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Paternal or maternal history of cardiovascular disease and the risk of cardiovascular disease in offspring. A systematic review and meta-analysis

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ABSTRACT

Background: Parental history of cardiovascular disease (CVD) is an established risk factor for the development of CVD in offspring. Several studies have suggested that a maternal transmission of CVD is more important for the development of CVD than paternal transmission.
Methods: A systematic search and meta-analysis were conducted, using the Medline and Embase databases. Included were cohort, case–control and cross-sectional studies (n = 26) focusing on the relation between paternal and maternal histories of cardiovascular disease and offspring CVD (myocardial infarction, stroke or cardiovascular mortality). The pooled estimates were calculated using a random-effects model.
Results: The pooled OR of CVD in offspring having a positive paternal history of CVD compared to not having a positive parental history was 1.91 (95% CI 1.56–2.34; $I^2$53%), the RR1.54 (95% CI 1.33–1.77; $I^2$96%). The OR of a maternal history was 2.16 (95% CI 1.71–2.74; $I^2$50%), RR1.59 (95% CI 1.38–1.84; $I^2$90%). Regarding different age limits, a maternal history <50 years (3.15, 95% CI 2.18–4.55) and paternal history <55 years (2.82, 95% CI 2.25–3.54) were associated with the highest cardiovascular risk. Additional analyses for sons demonstrated an estimate for a positive paternal history of 1.55 (95% CI 1.39–1.71; $I^2$74%) and 1.56 (95% CI 1.46–1.67; $I^2$16%) for maternal history. For daughters, the estimate for paternal history was 1.48 (95% CI 1.26–1.74; $I^2$73%) and 1.79 (95% CI 1.50–2.13; $I^2$68%) for maternal history .
Conclusions: The conferred risk of CVD in offspring was not substantially different between positive paternal and maternal histories of CVD, the highest risk was observed for maternal history <50 years. Since a positive parental history of CVD involves an increased cardiovascular risk, parental history inquiry is useful in clinical practice. No distinction has to be made whether the affected parent is the mother or the father.

1. Introduction

Parental history of cardiovascular disease is a risk factor for the development of cardiovascular events, with reported relative risks ranging from 1.2 to 7.2 [1–6]. In clinical practice, assessing parental history of cardiovascular disease is an integral part of a patient's history, which may provide valuable information regarding the risk of cardiovascular disease in patients. In addition, several widely used cardiovascular risk prediction scores, such as the Reynolds Risk Score and the PROCAM, have incorporated parental history of myocardial infarction [7–9]. However, no distinction is made between the sex of the affected parent, while several studies suggest that maternal history of cardiovascular disease confers a higher cardiovascular risk in their offspring than a paternal history of cardiovascular disease [3,10–12] (e.g. 7.2 for maternal history and 3.4 for paternal history [6]). Not all studies though found a difference between paternal and maternal histories [13,14] and some even attributed a higher risk to paternal history [15,16]. The lower age-specific incidence causes cardiovascular disease in women to be less common, which may reduce the power of demonstrating a differential risk of paternal and maternal transmissions. In addition it is possible that cardiovascular events in mothers occur after the assessment of a paternal or maternal history of cardiovascular disease in offspring which may lead to misclassification of a maternal history. An increased risk for maternal transmission of diabetes mellitus type 2 compared to paternal transmission has also been described [17].

To evaluate whether paternal and maternal histories confer different risks of cardiovascular disease in offspring, we conducted a systematic review and summarized the results in a meta-analysis.

2. Methods

2.1. Search strategy

One investigator (M.W.) identified articles through a systematic search of the Medline (PubMed) and Embase databases up to 7 July 2014 using the following or similar search

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terms: parental history and cardiovascular events (full search string is provided in Supplemental table 1). The references of the retrieved articles were scanned manually. If the full text was unavailable, the authors were contacted by email.

2.2. Study selection

Studies were considered eligible if authors reported data from original peer-reviewed studies, if parental history was a specific determinant of the study, if a clear distinction was made between paternal and maternal histories of cardiovascular disease in the reporting of results and if the outcome consisted of cardiovascular events. Articles which provided insufficient data for the analyses were excluded.

2.3. Data extraction and quality assessment

One author (M.W.) extracted the data and two other authors (F.V. and Y.G.) independently extracted the data from the relevant studies. Discrepancies between the authors were discussed and resolved. From each included study the following information was extracted: first author surname, year of publication, country, study design, population, gender distribution, follow-up years, mean age or age range, number of cardiovascular events, number of participants, definition exposure, definition outcome, all reported risk estimates and their measures of precision (e.g. standard error or confidence intervals) and the number and type of confounders included in the analyses (Table 1 and Supplemental table 2). Studies using the same study population for different outcomes and definitions of parental history, were both included. Studies were included if they reported on one or a combination of the following outcomes: coronary artery disease, cerebrovascular disease or cardiovascular death.

The methodological quality of each included study was evaluated using the Newcastle–Ottawa quality assessment scales (NOS) for cohort, case–control and cross-sectional studies [18]. These scales comprised standard criteria assessing the risk of bias using four main themes: selection, comparability, exposure and outcome. A summary score can be calculated ranging from 0 to 9 points with higher scores indicating to lower risk of bias.

2.4. Data analysis

The comparator of having a paternal history or maternal history of cardiovascular disease in the different studies was not having a paternal or maternal history of cardiovascular disease or not having a parental history of cardiovascular disease. The summary relative risks and odds ratios were calculated using the generic inverse variance method and using the random-effects model of DerSimonian-Laird [19] to incorporate heterogeneity in results between studies. If studies reported results for several age limits of parental history, the results of the highest age limit of parental history were used. A mixture of regression techniques can be used in longitudinal association studies (e.g. logistic regression, Cox or parametric survival models, Poisson regression) leading to different types of effect measures including odds ratios (OR), hazard ratios (HR), and relative risks (RR). Because the rare disease assumption might not hold, the odds ratios were first displayed separately from the other effect estimates (rate ratios and hazard ratios) for the main analyses and pooled afterwards.

Different adjustments for potential confounders were performed across the included studies. The pooled effect estimates of two types of models were presented: a model with

Table 1
Characteristics of the included studies.

Author/year/country	Study design	Population	Men (%)	Follow-up years	Mean age/age distribution	Definition exposure	Outcome	#Events/ #participants
Colditz/1986/USA	Cohort	Nurses' Health Study	0	141,982 py	30–55	MI	Nonfatal MI	132/117,156
Schildkraut/1989/USA	Cohort	Framingham Study (original)	Not stated	Not stated	46	Coronary heart disease	Coronary heart disease	988/3933
Colditz/1991/USA	Cohort	Health Professionals Follow-up Study	100	72,454 py	40–75	MI	MI or sudden death	370/45,317
Kiely/1993/USA	Cohort	Framingham Study (original)	Not stated	16	36	Death due stroke	Stroke or TIA	604/4933
Wannamethee/1996/UK	Cohort	British Regional Heart study	100	15	40–59	Fatal stroke	Stroke	278/7683
Jousilahti/1996/Finland	Cohort	Eastern Finland	49	12	43	Premature CHD	Nonfatal MI or coronary death	1046/15,620
Jousilahti/1997/Finland	Cohort	Eastern Finland	49	149,896 py	25–64	Stroke	Stroke	453/14,371
Sesso/2001/USA	Cohort	Physicians' & Women's Health Study	36	13 & 6	53	MI	Cardiovascular events	3217/61,947
Kinra/2003/UK	Cohort	University of Glasgow	100	43	21	Coronary heart disease	Fatal coronary heart disease	373/8402
Lloyd-Jones/2004/USA	Cohort	Framingham Study (offspring)	49	8	44	Cardiovascular events	Cardiovascular events	243/2302
Nilsson/2004/Sweden	Cohort	Malmo Preventive project	67	Not stated	47	Cardiovascular mortality	Cardiovascular events	2677/33,346
Sundquist/2006/Sweden	Cohort	The Multigeneration Register	Not stated	192.7 million py	Not stated	Coronary heart disease	Coronary heart disease	76575/?
Seshadri/2010/USA	Cohort	Framingham Study (offspring)	47	77,534 py	48	Stroke	Stroke	128/3443
van Dis/2011/ The Netherlands	Cohort	MORGEN-project	46	10	40–65	MI and stroke	MI, unstable angina, ischemic stroke	914/10,524
Eguchi/2012/Japan	Cohort	Japan Collaborative Cohort Study	42	15.9	57	Stroke	Stroke-related mortality	1502/53,691
Nielsen/2013/Denmark	Cohort	Danish registries	Not stated	Not stated	Not stated	MI	MI	?/248,490
Roncaglioni/1992/Italy	Case–control	GISSI-2 trial	89	NA	56	MI	MI	916/2022
Castro-Beiras/1993/Spain	Case–control	Spain	80	NA	57	Coronary heart disease	Coronary heart disease	106/212
Ciruzzi/1997/Argentinia	Case–control	Various clinical centers in Argentina	74	NA	60	CAD	MI	1060/2031
Friedlander/2001 /USA	Case–control	Western Washington State	0	NA	38	MI	MI	107/633
Bertuzzi/2003/Italy	Case–control	Milan area, northern Italy	69	NA	60	Ischemic heart disease	First nonfatal AMI	507/985
MacClellan/2006/USA	Case–control	SPYW Study	0	NA	39	Stroke	Stroke	487/1102
Choi/2009/Korea	Case–control	Jeju National University Hospital	57	NA	70	Stroke	Ischemic stroke	400/800
Siegerink/2012/ The Netherlands	Case–control	RATIO study	0	NA	39	MI and stroke	MI or ischemic stroke	451/1376
Liao/1997/USA	Cross-sectional	Family Heart Study	50	NA	60	Stroke	Stroke	105/3144
Brown/2002/USA	Cross-sectional	NHANES IIII	49	NA	39	MI	MI	237/11,307