Accuracy and Effectiveness of Mammography versus Mammography and Tomosynthesis for Population-Based Breast Cancer Screening: A Systematic Review and Meta-Analysis

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CENTRAL-COCHRANE

#1	tomosynthesis	49
#2	digital breast tomosynthesis	35
#3	breast tomosynthesis, digital 34	3
#4	3d mammography	16
#5	3-d mammography	4
#6	x ray breast tomosynthesis	12
#7	x- ray breast tomosynthesis	12
#8	Digital breast tomosynthesis	35
#9	MeSH descriptor: [Mammography] explode all trees	1045
#10	3D-Mammographies	0
#11	#1 or #2 or #3 or #4 or #5 or #6 or #7 or #8 or #9	1093

Table X. Characteristics of the included studies

Author/Year	Country	Study Design	Time of Study	Index Test	Comparison	DBT Manufacture	Number Radiologists Single/Double reading (sequentially / independently)	Inclusion/ Exclusion Criteria	Years Old (Included Women)	Differences between Family and Personal Background	Recall Criteria
Hofvind 2019 (To-Be)	Norway	RCT	Jan 2016 to Dec 2017	DBT and SM	DM alone	GE Healthcare (Chicago, IL, USA; SenoClaire 3D)	08 Double (independently)	Women who attend Breast Screen Norway with a complete screening exam and signed an informed consent/ No consent to participate, breast implants, breast cancer diagnosed before date of screening, metastatic melanoma, symptoms of breast cancer at the screening examination	50 to 69	-	A score of 2 or higher to one or both breasts (probably benign, intermediate suspicion; probably malignant; high suspicion of malignancy), there was a consensus meeting for further assessment
Pattacini 2018 (RETomo Study)	Northern Italy	RCT	Mar 2014 to Mar 2016	DBT and DM	DM alone	GE Senographe Essential digital systems (GE Healthcare, Buc, France)	02 Double	Women attending screening in one of three clinics equipped with DBT and who had already participated in at least one round of the Reggio Emilia screening program/Women with previous breast cancer, prior DBT, and ascertained genetic risk for breast cancer	45 to 70	Age was balanced (mean age was 56.2 years versus 56.3 years)	Proportion of women recalled for further assessment (after double reading and arbitration)
Houssami 2019	Maroondah BreastScreen (Australia)	Quasi-randomized pilot trial	Aug 2017 to Nov 2018	DBT and SM		Selenia; Dimensions 8000, with C-View 2D software, Hologic.	07 Double (independently)	Women who attend a routine biennial screening as part of the BreastScreen Victoria program/ Women who reported symptoms of breast cancer (sub analysis)	50 to 74	No significance difference for family and personal history of breast cancer	Need for further assessment in accordance with National Accreditation Standards of BreastScreen Australia
Hofvind 2018	Norway	Prospective Cohort	Feb 2014 to Jan 2016	DBT and SM	DM alone	Dimension; Hologic , (Beldfor, Mass)	16 Double (independently)	All Norwegian women aged 50–69 years to undergo biennial mammographic screening, with a stated time and place for the examination	50 to 69	-	BIRADS classification, consensus or arbitration meeting was held to determine the recall
Bernardi 2016 (STORM – 2)	Italy	DAT	May 2013 to May 2015	DBT, DM and SM	DM alone	Selenia Dimensions 2D/3D (Hologic)	07 Double (sequencially)	Asymptomatic women aged 49 years or older attending for biennial screening mammography provided to women at standard (population) risk for breast cancer	58 (53-63)	NA	A screen was classified as positive and the woman recalled to assessment for further investigations if recalled by either screen reader in either of the double-reading strategies based on recall at any screen-reading phase
Ciatto 2013 (STORM)	Ittaly	DAT	Aug 2011 to Aug 2012	DBT and DM	DM alone	Selenia Dimensions 2D/3D (Hologic)	08 Double (sequencially)	Asymptomatic women aged 49 years or older attending for biennial screening mammography provided to women at standard (population) risk for breast cancer	58 (48-71)	NA	Same as STORM – 2
Lang 2016 (MBTST)	Sweden	DAT	Jan 2010 to Dec 2012	DBT and DM	DM alone	Mammomat Inspiration (Siemens)	06 Single DBT, Double DM (independently)	All women aged 40–74 years are included in the Swedish breast cancer screening Programme. The exclusion criteria were pregnancy and women not speaking Swedish or English	56 (40-76)	NA	If one or both of the screening modalities was given a score of 3 or higher by one of the two readers (BI-RADS), it was referred for arbitration, where at least two readers re-evaluated the images and decided whether to recall the woman for further work-up.

Martin 2018	Spain	DAT	Jan 2015 to Dec 2016	DBT and SM	DM alone	Dimensions; Hologic; Bedford, A, USA and C view 2D software	05 Single	Women aged 50 to 69 years are invited to undergo routine biennial screening mammography	50 to 69	NA	Women were recalled for diagnostic work up if one or both readers consider the mammography as suspicious for malignancy
Skaane 2013	Norway	DAT	Nov 2010 to Dec 2011	DBT, DM and SM	DM alone	Dimension; Hologic , (Beldfor, Mass)	08 Double	Women (age range, 50–69 years) were invited to undergo routine, biennial, two-view (craniocaudal and mediolateral oblique) screening mammography during study period	50 a 69	NA	To receive a score ≥ 2 (Scale Used to Score Breasts and Cases), or after arbitration
Zervoudis 2013	Greece	DTA	2010 to 2012	DBT and DM	DM alone	Selenia BT device/FFDM (Hologic)	-	-	57 (34 a 85)	NA	Biopsy indication
Alsheik 2019	USA	Retrospective Cohort	Jun 2015 to Sep 2017	DBT and DM	DM alone	Hologic Selenia Dimensions / Siemens MAMMOMAT Inspiration	-	Women who underwent screening mammograms (DBT or DM) during the study period/Previous diagnosis of breast cancer, previous breast augmentation, or for lack of clinical information during the screening encounter	40 to 79	Women with dense breasts and higher calculated risk were more likely to be screened with DBT	BI-RADS 0, 3, 4 and 5; additional imaging needed
Cohen 2018	USA	Retrospective Cohort	Feb 2011 to Jun 2014	DBT and DM	DM alone	Selenia, Hologic	12 Single	Patients without at least 24 months of routine mammographic follow-up after the screening were excluded	40 to 70	The DBT group had a significantly higher personal and family history of breast cancer and a larger number of women with hyperdense breasts	Biopsy indication
Conant 2016	USA	Retrospective Cohort	2011 to 2014	DBT and DM	DM alone	Selenia Dimensions (Hologic)	14 -	All bilateral exams with an indication of screening and no other breast imaging within 3 months prior, among women 40–74 years of age with no known history of prior breast cancer	40 to 74 anos	DBT exams were more likely in women 40–49 years of age, among non-Hispanic black women, and among women with heterogeneously or extremely dense breasts	BI-RADS assessment category 0, 3, 4, or 5. Any biopsy occurring after screening, regardless of the BI-RADS assessment category of the exam.
Destounis 2014	USA	Retrospective Cohort	Jun 2011 to Dec 2011	DBT and DM	DM alone	Selenia Dimensions (Hologic)/Senographe Essential (GE Healthcare) /Fuji CRm, (Fujifilm)	06 Double	Women presenting for screening mammography at institution from June 2011 through December 2011	59 (36-92) / 59 (30-90)	DBT group had a significantly higher personal and family history of breast cancer and a larger number of women with hyperdense breasts.	BI-RADS scores entre 1 and 5, masses, microcalcifications, asymmetries, tissue overlap
Durand 2015	USA	Retrospective Cohort	Aug 2011 to Dec 2012	DBT and DM	DM alone	Selenia Dimensions (Hologic)/-Digital Mammographic Imager (Selenia, Hologic)	07 Single	Screening mammograms performed at their facility from August 1, 2011, to December 31, 2012. Women with breast implants or large breasts that required tiled images were excluded	<40 to >70	DBT exams were more likely in women 40–49 years of age, among non-Hispanic black women, and among women with heterogeneously or extremely dense breasts	Score BI-RADS 0, asymmetries, calcifications, masses
Giess 2017	USA	Retrospective Cohort	Oct 2012 to May 2015	DBT and DM	DM alone	Selenia Dimensions (Hologic)/Senographe DS. (GE Healthcare)	24 Single	Screening mammograms performed at study period	54,8 ± 10,3	The authors used a propensity score to counterbalance the factors associated with greater DBT (age <50 years, hyperdense breasts, calcifications or asymmetries in previous exams)	Score BI-RADS 0

Greenberg 2014	USA	Retrospective Cohort	Aug 2011 to Nov 2012	DBT and DM	DM alone	Selenia or Selenia Dimensions (Hologic)	14 Double	Screening mammograms performed at study period	59,5 (±10,31) /59,5 (± 11,44)	No difference between the groups regarding risk factors due to breast cancer	Score BI-RADS 0, 4 or 5
Powell 2017	USA	Retrospective Cohort	Jun 2012 to Aug 2014	DBT and DM	DM alone	Selenia e Selenia Dimensions (Hologic)	-	Women who attended breast cancer screening	>35 anos	The DBT group had more women with hyperdense breasts	Score BI-RADS 0

RCT: Randomized Clinical Trial. DTA: Diagnostic Accuracy Test Study. DBT: Digital Breast Tomosynthesis. DM: Digital Mammography. SM: Synthetic Mammography. NA: Not Applicable. – No Information Provided

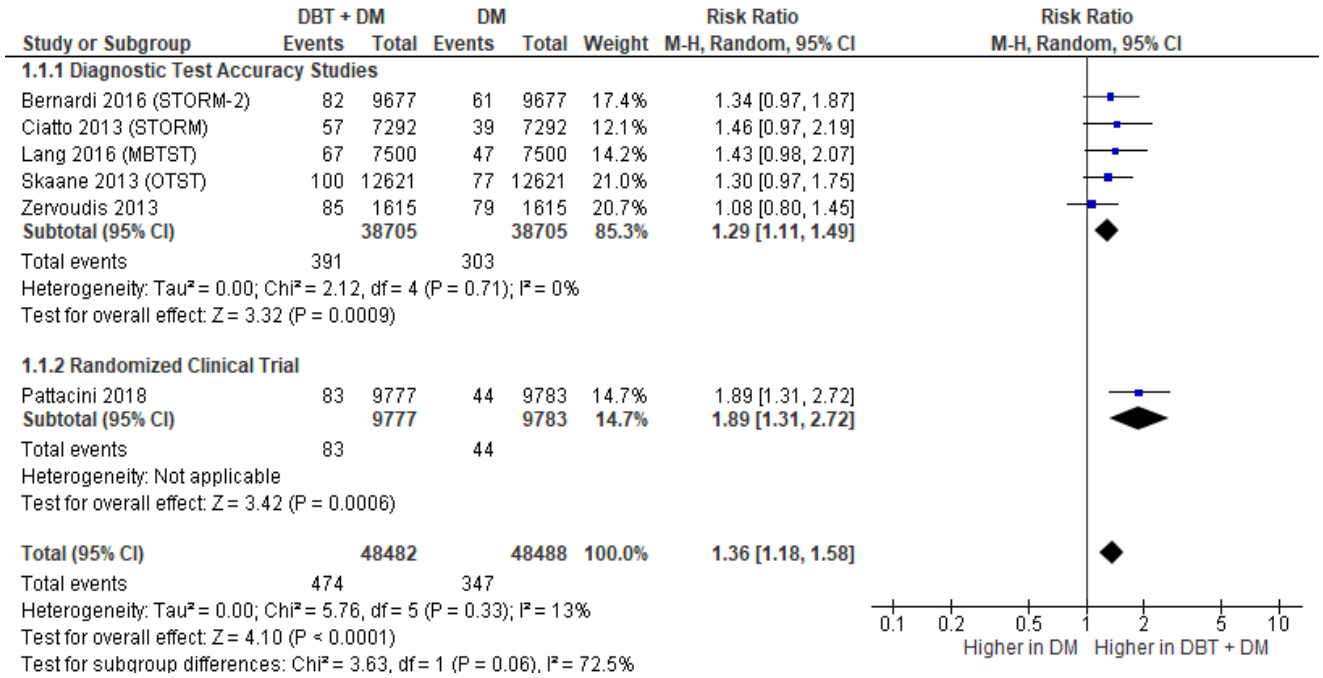

Fig. 3 Meta-analysis of the overall detection rate of breast cancer – digital breast tomosynthesis (DBT) and digital mammography (DM) versus digital mammography alone - diagnostic test accuracy studies and the randomized clinical trial.

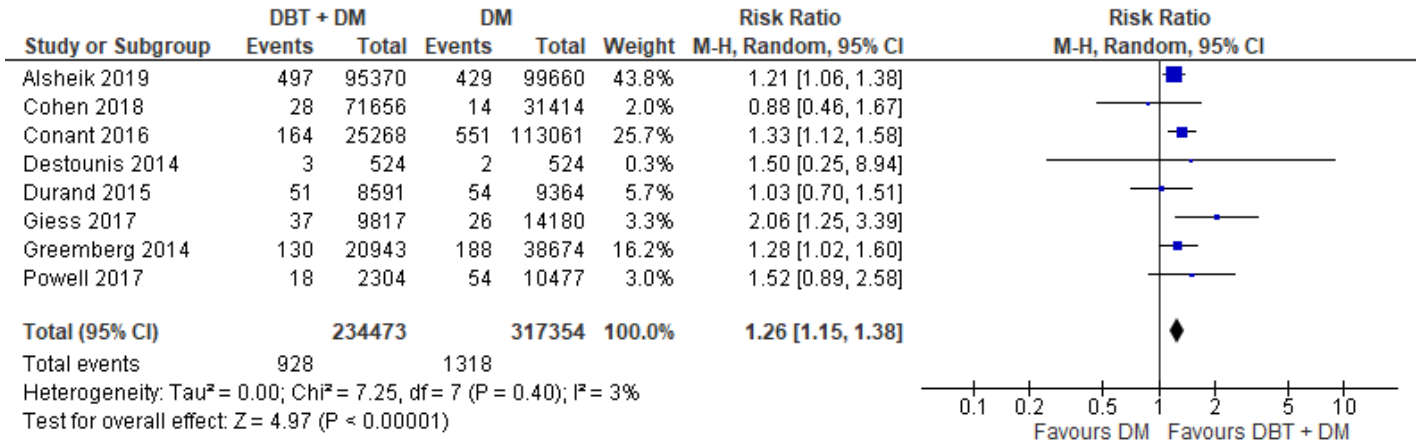

Fig. 4 Meta-analysis of the overall detection rate of breast cancer – digital breast tomosynthesis (DBT) and digital mammography (DM) versus digital mammography alone - **r**etrospective cohort studies

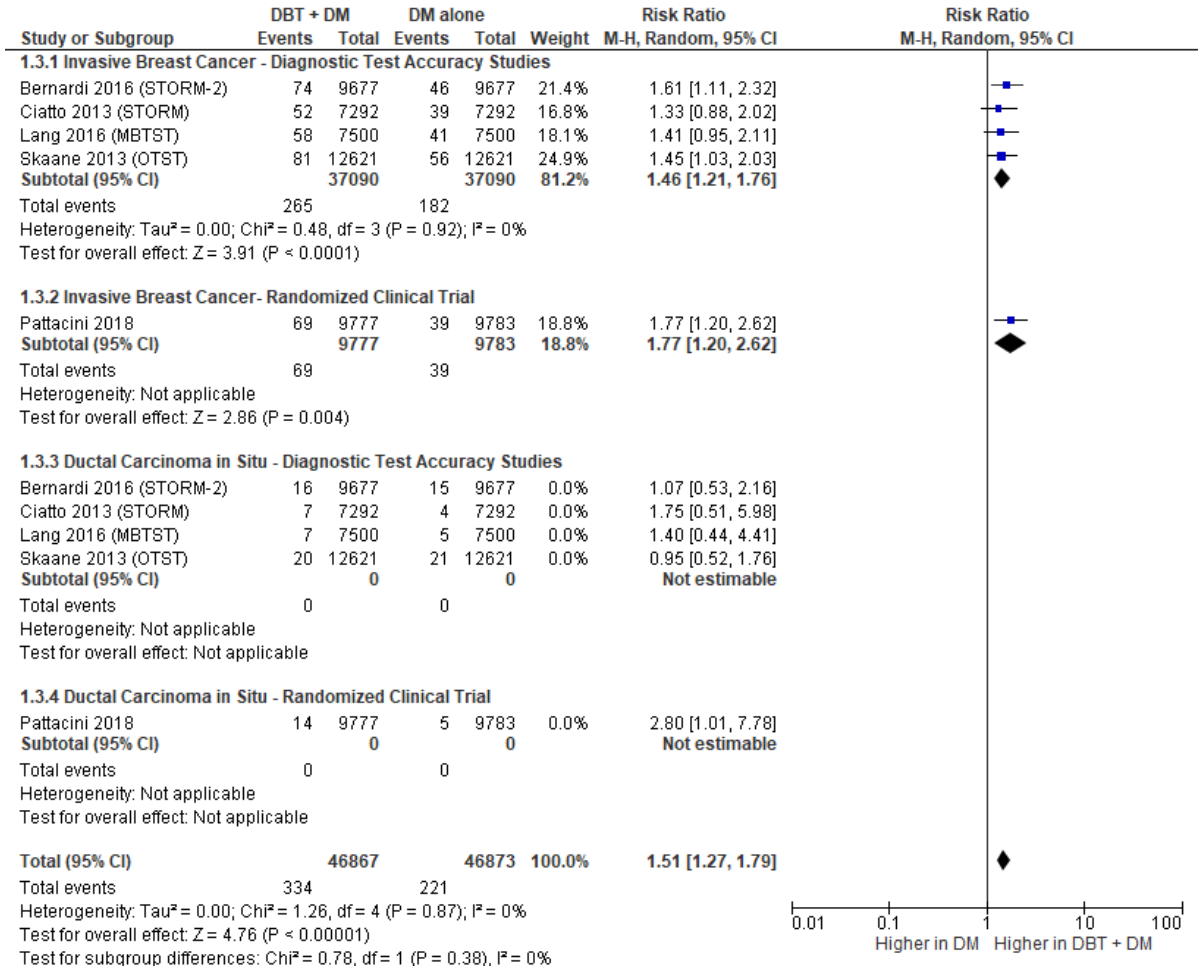

Fig. 5 Meta-analysis of the invasive breast cancer rate – digital breast tomosynthesis (DBT) and digital mammography (DM) versus digital mammography alone - diagnostic test accuracy studies and randomized clinical trial

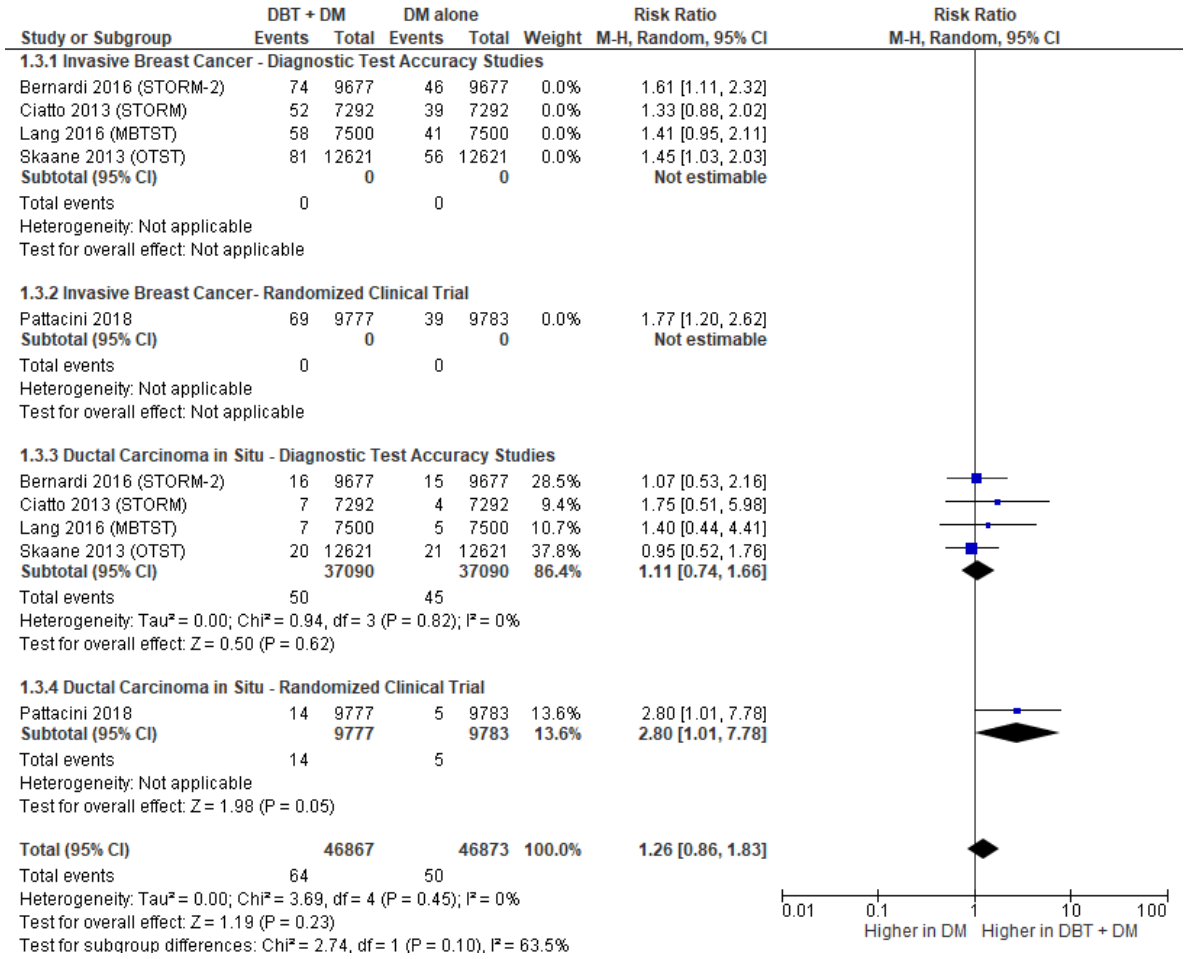

Fig. 6 Meta-analysis of the ductal carcinoma in situ rate – digital breast tomosynthesis (DBT) and digital mammography (DM) versus digital mammography alone - diagnostic test accuracy studies and randomized clinical trial

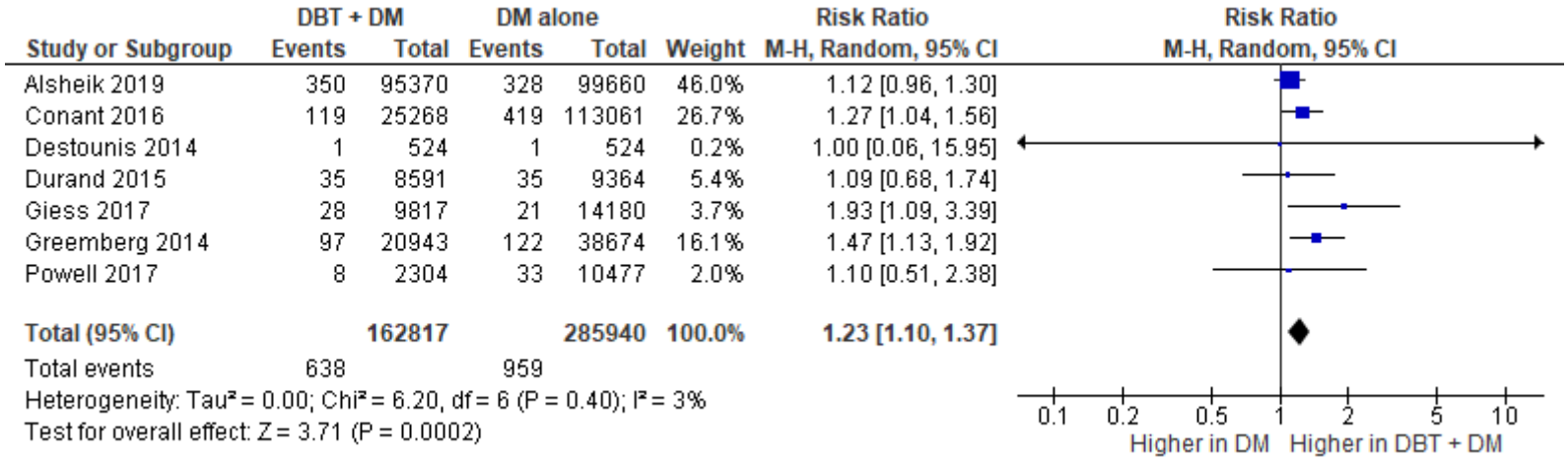

Fig. 7 Meta-analysis of the invasive detection rate of breast cancer – digital breast tomosynthesis (DBT) and digital mammography (DM) versus digital mammography alone - **r**etrospective cohort studies

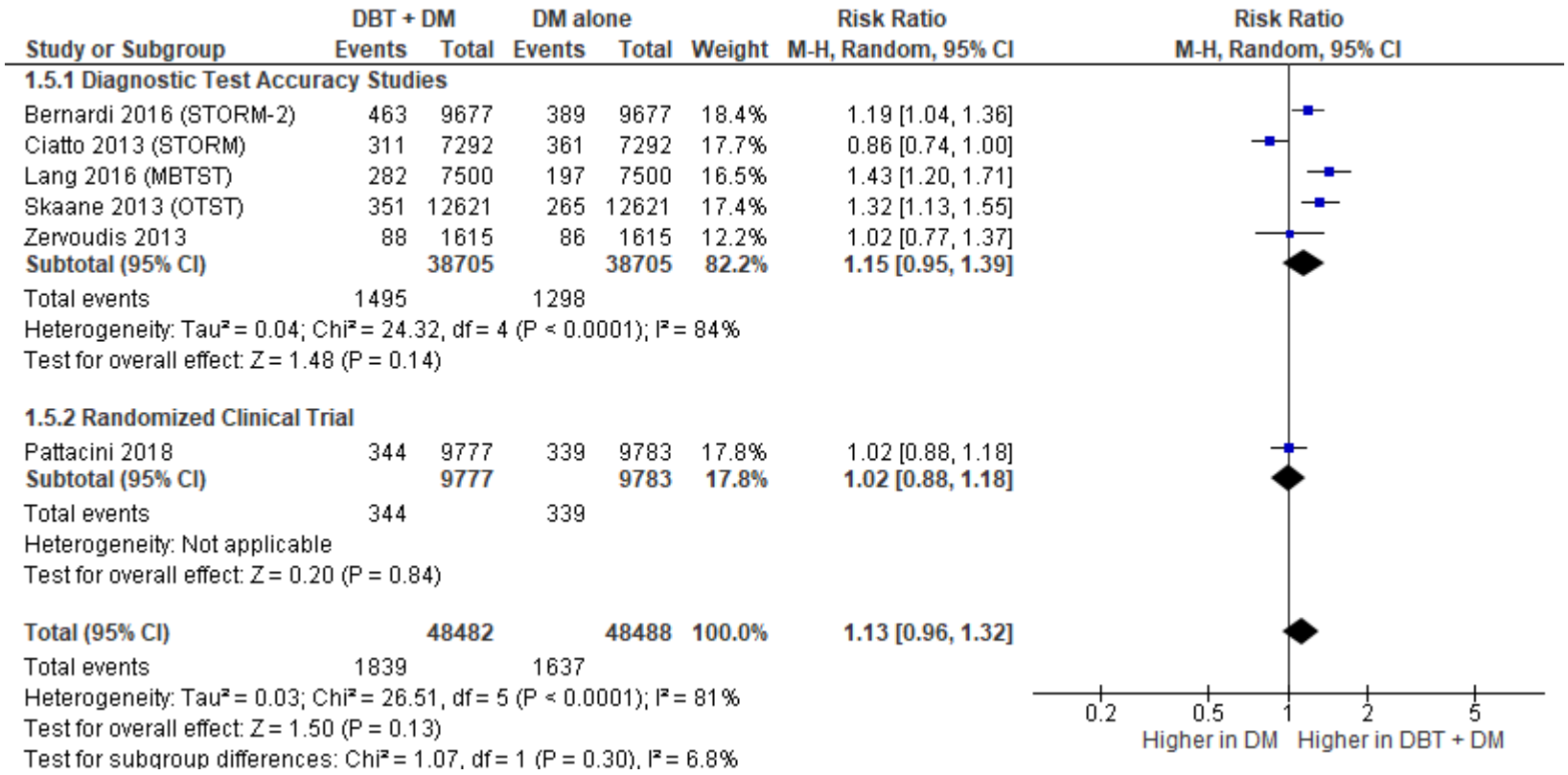

Fig. 8 Meta-Analysis of recall rates – digital breast tomosynthesis (DBT) and digital mammography (DM) versus digital mammography alone - diagnostic test accuracy studies and randomized clinical trial

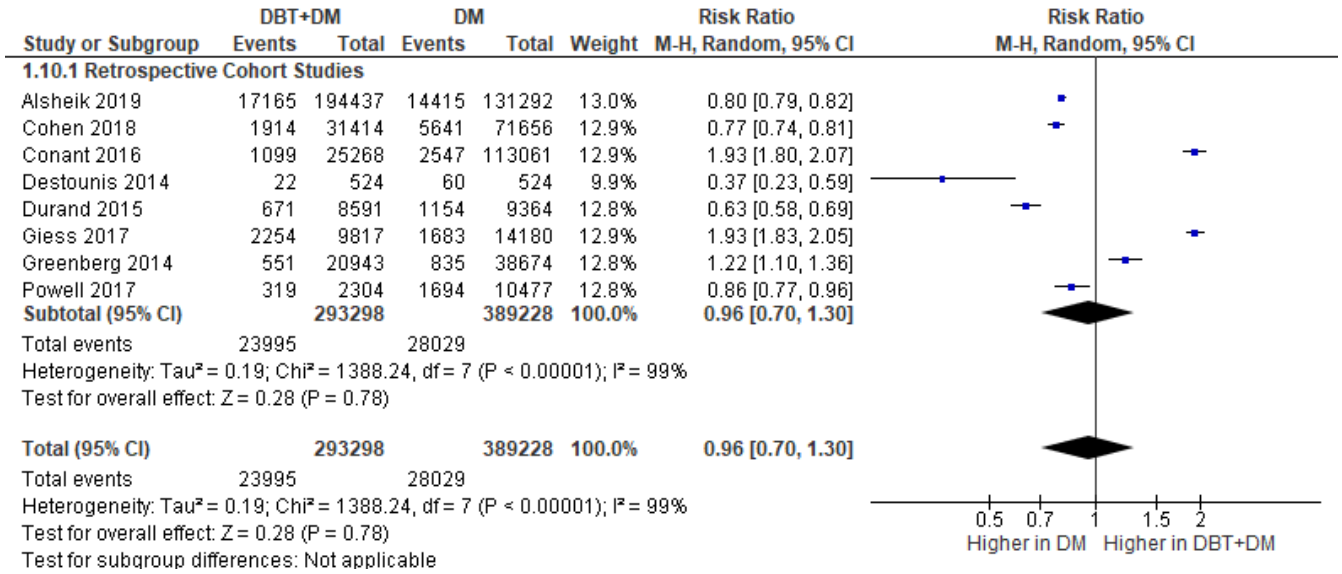

Fig. 9 Meta-Analysis of recall rates – digital breast tomosynthesis (DBT) and digital mammography (DM) versus digital mammography alone – retrospective cohort studies

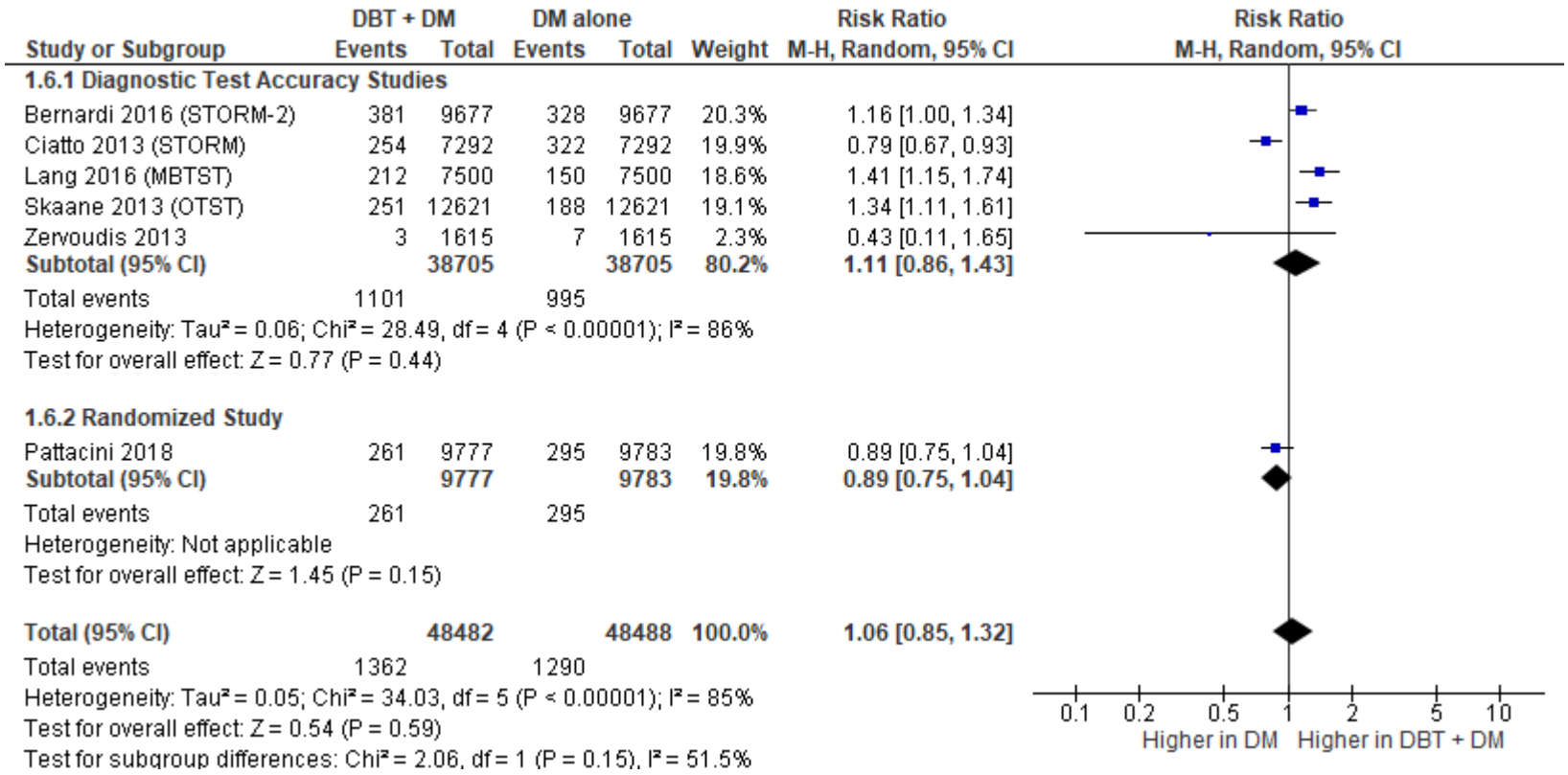

Fig. 10 Meta-Analysis of false positive for recall rates – digital breast tomosynthesis (DBT) and digital mammography (DM) versus digital mammography alone - diagnostic test accuracy studies and randomized clinical trial

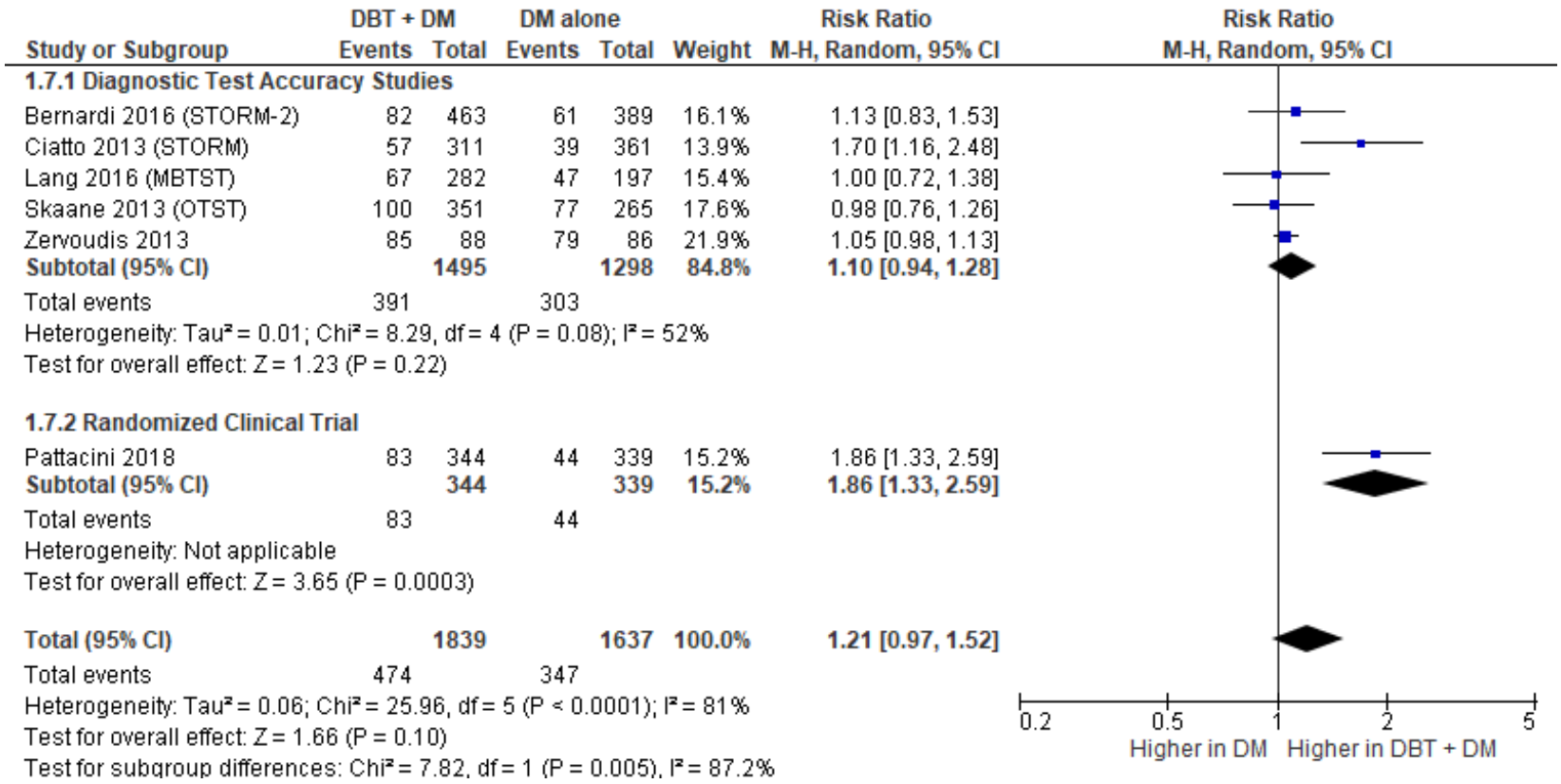

Fig. 11 Meta-Analysis of positive predictive value – digital breast tomosynthesis (DBT) and digital mammography (DM) versus digital mammography alone - diagnostic test accuracy studies and randomized clinical trial

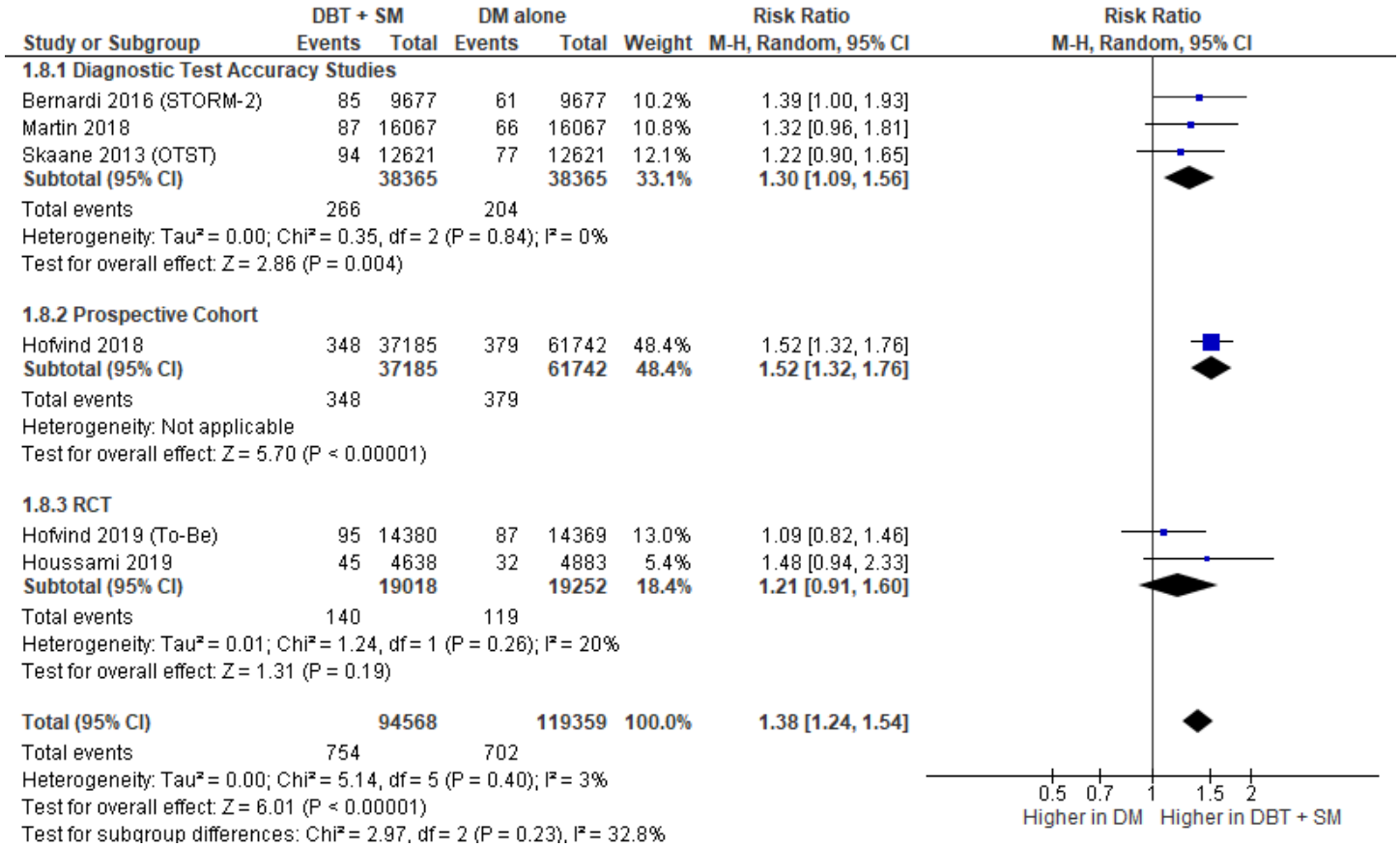

Fig. 12 Meta-analysis of the overall detection rate of breast cancer – digital breast tomosynthesis (DBT) and synthetic mammography (SM) versus digital mammography alone - diagnostic test accuracy studies, randomized clinical trial and prospective cohort study

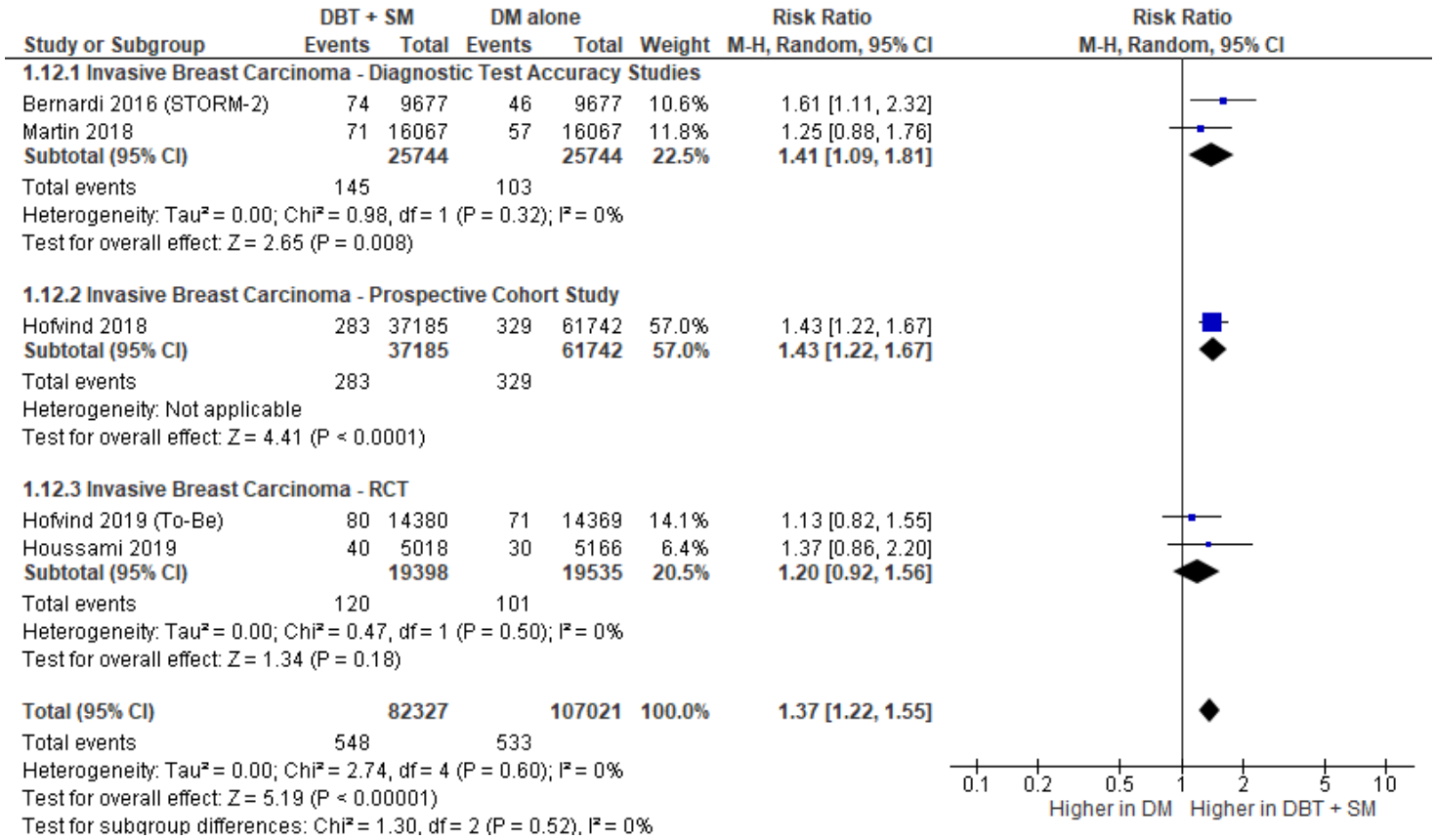

Fig. 13 Meta-analysis of the characteristics of breast cancer detection (invasive breast cancer)– digital breast tomosynthesis and synthetic mammography (SM) versus digital mammography alone - diagnostic test accuracy studies, randomized clinical trial and prospective cohort study

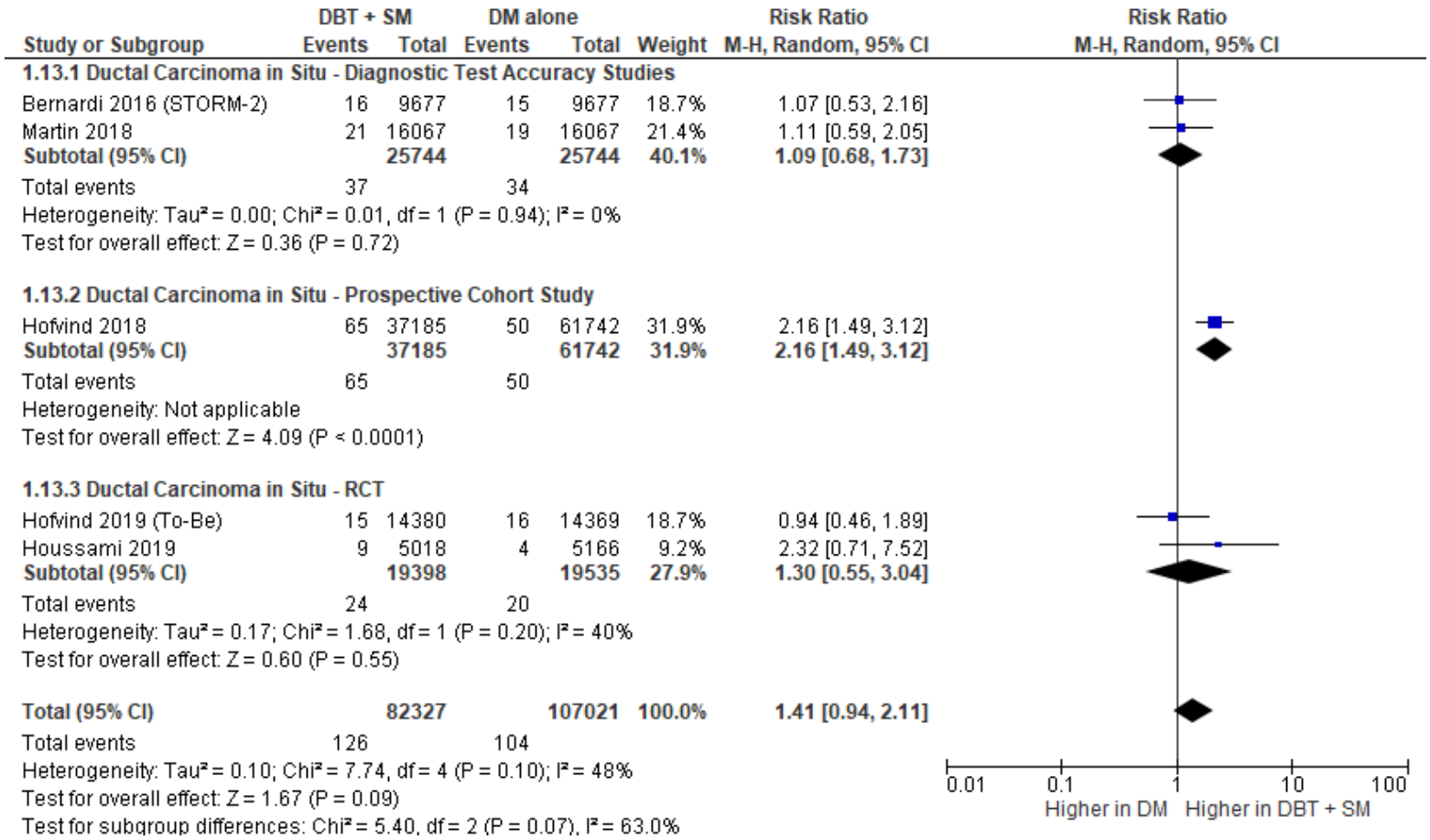

Fig. 14 Meta-analysis of the characteristics of breast cancer detection (ductal carcinoma in situ)– digital breast tomosynthesis and synthetic mammography (SM) versus digital mammography alone - Diagnostic test accuracy and randomized trial studies

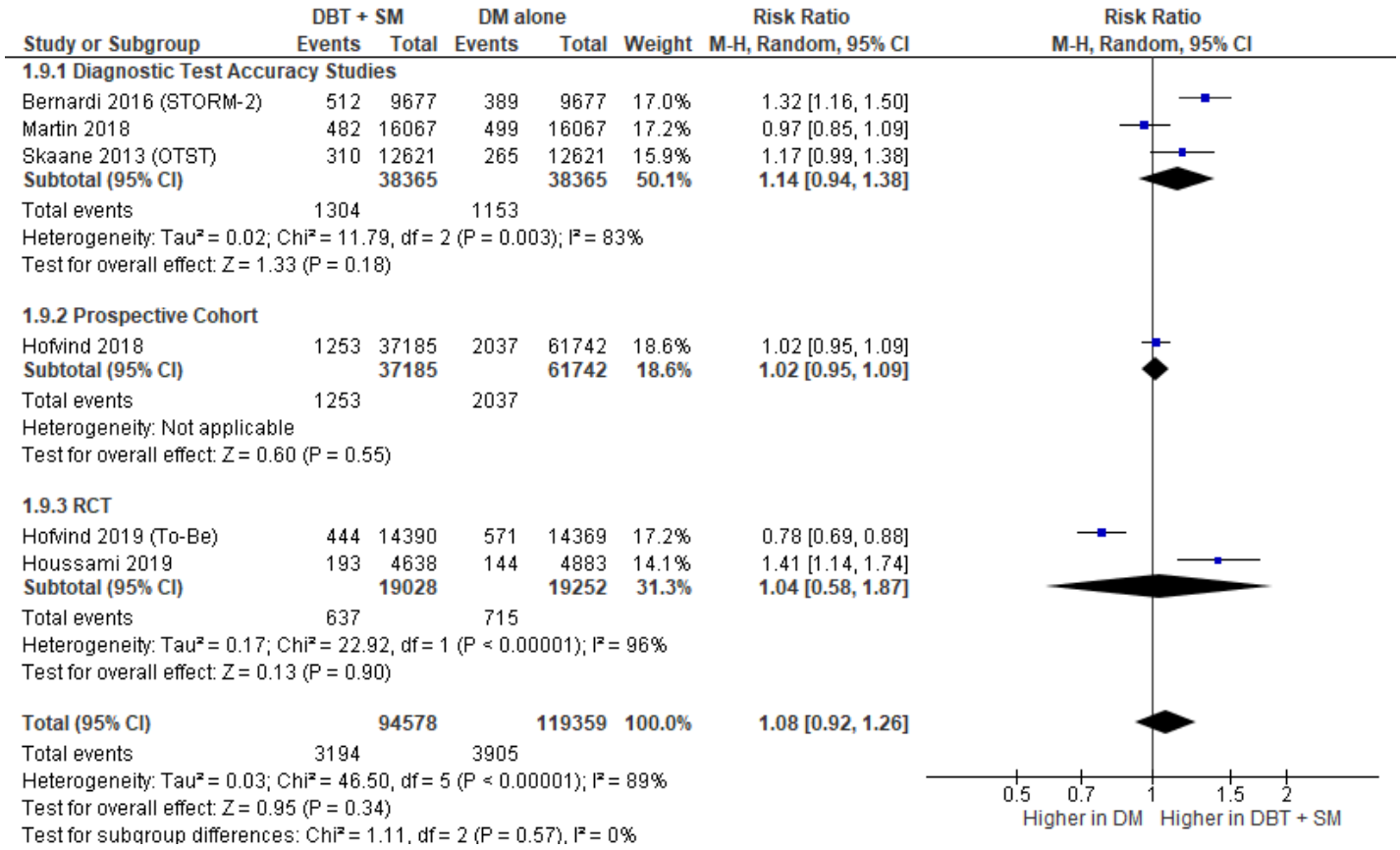

Fig. 15 Meta-Analysis of recall rates – digital breast tomosynthesis and synthetic mammography (SM) **-** Diagnostic test accuracy, randomized trial studies and prospective cohort study.

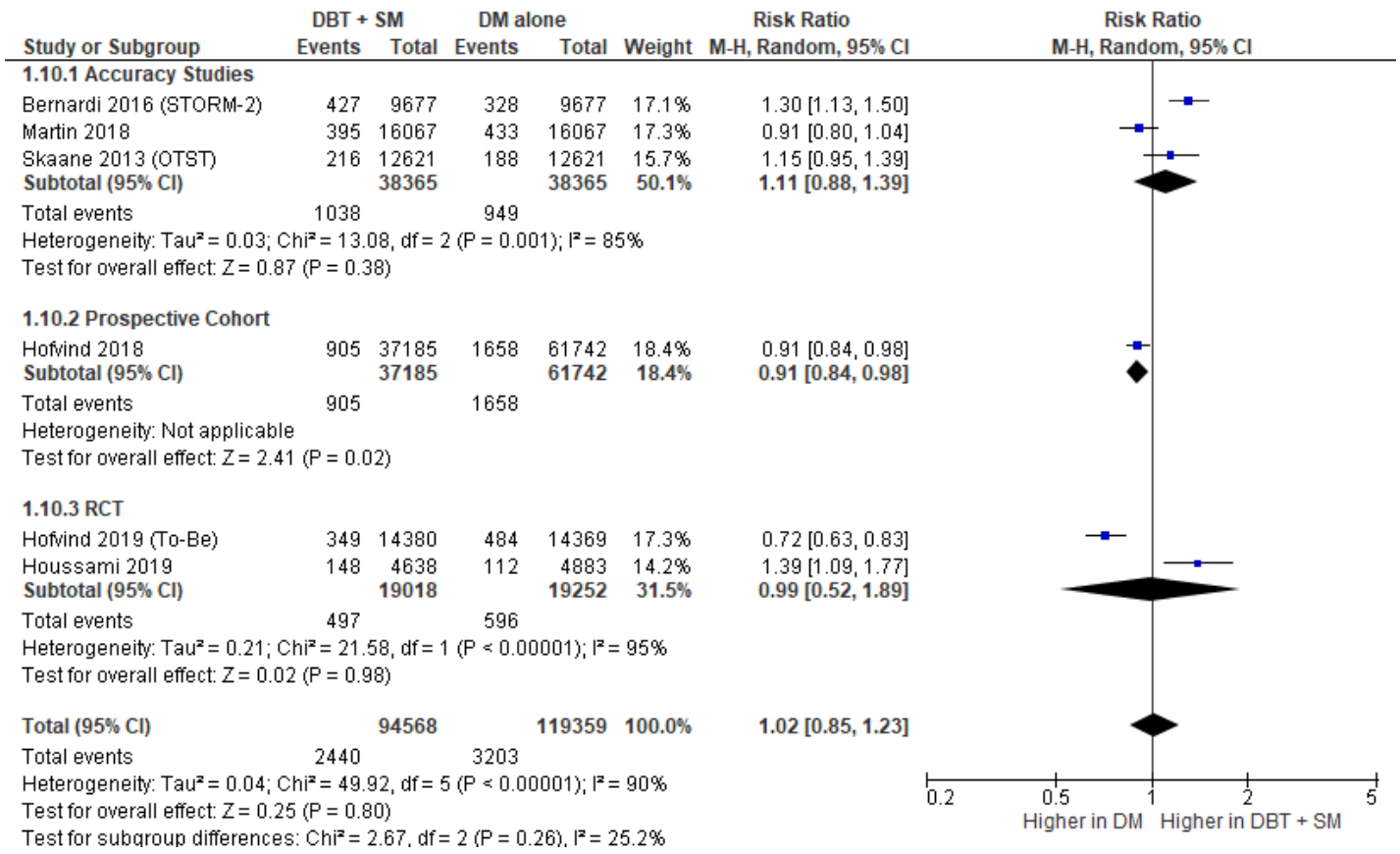

Fig. 16 Meta-Analysis of false positive recall – digital breast tomosynthesis and synthetic mammography (SM) versus - diagnostic test accuracy, randomized trial and prospective cohort study.

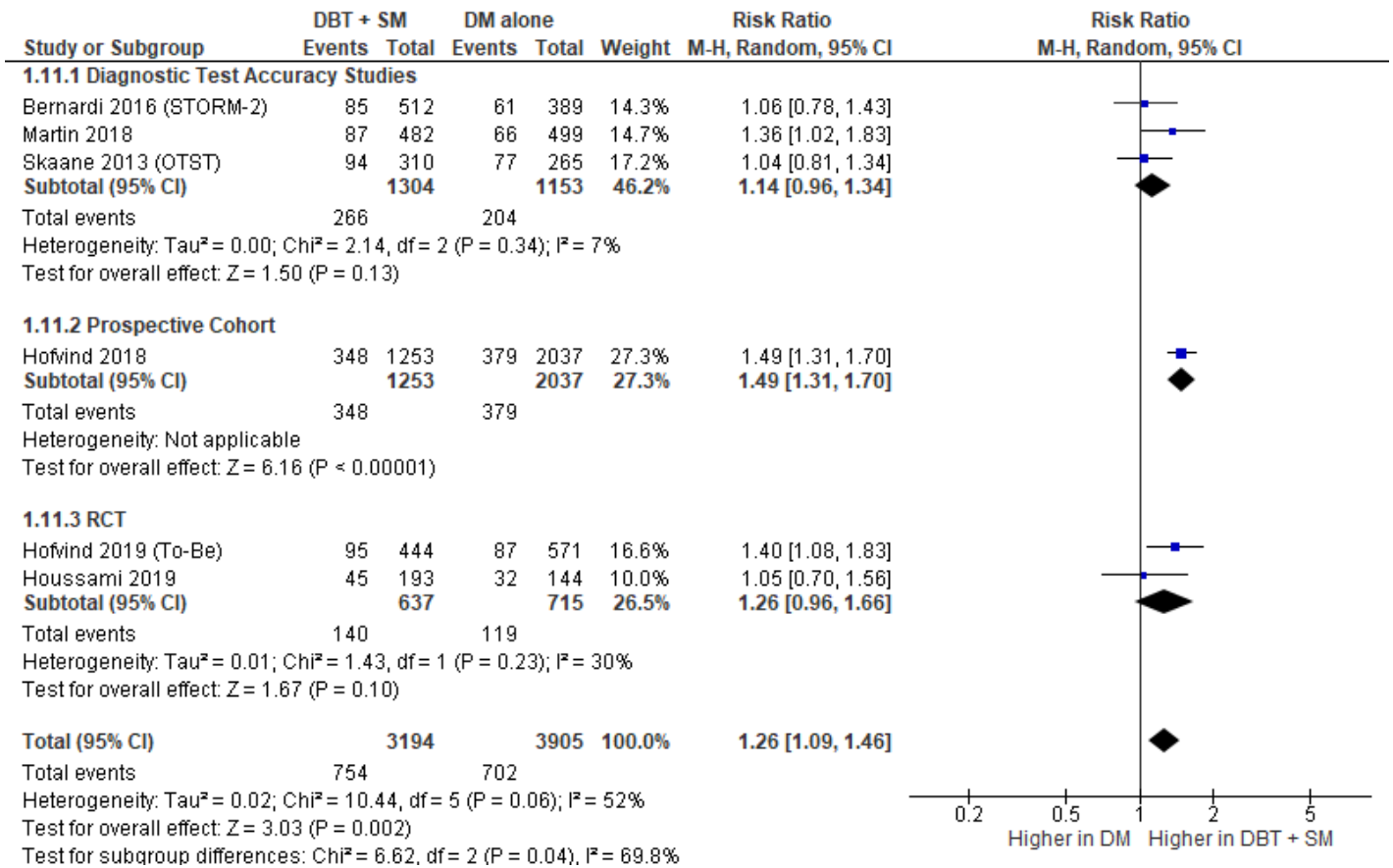

Fig. 17 Meta-Analysis of positive predictive value – digital breast tomosynthesis and synthetic mammography (SM) - diagnostic test accuracy, randomized trial and prospective cohort study.