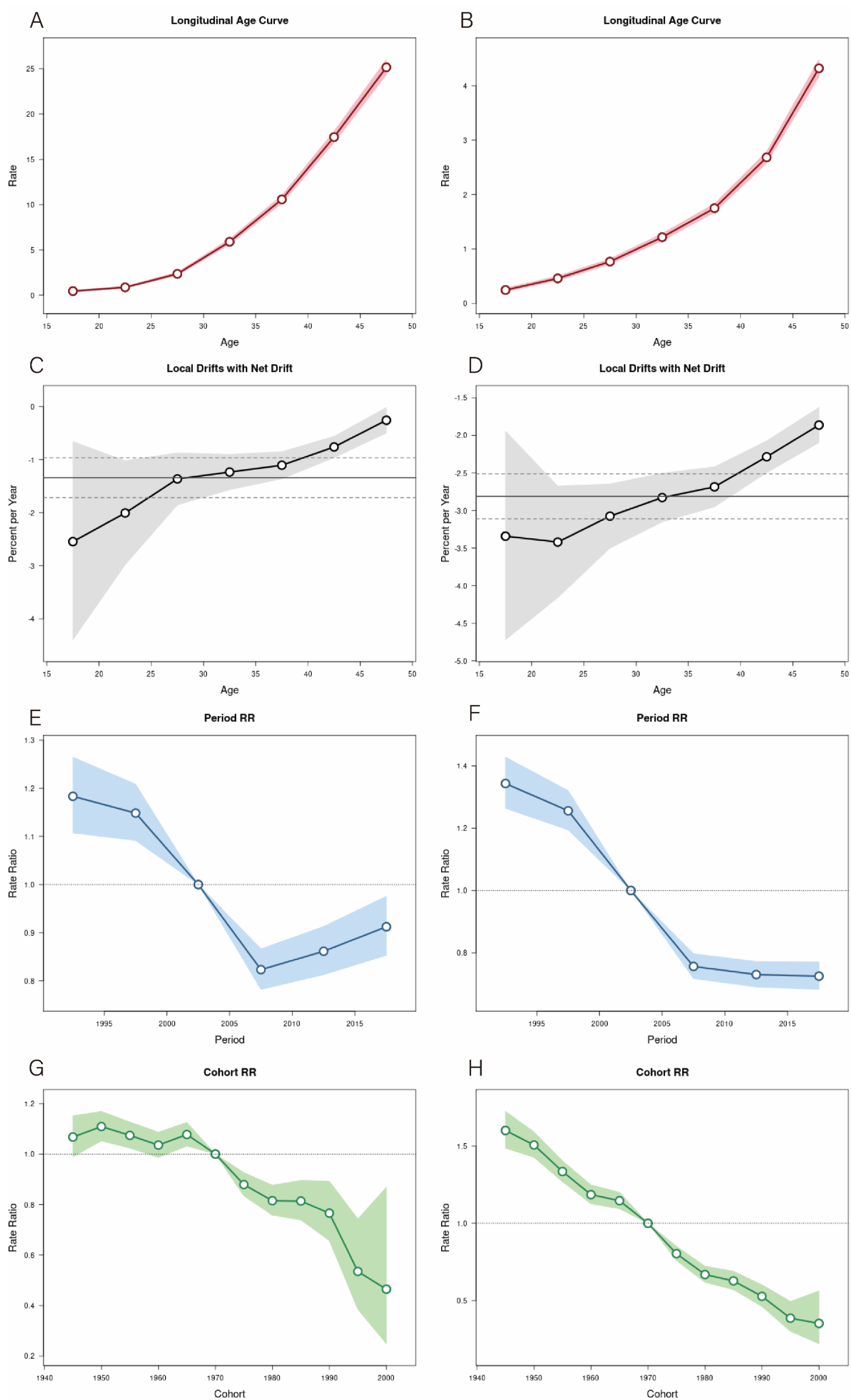
Year	High Body-mass Index Attribution to DALYs, %		
	Male	Female	Total
1990	1.96(0.89-3.15)	1.78(0.80-2.91)	1.93(0.89-3.09)
1991	2.04(0.92-3.28)	1.85(0.84-3.03)	2.01(0.92-3.21)
1992	2.12(0.96-3.42)	1.91(0.87-3.12)	2.08(0.96-3.33)
1993	2.21(1.00-3.55)	1.99(0.91-3.26)	2.17(0.99-3.47)
1994	2.29(1.04-3.65)	2.07(0.94-3.43)	2.25(1.02-3.60)
1995	2.37(1.08-3.77)	2.16(0.98-3.59)	2.33(1.06-3.71)
1996	2.47(1.11-3.93)	2.25(1.01-3.73)	2.43(1.10-3.91)
1997	2.57(1.16-4.10)	2.35(1.06-3.90)	2.53(1.14-4.06)
1998	2.69(1.20-4.35)	2.47(1.10-4.13)	2.65(1.19-4.29)
1999	2.82(1.25-4.59)	2.60(1.15-4.35)	2.78(1.24-4.55)
2000	2.95(1.30-4.73)	2.73(1.20-4.59)	2.91(1.30-4.72)
2001	3.08(1.35-4.95)	2.87(1.25-4.79)	3.05(1.34-4.93)
2002	3.24(1.41-5.28)	3.02(1.29-5.05)	3.20(1.40-5.26)
2003	3.39(1.47-5.54)	3.19(1.35-5.25)	3.36(1.45-5.52)
2004	3.56(1.51-5.83)	3.34(1.42-5.59)	3.52(1.50-5.78)
2005	3.73(1.57-6.10)	3.51(1.46-5.82)	3.70(1.55-6.07)
2006	3.92(1.63-6.43)	3.71(1.55-6.23)	3.89(1.62-6.42)
2007	4.13(1.72-6.86)	3.94(1.66-6.65)	4.11(1.71-6.85)
2008	4.36(1.81-7.27)	4.21(1.75-7.06)	4.33(1.80-7.28)
2009	4.60(1.89-7.75)	4.50(1.85-7.60)	4.58(1.89-7.75)
2010	4.84(1.97-8.22)	4.81(1.95-8.11)	4.84(1.97-8.22)
2011	5.10(2.06-8.62)	5.18(2.11-8.89)	5.11(2.08-8.60)
2012	5.37(2.18-9.07)	5.55(2.23-9.66)	5.40(2.20-9.04)
2013	5.66(2.28-9.59)	5.89(2.37-10.30)	5.69(2.30-9.61)
2014	5.95(2.37-10.17)	6.24(2.50-10.89)	5.99(2.4-10.06)
2015	6.24(2.52-10.53)	6.57(2.60-11.66)	6.29(2.54-10.58)
2016	6.54(2.64-10.95)	6.89(2.76-12.08)	6.59(2.66-10.98)
2017	6.83(2.76-11.53)	7.19(2.90-12.51)	6.88(2.77-11.63)
2018	7.14(2.87-12.05)	7.52(3.00-13.33)	7.19(2.88-12.17)
2019	7.44(3.00-12.70)	7.85(3.18-13.99)	7.50(3.02-12.91)
2020	7.74(3.11-13.21)	8.19(3.30-14.67)	7.80(3.13-13.35)
2021	8.07(3.23-13.87)	8.55(3.43-15.11)	8.14(3.26-14.04)

Supplementary Table 11. Proportions of liver cancer DALYs attribute to alcohol use in young adults aged 15- 49 years by sex in China, 1990-2021

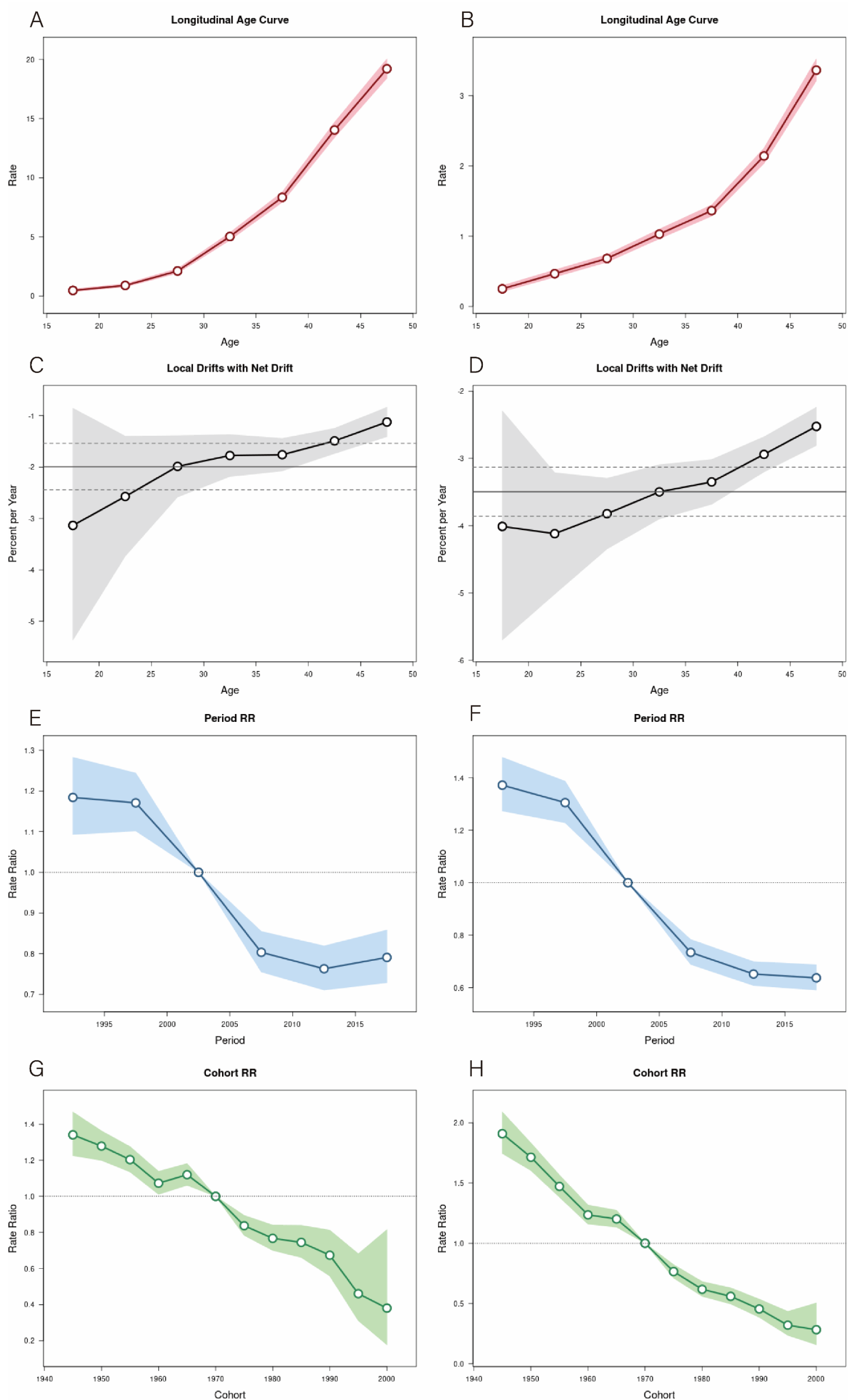
Year	Alcohol use Attribution to DALYs, %		
	Male	Female	Total
1990	7.98(3.90-13.70)	6.98(5.21-8.93)	7.79(4.27-12.49)
1991	8.07(3.97-13.82)	7.09(5.35-9.10)	7.88(4.34-12.45)
1992	8.13(3.97-13.84)	7.13(5.38-9.15)	7.94(4.37-12.58)
1993	8.16(3.96-13.76)	7.18(5.41-9.30)	7.98(4.37-12.59)
1994	8.17(3.98-13.64)	7.23(5.45-9.29)	7.99(4.38-12.58)
1995	8.16(3.98-13.54)	7.25(5.48-9.34)	7.99(4.40-12.58)
1996	8.08(3.91-13.47)	7.26(5.49-9.35)	7.93(4.36-12.45)
1997	7.92(3.88-13.25)	7.26(5.46-9.39)	7.80(4.32-12.23)
1998	7.71(3.81-13.00)	7.33(5.47-9.44)	7.64(4.25-12.07)
1999	7.55(3.73-12.76)	7.36(5.50-9.48)	7.52(4.21-11.81)
2000	7.48(3.71-12.65)	7.40(5.52-9.60)	7.47(4.17-11.84)
2001	7.46(3.74-12.65)	7.44(5.56-9.64)	7.46(4.17-11.83)
2002	7.45(3.75-12.65)	7.52(5.60-9.72)	7.46(4.17-11.95)
2003	7.44(3.77-12.71)	7.60(5.70-9.81)	7.47(4.18-11.93)
2004	7.43(3.77-12.70)	7.64(5.73-9.87)	7.46(4.15-11.99)
2005	7.44(3.77-12.73)	7.71(5.80-9.96)	7.48(4.15-11.94)
2006	7.53(3.79-12.79)	7.87(5.92-10.13)	7.58(4.24-12.09)
2007	7.73(3.92-13.12)	8.15(6.12-10.56)	7.79(4.39-12.48)
2008	7.99(4.11-13.37)	8.48(6.34-10.97)	8.06(4.59-12.76)
2009	8.23(4.28-13.65)	8.78(6.55-11.37)	8.31(4.77-13.02)
2010	8.38(4.37-13.95)	9.00(6.65-11.68)	8.47(4.93-13.22)
2011	8.47(4.45-14.13)	9.19(6.80-12.05)	8.58(5.01-13.37)
2012	8.56(4.49-14.24)	9.32(6.88-12.25)	8.67(5.04-13.38)
2013	8.62(4.56-14.28)	9.34(6.86-12.23)	8.72(5.01-13.56)
2014	8.68(4.55-14.39)	9.34(6.87-12.28)	8.77(5.09-13.72)
2015	8.72(4.61-14.47)	9.36(6.90-12.29)	8.81(5.04-13.77)
2016	8.76(4.66-14.58)	9.38(6.89-12.35)	8.84(5.11-13.77)
2017	8.79(4.67-14.53)	9.38(6.87-12.39)	8.87(5.15-13.83)
2018	8.83(4.69-14.63)	9.39(6.88-12.28)	8.90(5.16-13.90)
2019	8.83(4.68-14.59)	9.39(6.91-12.36)	8.90(5.17-13.87)
2020	8.86(4.71-14.64)	9.23(6.76-12.10)	8.91(5.16-14.16)
2021	8.91(4.75-14.70)	9.26(6.85-12.16)	8.96(5.14-14.09)

Supplementary Table 12. Proportions of liver cancer DALYs attribute to drug use in young adults aged 15- 49 years by sex in China, 1990-2021

Year	Drug use Attribution to DALYs, %		
	Male	Female	Total
1990	0.39(0.04-0.80)	0.98(0.10-2.10)	0.50(0.05-1.03)
1991	0.39(0.04-0.78)	0.98(0.10-2.07)	0.49(0.05-1.00)
1992	0.38(0.04-0.77)	0.97(0.10-2.07)	0.49(0.05-0.99)
1993	0.38(0.04-0.77)	0.97(0.09-2.07)	0.48(0.05-0.99)
1994	0.37(0.04-0.76)	0.98(0.10-2.09)	0.48(0.05-0.99)
1995	0.37(0.04-0.77)	0.99(0.10-2.12)	0.49(0.05-0.99)
1996	0.38(0.04-0.78)	1.02(0.10-2.17)	0.50(0.05-1.03)
1997	0.40(0.04-0.81)	1.06(0.11-2.21)	0.52(0.05-1.06)
1998	0.42(0.04-0.85)	1.12(0.11-2.42)	0.54(0.06-1.12)
1999	0.44(0.05-0.88)	1.17(0.12-2.49)	0.57(0.06-1.15)
2000	0.45(0.05-0.91)	1.21(0.13-2.57)	0.58(0.06-1.19)
2001	0.46(0.05-0.93)	1.23(0.13-2.58)	0.59(0.06-1.20)
2002	0.47(0.05-0.95)	1.25(0.13-2.62)	0.60(0.06-1.22)
2003	0.48(0.05-0.95)	1.27(0.13-2.62)	0.60(0.06-1.21)
2004	0.48(0.05-0.96)	1.28(0.14-2.64)	0.61(0.07-1.21)
2005	0.49(0.05-0.97)	1.30(0.14-2.71)	0.62(0.07-1.22)
2006	0.50(0.05-0.98)	1.32(0.14-2.73)	0.62(0.07-1.23)
2007	0.51(0.05-1.01)	1.35(0.15-2.80)	0.64(0.07-1.26)
2008	0.52(0.05-1.04)	1.39(0.15-2.88)	0.65(0.07-1.30)
2009	0.54(0.06-1.07)	1.43(0.16-2.97)	0.67(0.07-1.31)
2010	0.55(0.06-1.08)	1.48(0.16-3.08)	0.69(0.07-1.37)
2011	0.57(0.06-1.10)	1.52(0.16-3.19)	0.71(0.07-1.43)
2012	0.58(0.06-1.16)	1.56(0.17-3.30)	0.72(0.08-1.48)
2013	0.59(0.06-1.17)	1.58(0.17-3.35)	0.73(0.08-1.50)
2014	0.60(0.06-1.23)	1.61(0.17-3.42)	0.74(0.08-1.53)
2015	0.61(0.07-1.24)	1.63(0.17-3.47)	0.75(0.08-1.54)
2016	0.62(0.07-1.27)	1.65(0.17-3.42)	0.76(0.08-1.56)
2017	0.63(0.07-1.27)	1.67(0.18-3.50)	0.77(0.08-1.52)
2018	0.63(0.07-1.29)	1.70(0.18-3.58)	0.78(0.08-1.57)
2019	0.64(0.07-1.28)	1.72(0.18-3.59)	0.79(0.09-1.58)
2020	0.65(0.07-1.29)	1.70(0.18-3.51)	0.79(0.09-1.60)
2021	0.65(0.07-1.30)	1.66(0.17-3.40)	0.78(0.09-1.61)



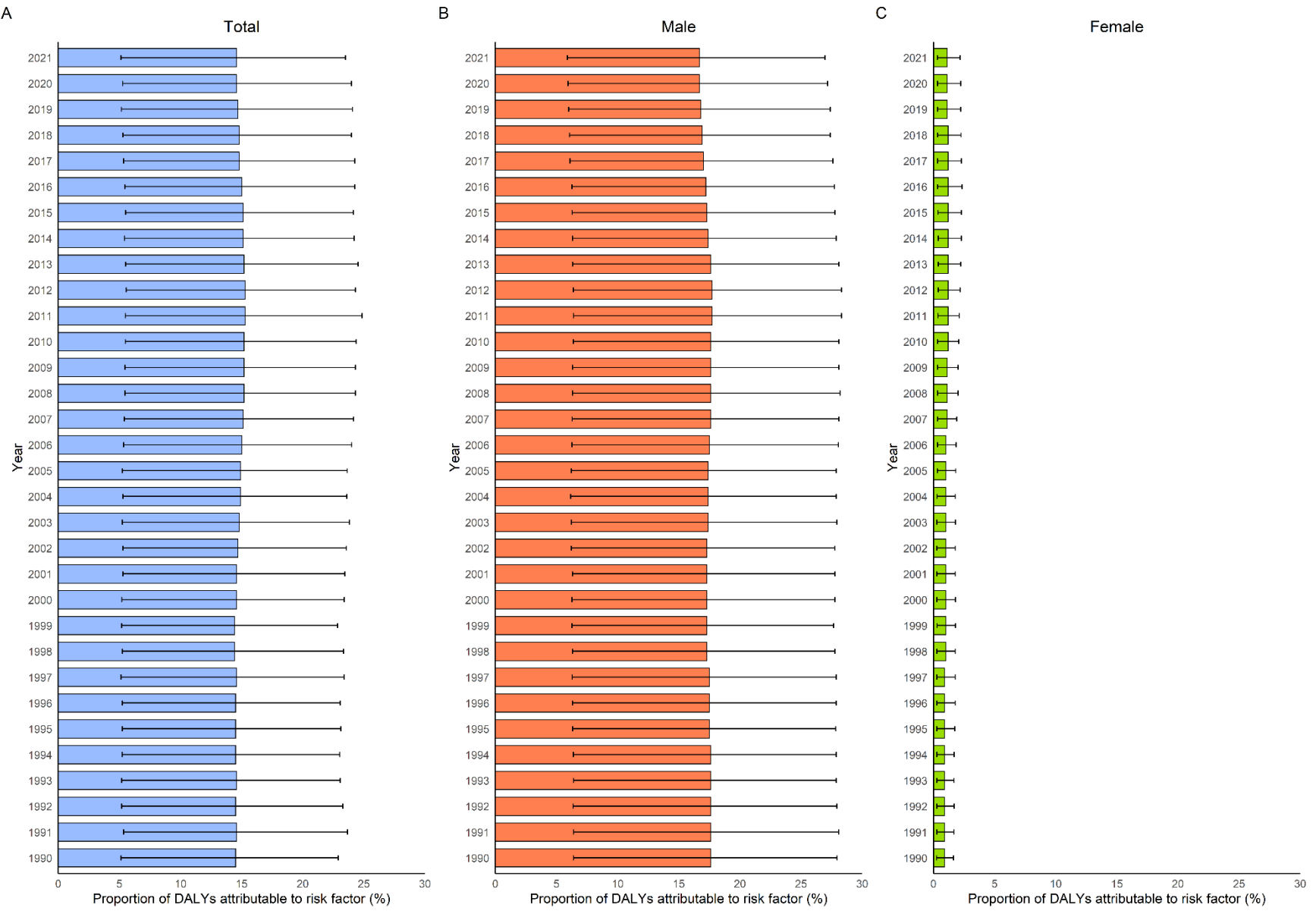
Supplementary Figure 1. Age-period-cohort effects of liver cancer incidence in China by sex, 1990-2021. (A) Longitudinal age curve for male. (B) Longitudinal age curve for female. (C) Local drift curve for male. (D) Local drift curve for female. (E) Period rate ratio (Period RR) curve for male. (F) Period rate ratio (Period RR) curve for female. (G) Cohort rate ratio (Cohort RR) curve for male. (H) Cohort rate ratio (Cohort RR) curve for female.



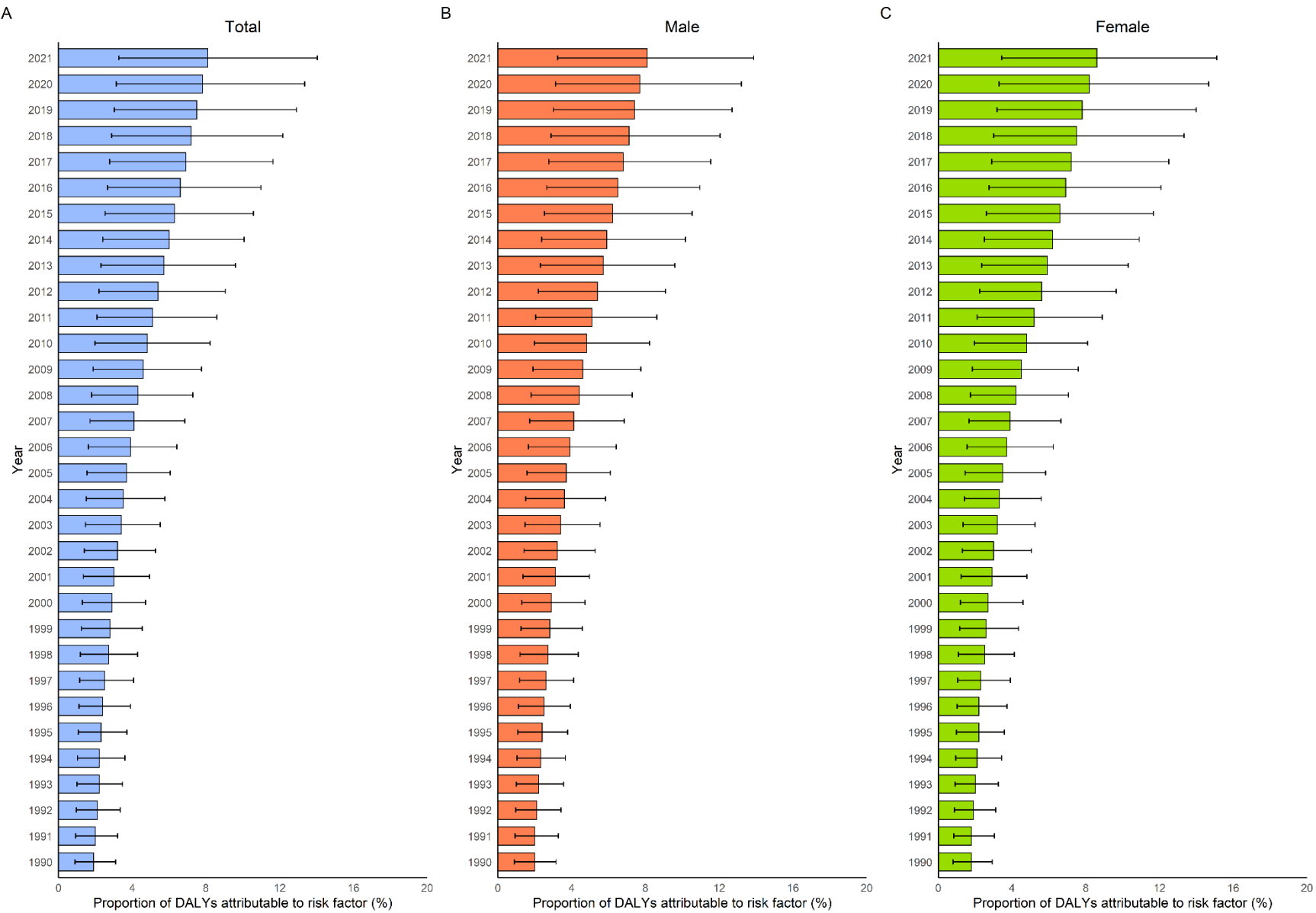
Supplementary Figure 2. Age-period-cohort effects of liver cancer mortality in China by sex, 1990-2021. (A) Longitudinal age curve for male. (B) Longitudinal age curve for female. (C) Local drift curve for male. (D) Local drift curve for female. (E) Period rate ratio (Period RR) curve for male. (F) Period rate ratio (Period RR) curve for female. (G) Cohort rate ratio (Cohort RR) curve for male. (H) Cohort rate ratio (Cohort RR) curve for female.



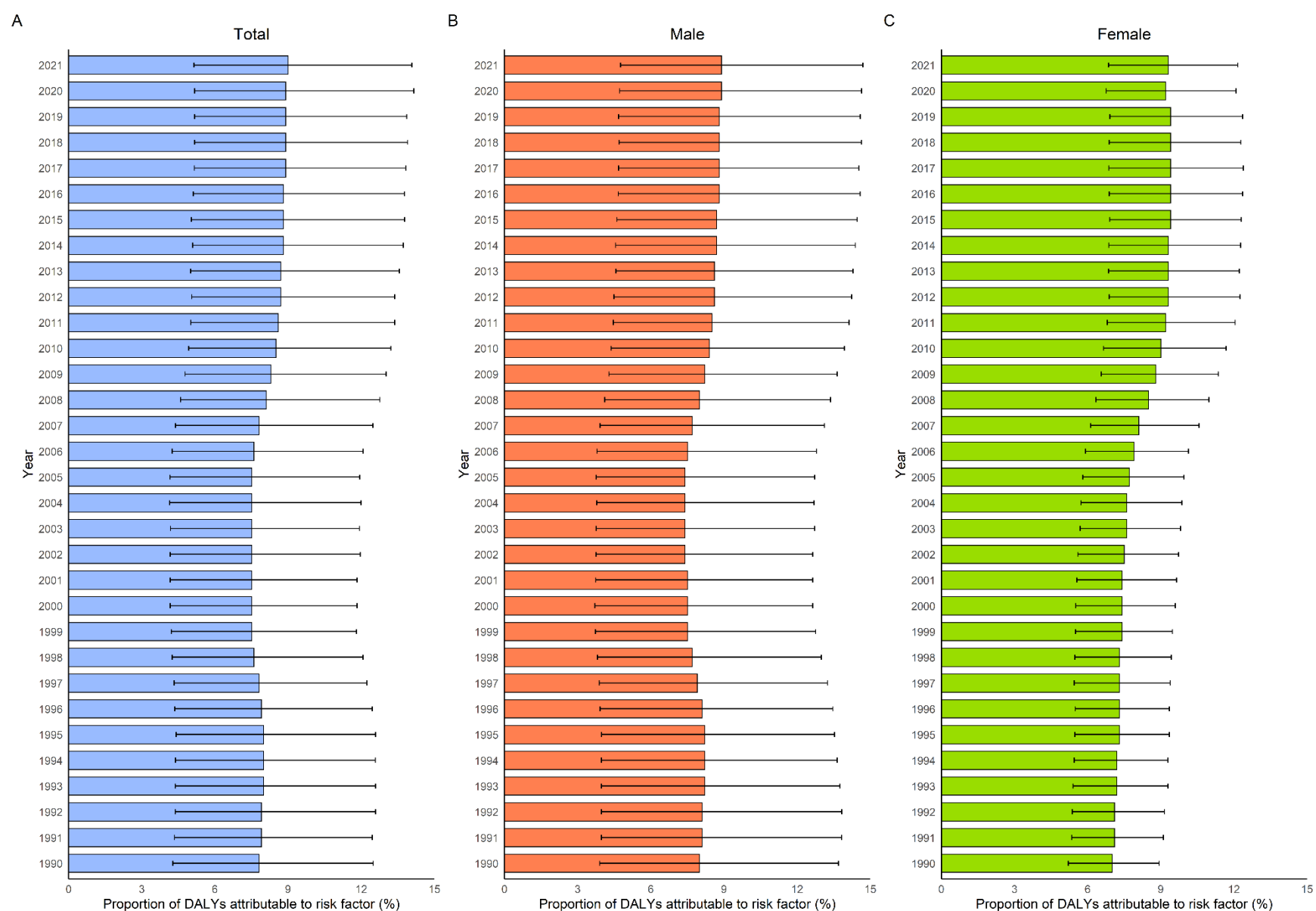
Supplementary Figure 3. Contributions of HBV, HCV, alcohol use, NASH and other causes to absolute liver cancer incident cases by different age groups in China, 1990 to 2021.



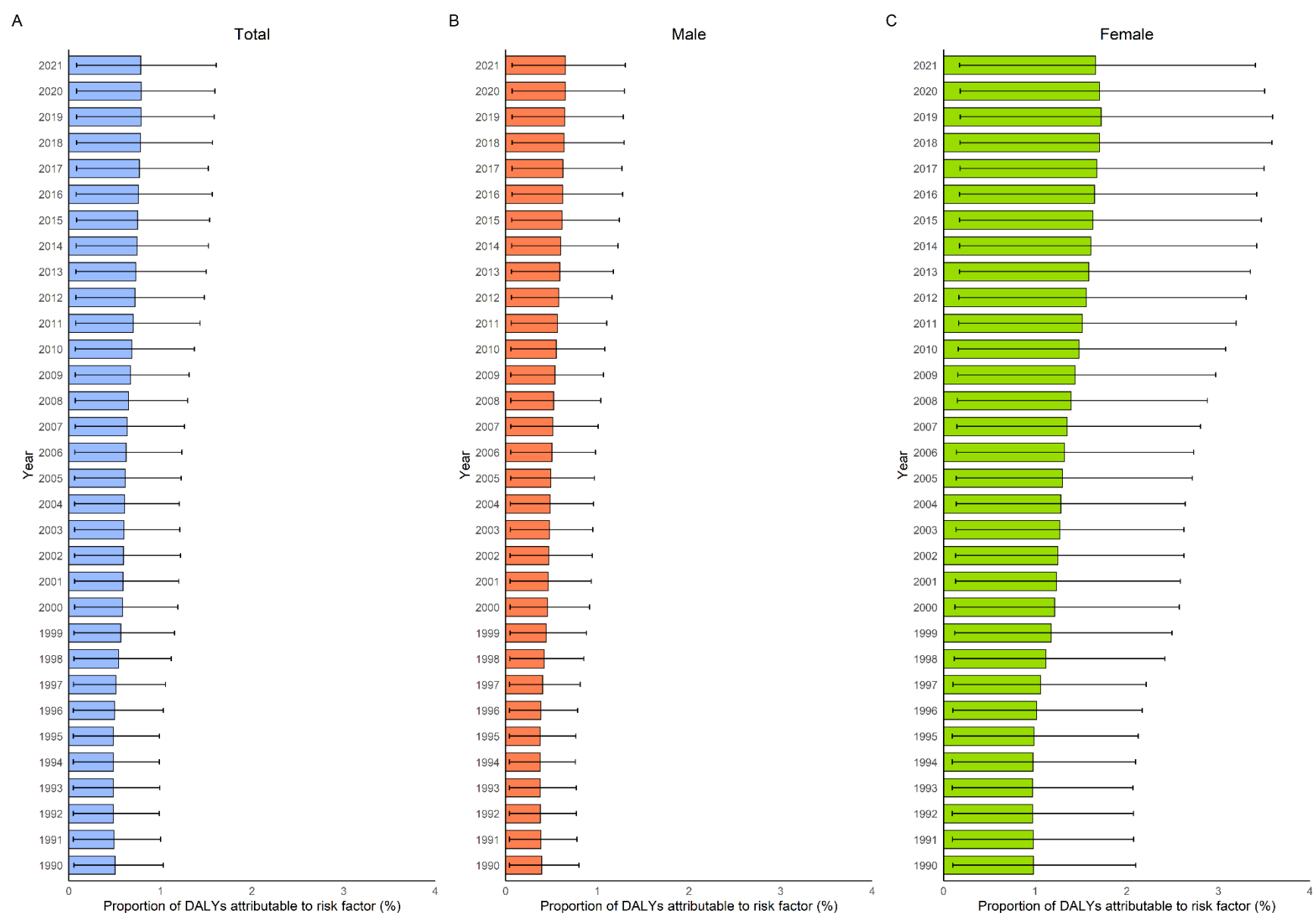
Supplementary Figure 4. Proportions of liver cancer DALYs attributable to smoking by sex in China, 1990-2021. (A) Both sexes. (B) Male. (C) Female.



Supplementary Figure 5. Proportions of liver cancer DALYs attributable to high body-mass index by sex in China, 1990-2021. (A) Both sexes. (B) Male. (C) Female.



Supplementary Figure 6. Proportions of liver cancer DALYs attributable to high alcohol use by sex in China, 1990-2021. (A) Both sexes. (B) Male. (C) Female.



Supplementary Figure 7. Proportions of liver cancer DALYs attributable to high fasting plasma glucose by sex in China, 1990-2021. (A) Both sexes. (B) Male. (C) Female.