Attachment 1: Empathy of medical students during the course of training – international study results

Authors	Year	Country	Sample (N)	Design	Measuring instrument	Significant differences in empathy over time	Development trend	Other significant results
Hojat et al. (N)	2004	USA	125	L	JSPE	Study progress correlates negatively with empathy (Begin 3rd SY > End 3rd SY)	--	No significant influence of gender and age
Chen et al. (N)	2007	USA	658	Q	JSPE	Study progress correlates negatively with empathy (1st SY > 4th SY)	--	Empathy: Women > Men, Patient-oriented course > Non-patient-oriented course
Austin et al. (N)	2007	UK	273	Q	JSPE	Preclinic: Women: decrease, Men: increase, later relatively stable	-- / =	Empathy: Women > Men
Hojat et al. (N) (F)	2009	USA	456	L	JSPE	Study progress correlates negatively with empathy (3rd SY > 4th/5th SY)	--	Empathy: Women > Men, Patient-oriented course > Non-patient-oriented course
Kataoka et al. (F)	2009	Japan	400	L	JSPE	Study progress correlates positively with empathy (6th SY > 1st SY)	+	Empathy: Women > Men
Roh et al.	2010	Korea	493	Q	JSPE	Study progress correlates positively with empathy (4th SY > 1st, 2nd, 3rd SY)	+	No significant gender-specific differences
Chen et al.	2010	USA	322	Q	JSPE OSCE	Study progress correlates negatively with empathy (2nd SY > 3rd SY)	-- / +	Study progress correlates positively with observed empathy in the OSCE (3. SY > 2. SY)
Rahimi-Madiseh et al.	2010	Iran	181	Q	JSPE	None	=	No significant gender-specific differences
Magalhães et al. (F)	2011	Portugal	476	Q	JSPE	Study progress correlates positively with empathy (6th SY > 1st SY)	+	Empathy: Women > Men, No significant correlation with course focus
Loureiro et al. (F)	2011	Portugal	81	Q	JSPE	Study progress correlates positively with empathy (over 6 months in 1st SY)	+	Positive correlation: Empathy and participation in the medical psychology course
Gonullu & Oztuna	2012	Turkey	752	L	JSPE	Study progress correlates negatively with empathy	--	Empathy: Women > Men

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Authors	Year	Country	Sample (N)	Design	Measuring instrument	Significant differences in empathy over time	Development trend	Other significant results
Chen et al. (F)	2012	USA	1162	L	JSPE	Study progress correlates negatively with empathy (Preclinic > Clinic)	--	Empathy: Women > Men, Patient-oriented course > Non-patient-oriented course, With high baseline values, lower reduction
Hong et al.	2012	Japan	334	L	JSPE	Study progress correlates positively with empathy (4th SY > 3rd SY > 1st SY)	--	No significant influence of age and gender on empathy, culture-dependent differences
Magalhães et al.	2012	Portugal	350	Q	JSPE NEO-FFI	No information		Positive correlations: Empathy and Big Five (FFM): Agreeableness and openness to experiences, Agreeableness and patient-oriented course
Shariat & Habibi	2013	Iran	1187	Q	JSPE	Study progress correlates negatively with empathy	--	Empathy: Women > Men
Costa et al. (F)	2013	Portugal	77	L	JSPE NEO-FFI	None (latent growth model)	=	Empathy: Women > Men Positive correlations: Empathy and Big Five (FFM): Agreeableness and openness to experiences
Lim et al. (F)	2013	New Zealand	72	L	JSPE	Study progress correlates negatively with empathy (5th SY > 6th SY)	--	Negative correlation: Self-estimate of empathy and rating by fellow students
Wen et al. (F)	2013	China	820	Q	JSPE	Study progress correlates positively with empathy (4th SY > 3rd SY > 2nd SY > 1st SY)	+	Empathy: Women > Men, American students > Chinese students > Iranian and Japanese students
Hasan et al.	2013	Kuwait	264	Q	JSPE	Study progress correlates negatively with empathy	--	Empathy: Women > Men
Hegazi & Wilson (F)	2013	Australia	404	Q	JSPE	None	=	Empathy: Women > Men, Highest among students with additional courses in personal and professional development
Shashikumar et al.	2014	India	488	Q	JSPE	Study progress correlates negatively with empathy (1st – 3rd SY > 4th SY)	--	Empathy: Women > Men, No significant correlation between empathy and course focus

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Youssef et al. (F)	2014	Trinidad and Tobago	699	Q	JSPE TEQ RMET	JSPE / TEQ: Study progress correlates negatively with empathy (1st SY > 5th SY, Downward trend highest in the 3rd SY), RMET: stable (1st SY = 5th SY)	--	Empathy: Women > Men, Significant correlations: JSPE - TEQ No significant correlations: JSPE -- RMET
Park et al.	2015	Korea	5343	Q	JSPE	Study progress correlates negatively with empathy (very small effect strength)	--	Empathy: Women > Men, Western students > Korean students
Santos et al.	2016	Brasil	320	Q	JSPE	None	=	Empathy: Women > Men; Patient-oriented course > Non-patient-oriented course
Papageorgiou et al.	2018	UK	333	L	JSPE	Reduction up to 3rd SY, then renewed increase, but lower values than at start of training	--	Affective empathy: Women > Men, Positive correlations with age
O'Tuathaigh et al.	2019	Ireland	241	Q	JSPE NEO-FFI	None (1st SY = final SY)	=	No significant correlation between empathy and course focus, No significant gender-specific differences Positive correlations: Empathy and Big Five (FFM): Agreeableness and openness to experiences,
Thomas et al. (N)	2007	UK	545	Q	IRI (EC and PT) QoL	None	=	Empathy: Women > Men, Medical students compared to age-matched control group: EC and PT higher, Negative correlations between empathy and burnout (increasing depersonalisation gender-independent with decreased PT and EC, increasing emotional exhaustion with low EC in men, trend toward correlation in women), Positive correlations empathy and well-being (quality of life)
Stratton et al. (N) (C)	2008	USA	64	L	IRI TMMS	Slight fluctuations: EC decreases, PD increases (small effect strengths)	-- / =	No significant gender-specific differences, Significant decrease in TMMS-dimensions: Attention to feelings and mood repair

Authors	Year	Country	Sample (N)	Design	Measuring instrument	Significant differences in empathy over time	Development trend	Other significant results
Quince et al. (F)	2011	UK	1653	L	IRI	PT stable; EC: Men: 1st/2nd SY > 4th/5th SY, (small effect strength)	**= / --**	Empathy: Women > Men
Lourinho & Severo	2013	Portugal	65		IRI Neo-FFI	No information, Single measurement at start of training		Positive correlations: Empathy and Big Five (FFM): Agreeableness and openness to experiences, PD - Neuroticism / Extraversion, PT - Conscientiousness
Rau et al.	2013	Germany	2277	Q	SPF / IRI	None (VK = K = PJ)	**=**	Empathy: Women > Men (lowest difference in PT), Age correlates negatively with PT and FS, FS, PD*:* Medical students < Norm sample, EC*:* Medical students > Norm sample
Handford et al. (F)	2013	Australia	100	Q	IRI EQ-60 RMET	None	**=**	Empathy : Correlations with age, not with SY: Positive: EC, Negative: PD / FS, Positive correlations with Big Five (FFM): EC - Extraversion, PD / FS - Neuroticism
Paro et al.	2014	Brasil	1350	Q	IRI WHOQOL MBI	Relatively stable, low negative correlation	**=**	Gender-specific differences*:* EC and PD: Women > Men; PT*:* Women = Men, PT *a*nd Gender significant predictors for EC, Correlations Personal accomplishment (MBI): positive with EC and PT, negative with PD, Burnout in all SY (highest at the end of training)
Bratek et al.	2015	Poland	509	Q	IRI	Relatively stable, Women: PT: 6th SY > 1st SY	**= / +**	Empathy: Women > Men, PD: Women = Men, Negative correlations: FS - Age and semester, PD – Age, No significant associations with relationship status and parenthood
van Ryn et al.	2014	USA	4732	Q	IRI JSPE	No information Single measurement at start of training		Attitude toward clinical empathy: Positive correlation with empathy, Further correlations with sociopolitical attitudes, well-being and self-concept

Authors	Year	Country	Sample (N)	Design	Measuring instrument	Significant differences in empathy over time	Development trend	Other significant results
Toto et al. (F)	2015	USA	460	Q	IRI NEO-FFI	1st – 3rd SY stable 4th SY > 1st – 3rd SY	+	Empathy: Women > Men, Correlation between PT and EC, Positive correlations PT/ EC and Big Five (FFM): Agreeableness and openness to experiences
Krogmann	2018	Germany	240	Q	SPF / IRI NEO-FFI	Study progress correlates negatively with empathy	-	Empathy: Women > Men (smallest difference in PT), Age correlates negatively with FS, E, EC, PD: Medical students < Control group Positive correlations empathy and Big Five (FFM): Agreeableness and openness to experiences
Seitz et al.	2017	Austria	77	Q	Qualitativ; Pilot-fragebogen	Study progress correlates negatively with intention to show empathy	--	No gender-specific difference in the intention to show empathy
Seitz et al.	2018	Austria	132	Q	GISEB NEO-FFI	Study progress correlates negatively with intention to show empathy (2nd SY > 4th SY)	--	No gender-specific difference and no significant influence of personality traits (Big Five) with respect to the intention to show empathy
Triffaux et al.	2019	Belgium	1353	Q	BES	Study progress correlates negatively with empathy	--	Affective empathy: Women > Men; Cognitive empathy: Women = Men, Empathy at start of training: Medical students > Control group (Economics students)
Colliver et al.	2010	USA		R*	JSPE (4) IRI (1) BEES (2)	Little or no change	=	The contradictory results of the studies reviewed (reduction in empathy) are explained as response bias: in part marked reduction in the response rate
Neumann et al.	2011	USA (8), UK (2), Poland (1)		R**	JSPE IRI BEES	1 Q: stable values otherwise: study progress correlates negatively with empathy (3rd SY > 1st patient contact)	= /--	Empathy: Reduction related to increased PD, Patient-oriented course > Non-patient-oriented course, No consistent results with respect to gender-specific differences
Roff	2015	International[1]		LR L / Q	JSPE	Non (latent growth model)	=	No information

Authors	Year	Country	Sample (N)	Design	Measuring instrument	Significant differences in empathy over time	Development trend	Other significant results
Ferreira-Valente et al.	2017	International²		R***	JSPE / IRI TEQ / EQ-60 RMET	No consistent trends: Q: Stable or increase L: Fluctuations or reduction	**+** **--** **=**	No clear relationship between study results, research design and country, Mostly small effect strengths (16 studies)

Note. (C): in Colliver et al. 2010, (N): in Neumann et al. 2011, (F): in Ferreira-Valente et al. 2017, Q:.Cross-sectional study, L: Longitudinal study, R*: Review: 7 Studies 2000-2008 (3 cross-sectional, 4 longitudinal), R**: Review: 11 Studies 1990-2010 (8 cross-sectional, 3 longitudinal), R***: Scoping Review: 20 Studies 2009-2016 (13 cross-sectional, 8 longitudinal), LR: Literature search, SY: Study Year, VK: Preclinical training phase (1st-3rd SY), K: Clinical training phase (4th-5th SY), PJ: Practical year, OSCE: Objective structured clinical examination**,** IRI: Interpersonal Reactivity Index, JSPE: Jefferson Scale of Physician Empathy, SPF: Saarbrücker Personality Questionnaire, MBI: Maslach Burnout Inventory, WHOQOL: World Health Organization Quality of Life, BEES: Balanced Emotional Empathy Scale, BES: Basic Empathy Scale, NEO-FFI: NEO-Five-Factor-Inventoryr, FFM: Five-Factor Model of Personality, GISEB: General Intention to Show Empathic Behavior, TMMS: Trait Meta-Mood Scale (emotional intelligence measure), QqL: Quality of Life (various measuring tools), EQ-60: Empathy Quotient Questionnaire, TEQ; Toronto Empathy Questionnaire, RMET: Reading the Mind-in-the Eyes Test, E: Total Empathy-Score, EC: Empathic concern, FS: Fantasy scale, PT: Perspective taking, PD: Personal distress, international¹: Japan, South Korea, China, Kuwait, India, Iran, UK, USA, Australia, Brasil, Portugal, Columbia, Dominican Republic, International²: USA, UK, Poland, Portugal, Spain, Australia, Japan, New Zealand, Brasil, China, Venezuela, Trinidad and Tobago, Dominican Republic.