Table 2.63. Studies of smoking and breast cancer risk by genetic subtype

NAT2	Cases/Controls	Smoking	Study RR	RR by Genotype				Controlled for
Cohort (Nested case–control)								
Hunter *et al.* (1997)	466/466			**Rapid**	**Slow**			Age at menarche, parity, age at first birth, BMI, family history of breast cancer, history of benign breast disease
		Never	1.0 (ref)	1.0 (ref)	0.8 (0.6–1.3)			
		Former	1.3 (0.9–1.7)	1.2 (0.8–1.9)	1.1 (0.7–1.7)			
		1–14 c/day	1.3 (0.6–2.5)	1.1 (0.4–3.1)	1.1 (0.4–3.0)			
		15+ c/day	1.6 (0.9–2.8)	1.2 (0.5–3.3)	1.5 (0.7–3.2)			
Egan *et al.* (2002)	791/797	**Ever vs. Never**	1.37 (1.12–1.69)	Rapid: 1.24 (0.91–1.70) Slow: 1.50 (1.11–2.02)				State, age, education, age at menarche, parity, age at first birth, benign breast disease, BMI, family history of breast cancer, menopausal status, age at menopause, alcohol
Case–Control								
Ambrosone *et al.* (1996)	304/327	**Pack–yrs**		**Premenopausal**		**Postmenopausal**		Age, education, age at menarche, age at first pregnancy, BMI, family history of breast cancer, age at menopause
		Never						
		≤183						
		184–365						
		>365		*Rapid*	*Slow*	*Rapid*	*Slow*	
				1.0 (ref)	1.0 (ref)	1.0 (ref)	1.0 (ref)	
				1.8 (0.5–6.5)	1.7 (0.5–5.1)	0.4 (0.1–1.6)	0.9 (0.3–3.0)	
				2.5 (0.7–8.6)	0.8 (0.3–2.4)	1.5 (0.5–4.2)	1.1 (0.4–2.7)	
				2.1 (0.5–7.9)	1.2 (0.4–3.8)	0.9 (0.4–2.1)	2.8 (1.4–5.5)	
Millikan *et al. (1998)*	498/473			**Premenopausal**		**Postmenopausal**		Age, race
		Never	1.0 (ref)	*Rapid*	*Slow*	*Rapid*	*Slow*	
		Current	1.0 (0.7–1.4)	1.0 (ref)	1.0 (ref)	1.0 (ref)	1.0 (ref)	
		Former	1.3 (0.9–1.8)	1.1 (0.5–2.3)	0.8 (0.4–1.6)	1.4 (0.7–2.8)	1.1 (0.6–2.2)	
				1.1 (0.6–2.1)	1.0 (0.5–1.9)	1.6 (0.9–2.9)	1.8 (1.0–3.3)	
Morabia *et al.* (2000)	177/170			**Rapid**	**Slow**			Age, education, family history of breast cancer
		Never		1.0 (ref)	1.0 (ref)			
		Ever pass.		1.9 (0.7–4.6)	5.9 (2.0–17.4)			
		Ever active		2.7 (1.1–6.6)	4.2 (1.5–12.0)			
		Former		2.8 (1.05–7.8)	5.2 (1.5–18.0)			
		Curr <20cpd		3.7 (1.05–12.9)	3.1 (0.7–12.7)			
		Curr 20+cpd		1.6 (0.7–6.9)	5.3 (1.4–20.5)			

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Table 2.63. Studies of smoking and breast cancer risk by genetic subtype

NAT2	Cases/ Controls	Smoking	Study RR	RR by Genotype		Controlled for
Delfino *et al*. (2000)	113/278	**Never** **Passive** **Former** **Current**	1.00 (ref) 1.32 (0.69–2.52) 0.94 (0.53–1.68) 0.55 (0.18–1.67)			Age, menopausal status, family history of breast cancer
Krajinovic *et al.* (2001)	149/207	**Ever vs. Never**		Rapid: 2.6 (0.8–8.2)		Age, age at menarche, BMI, family history of cancer, menopause, parity, breast feeding, HRT use, alcohol
Chang-Claude *et al*. (2002)	422/887	**Never A/P** **Pass only** **Current** **Former**		**Rapid** 1.0 (ref) 2.02 (0.99–4.10) 1.12 (0.56–2.22) 1.22 (0.59–2.54) 1.02 (0.49–2.13)	**Slow** 1.0 (ref) 1.19 (0.69–2.07) 1.40 (0.84–2.34) 1.67 (0.97–2.89) 1.16 (0.67–2.03)	Age, parity, breastfeeding, BMI, alcohol, menopausal status
van der Hel *et a*l. (2003)	229/264	**Never** **<15 yrs** **15–30 yrs** **30+ yrs**	1.00 (ref) 1.22 (0.68–2.18) 1.37 (0.86–2.16) 1.55 (0.92–2.61)	**Rapid** 1.00 (ref) 1.22 (0.68–2.18) 1.37 (0.86–2.16) 1.55 (0.92–2.61)	**Slow** 0.97 (0.53–1.80) 1.01 (0.47–2.19) 1.61 (0.84–3.12) 1.66 (0.80–3.44)	Genotype study; didn't do current vs ever; just by duration and dose
Alberg *et al*. (2004)	110/113	**Never** **Former** **Current**	1.0 (ref) 1.1 (0.56–2.1) 0.66 (0.30–1.4)	**Slow** 1.0 (ref) 1.4 (0.59–3.6) 1.3 (0.42–3.7)	**Int/Rapid** 1.0 (ref) 0.77 (0.29–2.1) 0.36 (0.11–1.2)	Family history, passive smoking, age at first birth, age at menarche, BMI
Kocabaş *et al*. (2004)	84/103	**Never** **Active** **Passive**	**Slow vs. Rapid:** 0.66 (0.30–1.42) 0.77 (0.19–3.16) 0.99 (0.30–3.24)			Age at menarche, age at first term pregnancy, BMI
Sillanpää *et al*. (2005)	483/482	**Never A/P** **Only Pass.** **Former** **Current**	1.0 (ref) 0.85 (0.62–1.16) 0.87 (0.56–1.37) 1.34 (0.86–2.09)	**Slow vs. Rapid:** 1.39 (0.91–2.13) 1.22 (0.75–1.98) 1.18 (0.51–2.74) 2.14 (0.93–4.95)		Age, age at menarche, age at first term pregnancy, number of pregnancies, family history of breast cancer, history of benign breast disease, alcohol

Table 2.63. Studies of smoking and breast cancer risk by genetic subtype

NAT2	Cases/Controls	Smoking	Study RR	RR by Genotype				Controlled for
Lilla *et al.* (2005)	419/884			**Rapid**	**Slow**			Age, family history of breast cancer, breastfeeding, BMI, parity, alcohol, menopausal status, education
		Never A/P		1.0 (ref)	1.0 (ref)			
		Pass only		1.95 (0.97–3.91)	1.25 (0.72–2.16)			
		1–10 p–y		0.98 (0.48–1.98)	1.24 (0.72–2.12)			
		11+ p–y		1.22 (0.59–2.54)	1.85 (1.04–3.30)			
van der Hel *et al.* (2005)	676/669			**Rapid**	**Slow**			Age, cohort
		Never	1.00 (ref)	1.0 (ref)	0.85 (0.66–1.08)			
		Former	1.29 (0.81–2.03)	1.25 (0.61–2.56)	1.24 (0.66–2.33)			
		Curr <10cpd	1.01 (0.74–1.36)	0.66 (0.40–1.09)	1.19 (0.78–1.83)			
		10–20 cpd	1.03 (0.77–1.38)	0.92 (0.55–1.52)	0.89 (0.60–1.33)			
		>20 cpd	1.28 (0.83–1.96)	1.31 (0.63–2.70)	1.08 (0.59–1.97)			
Lissowska *et al.* (2006)	2386/2502			**Rapid/intermediate**		**Slow**		Age, site, education, age at menarche, full–term births, age at first term birth, age at menopause, BMI, family breast cancer history, benign biopsy, mammography, OC use, HRT use
		Never A/P	1.00 (ref)	Never: 1.0 (ref)		Never: 0.89 (0.73–1.09)		
		Pass only	1.11 (0.85–1.46)	Ever: 1.04 (0.85–1.29)		Ever: 1.12 (0.92–1.36)		
		Act only	1.23 (0.83–1.83)					
		Act+Pass	1.21 (0.93–1.59)					

NAT1

NAT1	Cases/Controls	Smoking	Study RR	RR by Genotype				Controlled for
Millikan *et al.* (1998)	498/473		See above	*Premenopausal*		*Postmenopausal*		Age, race
				NAT1*10	**NAT1non*10**	**NAT1*10**	**NAT1non*10**	
		Never		1.0 (ref)	1.0 (ref)	1.0 (ref)	1.0 (ref)	
		Current		1.0 (0.5–2.1)	0.9 (0.5–1.8)	1.1 (0.6–2.2)	1.2 (0.6–2.4)	
		Former		1.0 (0.5–1.9)	1.2 (0.6–2.3)	1.8 (1.0–3.1)	1.4 (0.8–2.6)	
Zheng *et al.* (1999)	154/330			**NAT1*3/4 combo**	**NAT1*10/any**	**NAT1*11/any**		Age, family history of breast cancer
		Never	1.0 (ref)	1.0 (ref)	1.2 (0.7–2.0)	2.1 (0.6–6.7)		
		Ever	1.14 (0.84–1.54)	1.1 (0.7–2.0)	1.4 (0.7–2.9)	13.2 (1.5–116.0)		
		Quit >10yrs	1.40 (0.92–2.13)	1.3 (0.6–2.8)	2.2 (0.7–6.6)	N/A		
		≤14cpd <25 yr	0.88 (0.47–1.66)	1.1 (0.4–3.1)	5.0 (0.4–56.2	N/A		
		15+cpd >25 yr	1.07 (0.70–1.63)	0.8 (0.3–1.6)	0.6 (0.2–1.8)	N/A		

Table 2.63. Studies of smoking and breast cancer risk by genetic subtype

NAT2	Cases/ Controls	Smoking	Study RR	RR by Genotype						Controlled for
Millikan *et al.* (2000)	AA: 290/273 White: 199/192	**Never** **Ever**		*African–American* **NAT1*3/4** 1.0 (ref) 1.3 (0.6–3.0)	**NAT1*10** 0.7 (0.4–1.4) 1.0 (0.6–2.0)	**NAT1*11** N/A N/A	*White* **NAT1*3/4** 1.0 (ref) 1.1 (0.7–1.8)	**NAT1*10** 1.0 (0.6–1.6) 1.1 (0.6–1.7)	**NAT1*11** 0.7 (0.2–2.7) 0.3 (0.1–1.7)	Age, family history of breast cancer
Krajinovic *et al.* (2001)	149/207	**Ever vs Never**	See above	NAT1*10: 0.4 (0.1–1.6)						Age, age at menarche, BMI, family history of cancer, menopause, parity, breast feeding, HRT use, alcohol
van der Hel *et al.* (2005)	676/669	**Never** **Former** **Curr <10cpd** **10–20 cpd** **>20 cpd**	See above	**NAT1*10** 1.0 (ref) 1.48 (0.58–3.75) 0.73 (0.41–1.33) 0.94 (0.53–1.69) 1.24 (0.50–3.06)			**Non–NAT1*10** 1.12 (0.85–1.48) 1.40 (0.76–2.56) 1.14 (0.73–1.77) 1.10 (0.72–1.70) 1.54 (0.83–2.86)			Age, cohort

CYP1A1

	Cases/ Controls	Smoking	Study RR	RR by Genotype				Controlled for
Ambrosone *et al.* (1995)	216/282	**Nonsmokers** **<29 pack–yrs** **29+ pack–yrs**		**CYP1A1 W/M vs. W/W (ref):** 1.30 (0.62–2.70) 5.22 (1.16–23.56) 0.86 (0.24–3.09)				Age, age at menarche, age at first pregnancy, age at menopause, BMI, family history of breast cancer
Ishibe *et al.* (1998)	466/466	**Never** **Former** **Current**	1.0 (ref) 1.25 (0.93–1.67) 1.44 (0.90–2.32)	**MspI WT** 1.0 (ref) 1.21 (0.87–1.69) 1.24 (0.75–2.03)	**MspI Variants** 0.89 (0.54–1.46) 1.28 (0.75–2.20) 7.36 (1.39–39.0)	**Exon 7 WT** 1.0 (ref) 1.19 (0.86–1.59) 1.32 (0.78–2.22)	**Exon 7 Variants** 0.66 (0.35–1.26) 1.17 (0.64–2.11) 1.51 (0.55–4.13)	age, menopausal status, HRT use, month of blood return, time and fasting status of DNA collection, BMI, benign breast disease, age at menarche, parity, age at first birth, family history of breast cancer

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Table 2.63. Studies of smoking and breast cancer risk by genetic subtype

NAT2	Cases/ Controls	Smoking	Study RR	RR by Genotype		Controlled for
Li *et al.* (2004)	688/702			**M1/herterozygote**	**WT**	Age, race, sampling fractions
		Never		1.0 (ref)	1.0 (ref)	
		Former		1.7 (1.1–2.8)	1.2 (0.9–1.6)	
		Current		1.1 (0.6–1.8)	0.8 (0.6–1.2)	

GST

GST	Cases/ Controls	Smoking	Study RR	RR by Genotype		Controlled for
Ambrosone *et al.* (1995)	See above			**M1–Present**	**M1–Null**	See above
		Nonsmokers		1.0 (ref)	1.09 (0.61–1.98)	
		<29 pack–yrs		1.0 (ref)	0.82 (0.31–2.16)	
		29+ pack–yrs		1.0 (ref)	1.08 (0.43–2.72)	
Garcia-Closas *et al.* (1999)	466/466	**Never**		**T1–present**	**T1–deleted**	Age, HRT use, time of blood collection, month of blood return
		<20 pack–yrs		1.0 (ref)	0.61 (0.35–1.06)	
		20+ pack–yrs		1.07 (0.75–1.51)	0.81 (0.40–1.64)	
				1.18 (0.84–1.66)	1.47 (0.83–2.63)	

Millikan (2000)	Cases/ Controls	Smoking	**M1 Null**	**M1 Present**	**T1–Null**	**T1–Present**	**P1–Ile/Val or Val/Val**	**P1–Ile/Ile**	Controlled for
	688/633	**Never**	1.0 (ref)	1.0 (ref)	1.0 (ref)	1.0 (ref)	1.0 (ref)	1.0 (ref)	Age, race, menopausal status, age at first term pregnancy/parity, breastfeeding, family history of breast cancer, biopsy, alcohol
		Current	1.2 (0.7–1.9)	0.7 (0.4–1.0)	0.3 (0.1–0.9)	0.9 (0.6–1.3)	0.8 (0.6–1.3)	0.7 (0.4–1.2)	
		Former	1.2 (0.7–1.8)	1.4 (0.9–2.0)	1.5 (0.7–3.0)	1.2 (0.9–1.7)	1.1 (0.8–1.5)	1.7 (1.0–2.7)	

Mitrunen *et al.* (2001a)	Cases/ Controls	Smoking	**M1 Null**	**M3 A/B B/B**	**P1 Ile/Val**	**P1 Val/Val**	**T1 null**	Controlled for
	483/482	**Never** **Ever**	*Premenopausal*					Age, age at menarche, age at first term pregnancy, parity, family history of breast cancer, history of benign breast disease
			1.05 (0.59–1.85)	1.74 (0.90–3.36)	0.74 (0.39–1.39)	0.58 (0.17–1.98)	2.04 (0.90–4.59)	
			0.85 (0.41–1.77)	1.12 (0.43–2.93)	1.01 (0.48–2.16)	1.98 (0.37–10.6)	0.78 (0.24–2.56)	
		Never **Ever**	Postmenopausal					
			1.72 (1.14–2.58)	0.69 (0.43–1.10)	0.96 (0.64–1.45)	0.52 (0.20–1.37)	1.05 (0.59–1.88)	
			0.65 (0.24–1.82)	1.31 (0.49–3.45)	0.37 (0.13–1.09)	0.12 (0.01–1.58)	1.54 (0.41–5.82)	

Zheng *et al.* (2002)	Cases/ Controls	Smoking	Study RR	**M1–A**	**M1–B**	**M1–null**	**T1–positive**	**T1–null**	Controlled for
	338/345	**Never**	1.0 (ref)	1.0 (ref)	1.0 (ref)	1.0 (ref)	1.0 (ref)	1.0 (ref)	Age, BMI, age at first term pregnancy, breastfeeding, family history, menopausal status
		Current	1.0 (0.6–1.6)	0.5 (0.2–1.3)	1.4 (0.3–6.2)	1.5 (0.8–2.9)	1.1 (0.6–1.9)	1.1 (0.4–2.7)	
		Former	1.1 (0.8–1.6)	1.2 (0.7–2.3)	1.0 (0.4–2.7)	1.1 (0.7–1.8)	1.0 (0.7–1.5)	1.3 (0.6–2.6)	

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Table 2.63. Studies of smoking and breast cancer risk by genetic subtype

NAT2	Cases/ Controls	Smoking	Study RR	RR by Genotype				Controlled for
van der Hel *et al.* (2003)	See above		See above	**M1–Present**			**M1–Null**	See above
		Never		1.0 (ref)			1.65 (0.90–3.05)	
		<15 yrs		1.58 (0.67–3.72)			1.70 (0.76–3.82)	
		15–30 yrs		1.57 (0.82–3.01)			2.40 (1.17–4.92)	
		30+ yrs		1.51 (0.67–3.40)			2.53 (1.24–5.16)	
van der Hel *et al.* (2005)	676/669		See above	**M1–Present**	**M1–Null**	**T1–Present**	**T1–Null**	Age, cohort
		Never		1.0 (ref)	1.17 (0.90–1.52)	1.0 (ref)	1.43 (1.07–1.89)	
		Former		0.92 (0.42–2.01)	1.99 (0.99–3.97)	1.10 (0.57–2.11)	2.55 (1.10–5.90)	
		Curr <10cpd		0.94 (0.43–2.05)	0.87 (0.52–1.46)	1.03 (0.68–1.55)	1.02 (0.57–1.82)	
		10–20 cpd		1.08 (0.68–1.72)	1.13 (0.68–1.86)	0.95 (0.61–1.46)	1.29 (0.76–2.20)	
		>20 cpd		0.96 (0.60–1.54)	1.30 (0.60–2.80)	1.97 (0.99–3.94)	1.06 (0.51–2.18)	
NOS3								
Yang *et al.* (2007)	502/505			**GG**	**GT**	**TT**	**GT and TT**	Age, race, BMI, family history of breast cancer, age at menarche, parity, age at menopause, HRT use, fruit and vegetable consumption
		Never		1.0 (ref)	0.65 (0.43–0.97)	0.78 (0.37–1.63)	0.67 (0.45–0.99)	
		Ever		1.0 (ref)	1.49 (0.96–2.31)	2.06 (1.01–4.18)	1.59 (1.05–2.41)	
MPO								
Yang *et al.* (2007)	See above			**GG**	**GA**	**AA**	**GG and AA**	See above
		Never		1.0 (ref)	0.98 (0.65–1.49)	1.65 (0.62–4.37)	1.04 (0.70–1.55)	
		Ever		1.0 (ref)	1.35 (0.85–2.14)	2.84 (0.73–11.1)	1.44 (0.92–2.24)	
MnSOD2								
Mitrunen *et al.* (2001b)	483/482			**Val/Val**	**Val/Ala**	**Ala/Ala**	**Val/Ala or Ala/Ala**	Age
		Never		1.0 (ref)	1.6 (1.0–2.5)	1.2 (0.7–2.1)	1.5 (1.0–2.3)	
		Ever		1.0 (ref)	4.0 (1.4–11.2)	3.2 (0.9–11.0)	3.7 (1.4–9.9)	

Table 2.63. Studies of smoking and breast cancer risk by genetic subtype

NAT2	Cases/ Controls	Smoking	Study RR	RR by Genotype			Controlled for
Millikan *et al.* (2004)	2025/ 1812			**Val/Val or Val/Ala**		**Ala/Ala**	Age, race, family history, age at menarche, age at first term pregnancy/parity, alcohol
		Never A/P		1.0 (ref)		0.8 (0.6–1.2)	
		Passive only		1.0 (0.8–1.3)		1.0 (0.7–1.3)	
		≤10 years		0.9 (0.7–1.3)		0.9 (0.6–1.3)	
		>10 to 20		1.0 (0.8–1.4)		0.8 (0.6–1.4)	
		>20 years		1.2 (0.9–1.5)		1.5 (1.0–2.2)	
Tamimi *et al.* (2004)	968/1205			**Val/Val**	**Val/Ala**	**Ala/Ala**	Age, menopausal status, postmenopausal hormone use, date of blood draw, time of blood draw, fasting status, BMI weight gain, age at menarche, benign breast disease, family history of breast cancer, age at first birth/parity, age at menopause, alcohol
		Never		1.0 (ref)	0.79 (0.58–1.09)	0.84 (0.58–1.20)	
		Former		1.06 (0.74–1.53)	0.94 (0.68–1.29)	0.95 (0.65–1.39)	
		Current		0.41 (0.21–0.81)	0.83 (0.52–1.35)	1.41 (0.77–2.60)	
Gaudet *et al.* (2005)	1034/ 1084	**Never** **Former** **Current**		**Val/Val** 1.0 (ref) 1.02 (0.69–1.51) 1.30 (0.81–2.07)		**Ala carrier** 1.09 (1.10–1.28) 0.97 (0.72–1.31) 1.11 (0.79–1.56)	Age

DNA repair Genes

Nucleotide Excision Repair Genes

Mechanic *et al.* (2006)	2311/ 2022			**African Americans**			Offsets, age, age at menarche, age at first full–term pregnancy/parity composite, family history and alcohol
				0–1 at risk genotype	*2–3 at risk genotypes*	*≥4 at risk genotypes*	
		Never A/P		1.0 (ref)	1.0 (ref)	1.0 (ref)	
		Passive only		0.5 (0.2–1.4)	1.5 (1.0–2.2)	1.6 (0.9–2.9)	
		Former		0.5 (0.2–1.5)	1.8 (1.1–2.9)	2.4 (1.2–4.6)	
		Current		1.2 (0.3–3.9)	0.9 (0.6–1.5)	2.1 (1.0–2.4)	
				White			
				0–1 at risk genotype	*2–3 at risk genotypes*	*≥4 at risk genotypes*	
		Never A/P		1.0 (ref)	1.0 (ref)	1.0 (ref)	
		Passive only		0.7 (0.4–1.3)	0.9 (0.6–1.3)	1.2 (0.7–2.1)	
		Former		1.0 (0.6–1.7)	1.0 (0.7–1.5)	1.2 (0.7–2.0)	
		Current		0.9 (0.5–1.7)	0.7 (0.4–1.0)	0.9 (0.5–1.5)	

Table 2.63. Studies of smoking and breast cancer risk by genetic subtype

NAT2	Cases/Controls	Smoking	Study RR	RR by Genotype						Controlled for
MGMT										
Shen *et al.* (2005b)	1067/1110			**Codon 84**			**Codon 143**			Age
				CC	*CT/TT*		*AA*	*AG/GG*		
		Never		1.0 (ref)	1.1 (0.8–1.4)		1.0 (ref)	1.1 (0.8–1.5)		
		Ever		1.0 (0.8–1.2)	1.0 (0.8–1.4)		1.1 (0.9–1.3)	0.9 (0.7–1.1)		
XRCC1										
Duell *et al.* (2001)	AA: 253/266 White: 386/381			**Codon 399, African Americans**			**Codon 399, Whites**			Age
				Arg/Gln or Gln/Gln	*Arg/Arg*		*Arg/Gln or Gln/Gln*	*Arg/Arg*		
		Never		1.0 (ref)	1.0 (ref)		1.0 (ref)	1.0 (ref)		
		Former		1.4 (0.6–3.2)	2.2 (1.3–3.6)		1.0 (0.7–1.6)	1.1 (0.7–1.9)		
		Current		0.4 (0.2–0.9)	1.4 (0.8–2.4)		0.9 (0.5–1.4)	0.9 (0.5–1.6)		
Patel *et al.* (2005)	502/502			**Codon 194**		**Codon 399**				BMI, age at menopause, age at menarche, alcohol, education, parity, age at first live birth, physical activity, history of breast cysts, family history of breast cancer, HRT use
				Arg/Arg	*Arg/Trp or Trp/Trp*	*Arg/Arg*	*Arg/Gln*	*Gln/Gln*		
		Never		1.0 (ref)	0.78 (0.43–1.40)	1.0 (ref)	0.91 (0.57–1.43)	0.64 (0.33–1.26)		
		Ever		1.0 (ref)	0.47 (0.24–0.94)	1.0 (ref)	1.06 (0.66–1.72)	2.76 (1.36–5.63)		
Shen *et al.* (2005a)	1067/1110	**Never** **Ever**		Did not understand results						
Pachkowski *et al.* (2006)	2077/1818			**Codon 194**		**Codon 280**		**Codon 399**		Age, race, age at menarche, age at first term pregnancy/parity, family history, alcohol
		Never A/P **Passive only** **Former** **Current**								
				Arg/Arg	*Any Trp*	*Arg/Arg*	*Any His*	*Arg/Arg*	*Any Gln*	
				1.0 (ref)	1.0 (ref)	1.0 (ref)	1.0 (ref)	1.0 (ref)	1.0 (ref)	
				1.1 (0.9–1.3)	1.2 (0.7–2.0)	1.0 (0.8–1.2)	2.8 (1.4–5.7)	1.2 (0.9–1.5)	1.2 (0.9–1.3)	
				1.4 (1.1–1.7)	1.0 (0.5–1.7)	1.2 (1.0–1.5)	3.0 (1.4–6.2)	1.5 (1.1–2.0)	1.2 (0.9–1.6)	
				1.0 (0.8–1.2)	0.6 (0.3–1.1)	0.9 (0.7–1.1)	2.0 (0.9–4.6)	1.1 (0.8–1.6)	0.7 (0.5–1.0)	

Table 2.63. Studies of smoking and breast cancer risk by genetic subtype

NAT2	Cases/Controls	Smoking	Study RR	RR by Genotype						Controlled for
Metsola *et al.* (2005)	483/482			**Codon 280**		**Codon 399**				Age, age at menarche, age at first term pregnancy, parity, history of benign breast disease, family history of breast cancer, waist–hip ratio, alcohol
				Arg/Arg	*Arg/His+2His*	*Arg/Arg*	*Arg/Gln*	*Gln/Gln*	*Arg/Gln+Gln/Gln*	
		Never A/P	1.0 (ref)	1.0 (ref)	1.09 (0.6–2.0)	1.0 (ref)	0.8 (0.5–1.3)	0.7 (0.3–1.6)	0.8 (0.5–1.3)	
		Passive only	0.78 (0.58–1.06)	1.0 (ref)	1.11 (0.6–2.1)	1.0 (ref)	1.4 (0.8–2.3)	1.6 (0.6–4.2)	1.4 (0.9–2.3)	
		Ever active	0.91 (0.65–1.28)	1.0 (ref)	1.41 (0.7–3.1)	1.0 (ref)	2.1 (1.2–4.0)	3.3 (1.3–8.6)	2.3 (1.3–4.2)	

XPD

XPD	Cases/Controls	Smoking	Study RR	RR by Genotype						Controlled for
Terry *et al.* (2004)	1053/1102			**AA**		**AC**		**CC**		
		Never		1.0 (ref)		0.89 (0.67–1.19)		0.87 (0.57–1.32)		
		Former		1.0 (ref)		1.56 (1.12–2.16)		1.16 (0.75–1.81)		
		Current		1.0 (ref)		1.25 (0.80–1.97)		1.97 (1.02–3.81)		
Metsola *et al.* (2005)	See above		See above	**Lys/Lys**	**Lys/Gln**	**Gln/Gln**	**Lys/Lys+ Lys/Gln**	**Gln/Gln**		See above
		Never		1.0 (ref)	1.03 (0.63–1.66)	0.78 (0.40–1.49)	1.0 (ref)	0.77 (0.43–1.39)		
		Passive only		1.0 (ref)	1.35 (0.78–2.34)	0.84 (0.41–1.69)	1.0 (ref)	0.70 (0.38–1.29)		
		Active		1.0 (ref)	0.68 (0.35–1.33)	1.96 (0.89–4.32)	1.0 (ref)	2.52 (1.27–5.03)		

XPC

XPC	Cases/Controls	Smoking	Study RR	RR by Genotype		Controlled for
Shore *et al.* (2008)	612/612			**XPC–PAT Wild Type/Heterozygote**	**XPC–PAT Homozygous variant**	Race, age at menarche, ln(BMI), ln(height), family history of breast cancer, parity/age at first birth, history of bilateral oophorectomy
		Never		1.0 (ref)	1.02 (0.62–1.67)	
		Ever		0.85 (0.62–1.16)	1.56 (0.95–2.58)	

IGHMBP2

IGHMBP2	Cases/Controls	Smoking	Study RR	RR by Genotype		Controlled for
Shen *et al.* (2006)	1067/1110			**AA genotype**	**AG+GG genotypes**	Age
		Never		1.0 (ref)	1.1 (0.9–1.4)	
		Current		0.2 (0.9–1.7)	1.1 (0.8–1.5)	
		Former		0.9 (0.7–1.2)	1.1 (0.8–1.4)	

BRCA Carriers

BRCA Carriers	Cases/Controls	Smoking	Study RR	RR by Genotype	Controlled for
Brunet *et al.* (1998)	186/186	**Never**	1.00(ref)		Parity, age at first birth, age at last birth, residence
		Ever	1.54 (0.34–0.84)		

Table 2.63. Studies of smoking and breast cancer risk by genetic subtype

NAT2	Cases/ Controls	Smoking	Study RR	RR by Genotype		Controlled for
Ghadirian et al. (2004)	1097/ 1097	**Never** **Ever**	1.0 (ref) 1.05 (0.88–1.25)			none
Gronwald *et al.* (2006)	591/743	**Never** **Ever**	1.0 (ref) 1.1 (0.8–1.5)			
Colilla *et al.* (2006)	176/140	**Never** **Ever**	1.0 (ref) 0.63 (0.47–0.87)			
BCFR (2008)	195/302 128/179	**Never** **Current** **Former**	1.0 (ref) 1.67 (1.26–2.22) 2.08 (1.41–3.06)	**BRCA1 carriers** 1.0 (ref) 1.44 (0.96–2.17) 2.02 (1.31–3.10)	**BRCA2 carriers** 1.0 (ref) 2.02 (1.37–2.96) 2.35 (1.25–4.43)	Age, site, parity, alcohol, family history of breast or ovarian cancer
Ginsburg *et al.* (2009)	2538/ 2538	**Never** **Ever**	1.0 (ref) 1.02 (0.61–1.15)	**BRCA1 carriers** 1.0 (ref) 1.09 (0.95–1.24)	**BRCA2 carriers** 1.0 (ref) 1.09 (0.95–1.24)	OC use, parity
A–T						
Swift & Lukin (2008)				No RR's; not a case–control		
p53						
Gammon *et al.* (1999)	378/462	**Never** **Former** **Current**		**p53+** 1.00 (ref) 1.66 (1.02–2.70) 1.29 (0.79–2.11)	**p53-** 1.00 (ref) 1.18 (0.77–1.84) 0.66 (0.41–1.06)	Age, race, education, alcohol, BMI, age at first birth, parity, age at menarche, family history, prior breast biopsy, caloric intake, electric blanket/pad use

Table 2.63. Studies of smoking and breast cancer risk by genetic subtype

NAT2	Cases/ Controls	Smoking	Study RR	RR by Genotype				Controlled for
mEH								
de Assis *et al.* (2002)	267/293			**Premenopausal (compared to wild–type)**		**Postmenopausal**		Age, education, age at menarche, age at first pregnancy, BMI, family history of breast cancer, age at menopause
		Never Ever						
				Exon 3 YY: 1.0 (ref) YH/HH: 1.1 (0.5–2.7) YH/HH: 1.5 (0.7–3.3)	*Exon 4* HH: 1.0 (ref) HA/AA: 0.8 (0.3–2.0) HA/AA: 1.6 (0.7–3.7)	*Exon 3* YY: 1.0 (ref) YH/HH: 1.1 (0.6–2.2) YH/HH: 0.8 (0.4–1.5)	*Exon 4* HH: 1.0 (ref) HA/AA: 1.0 (0.5–1.9) HA/AA: 1.0 (0.6–2.0)	
AIB1								
Colilla *et al.* (2006)	176/140	Never Ever	See Above	**No 28 allele** 1.0 (ref) 0.57 (0.35–0.92)		**At least one 28 allele** 0.63 (0.40–1.00) 0.31 (0.25–0.58)		Year of birth, parity, height, menopausal status, OC use, Jewish ancestry
Case–only								
Basham *et al.* (2001)	3821/ 2067	Never <10 pack– yrs 10–19 p–yrs 20+ p–yrs		**Ile462Val** 1.0 (ref) 1.1 (0.7–1.8) 1.6 (1.0–2.7) 0.7 (0.4–1.2)		**Thr461Asp** 1.0 (ref) 1.5 (1.0–2.2) 1.2 (0.8–2.0) 1.0 (0.6–1.6)		
ER/PR								
Yoo *et al.* (1997)	1154/ 21714	Never Ever	1.00 (ref) 1.25 (1.06–1.47)	**ER+** 1.00 (ref) 1.42 (1.04–1.94)	**ER-** 1.00 (ref) 1.33 (0.87–2.02)	**PR+** (ref) 1.73 (1.22–2.45)	**PR-** 1.00 (ref) 1.06 (0.73–1.54)	Age, occupation, family history, age at menarche, menstrual regularity, age at menopause, age at first term pregnancy, number of term pregnancies, average months of breast feeding, alcohol