

Supplemental Material

Supplemental Table 1: MEDLINE Search Strategy

Supplemental Table 2: Menstrual Disturbances in Dialyzed Females Living with CKD

Supplemental Table 3: Menstrual Disturbances in Transplanted Females Living with CKD

Supplemental Table 4: Study Quality Assessment.

Supplemental Figure 1. Prevalence of menstrual disturbances in dialyzed females.

Supplemental Figure 2. Pooled age of menarche, stratified by kidney replacement therapy type, in females with chronic kidney disease.

Supplemental Figure 3. Pooled age of menopause, stratified by kidney replacement therapy type, in females with chronic kidney disease.

Supplemental Figure 4. Pooled reproductive lifespan in females with chronic kidney disease.

Supplemental Figure 5. Funnel plot for assessment of publication bias of pooled risk difference of menstrual disturbance in females with chronic kidney disease pre- and post- kidney transplantation.

Supplemental Table 1: MEDLINE Search Strategy

1	(chronic kidney disease* or chronic renal disease* or nephropath*).tw,kf.	118006
2	((renal or kidney) adj (insufficien* or failure or diseas* or impair*)).tw,kf. or exp Renal Insufficiency/ or exp Renal Insufficiency, Chronic/	327849
3	(end adj stage adj (renal or kidney) adj diseas*).tw,kf. or exp Kidney Diseases/	541799
4	(kidney fail* or renal fail* or KF).tw,kf. or exp Kidney Failure, Chronic/	172686
5	(kidney transplant* or renal transplant* or kidney allograft* or renal allograft*).tw,kf. or Kidney Transplantation/	117335
6	((proteinuria or urin*) adj2 (albumin or protein) adj2 excret*).tw,kf. or exp Proteinuria/	43458
7	albuminuria.tw,kf. or exp Albuminuria/	21464
8	(glomerular adj filtration adj rate).tw,kf. or exp Glomerular Filtration Rate/ [mp=title, abstract, original title, name of substance word, subject heading word, floating sub-heading word, keyword heading word, organism supplementary concept word, protocol supplementary concept word, rare disease supplementary concept word, unique identifier, synonyms]	68116
9	(CKD or CRF or CRI or ESRD or ESKD).tw,kf.	69407
10	(?GFR or estimated GFR).tw,kf.	20451
11	(pre?dialysis or ?dialysis or renal replacement therapy or kidney replacement therapy or RRT or KRT).tw,kf. or exp Renal Replacement Therapy/ or exp Peritoneal Dialysis/ or exp Dialysis/ or exp Renal Dialysis/	288002
12	exp Hemofiltration/	6911
13	(h?emo?dialysis or h?emo?filtration).tw,kf.	83876
14	(MAU or micro?albuminuria or macro?albuminuria).tw,kf.	10524
15	((((albumin or protein) adj creatinine adj ratio) or albumin?creatinine* or protein?creatinine*).tw,kf.	3795
16	exp Menarche/	5132
17	exp Menstruation/ or exp Menstrual Cycle/ or exp Menstruation Disturbances/	58148
18	exp Menopause/	58981
19	(?menopaus* or menstrua* or mense* or menarche).tw,kf.	108039
20	exp Reproductive Medicine/ or exp Reproductive Health/	26814
21	exp Fertility/	42632
22	(reproduc* life* or reproduc* span* or reproduc* period).tw,kf.	3898
23	(premature ovarian failure* or primary ovarian failure*).tw,kf. or exp Primary Ovarian Insufficiency/	4216
24	exp Ovarian Follicle/	28722
25	amenorrh*.tw,kf. or exp Amenorrhea/	16859

26	hyperprolactinemi*.tw,kf. or exp Hyperprolactinemia/	6643
27	oligomenorrhe*.tw,kf. or exp Oligomenorrhea/	1571
28	dysmenorrhe.tw,kf. or exp Dysmenorrhea/	4148
29	metrorrhagi*.tw,kf. or exp Metrorrhagia/	3243
30	menorrhagi*.tw,kf. or exp Menorrhagia/	6111
31	(menopaus* adj prematur*).tw,kf. or exp Menopause, Premature/	1095
32	(premature ovarian insuffic* or primary ovarian insuffic*).tw,kf.	1495
33	1 or 2 or 3 or 4 or 5 or 6 or 7 or 8 or 9 or 10 or 11 or 12 or 13 or 14 or 15	874287
34	16 or 17 or 18 or 19 or 20 or 21 or 22 or 23 or 24 or 25 or 26 or 27 or 28 or 29 or 30 or 31 or 32	274412
35	33 and 34	2629
36	animals/ not humans/	4818559
37	35 not 36	2462
38	limit 37 to (case reports or comment or editorial or letter or "review" or "systematic review")	811
39	37 not 38	1651

Supplemental Table 2: Menstrual Disturbances in Dialyzed Females Living with CKD

Author (year)	MD pre-CRF (n)	MD pre-dialysis (n)	MD at study investigation (n)	KRT	Type of Disturbance	Definition	n (%)*
Ølgaard (1975)	NR	NR	8	HD	Irregular Menses	N/A	2 (33%)
					PD	Irregular Menses	N/A
Morley (1979)	1	10	12	HD	Polymenorrhea	N/A	5 (42%)
					Oligomenorrhea & Menorrhagia	N/A	2 (17%)
					Regular & Menorrhagia	N/A	1 (8%)
					Amenorrhea	N/A	4 (33%)
Gómez (1980)	NR	NR	11	HD	Oligomenorrhea	Menstruation interval of >35 days	4 (36%)
					Dysfunctional Uterine Bleeding	N/A	1 (9%)
					Amenorrhea	N/A	6 (55%)
Lim (1980)	NR	NR	16	HD	Irregular Menses	Ranging from occasional spotting to frequent dysfunctional uterine bleeding	6 (35%)
					Amenorrhea	N/A	10 (59%)
Weizman (1983)	NR	NR	9	HD	'No Menses'	N/A	9 (47%)
Otieno (1993)	NR	18	16	HD	Oligomenorrhea	N/A	0 (0%)
					Amenorrhea	N/A	11 (85%)

					PD	Oligomenorrhea	N/A	0 (0%)
						Amenorrhea	N/A	1 (100%)
					Conservative	Oligomenorrhea	N/A	2 (8%)
						Amenorrhea	N/A	2 (8%)
Kawashima (1998)	NR	0	12	HD		Normogonadotropic Amenorrhea	Menstruation interval of >6 months	3 (12%)
						Hypergonadotropic Amenorrhea	Menstruation interval of >6 months and serum FSH >40 mIU/mL	3 (12%)
						Oligomenorrhea	Menstrual-like bleeding episodes of bleeding >35 days apart	6 (24%)
Weisinger (2000)	NR	NR	31	HD		Amenorrhea	Absence of menstrual bleeding for >6 months	31 (42%)
Jang (2001)	NR	NR	5	HD		Irregular Menses	N/A	5 (33%)
Shanmugavadivoo (2003)	NR	NR	6	HD/PD		Irregular Menses	N/A	6 (17%)
Di Iorio (2004)	NR	NR	78	HD		Amenorrhea	No menstrual bleeding in the last 3 months	78 (59%)

Matuszkiewicz-Rowińska (2004)	NR	NR	55	HD	Amenorrhea	Absence of menstrual bleeding for >6 months	25 (33%)
					Polymenorrhea	Cycle <28 days	13 (17%)
					Oligomenorrhea	Cycle >32 days	17 (23%)
Arikan (2011)	NR	NR	13	HD	Amenorrhea	N/A	5 (17%)
					Oligomenorrhea	N/A	7 (23%)
					Menomentrorragia	N/A	1 (3%)
Al-Turki (2014)	NR	NR	11	HD	Irregular Menses	N/A	11 (61%)
Lin (2016)	NR	NR	88	HD	Polymenorrhea	Cycle <22 days	8 (17%)
					Oligomenorrhea	Cycle >35 days	6 (13%)
					Amenorrhea	Absence of menses for > 6months	21 (46%)
					Polymenorrhea	Cycle <22 days	8 (19%)
				PD	Oligomenorrhea	Cycle >35 days	5 (12%)
					Amenorrhea	Absence of menses for > 6months	18 (42%)
					Polymenorrhea	Cycle <22 days	6 (15%)
					NHD	Oligomenorrhea	Cycle >35 days
Amenorrhea	Absence of menses for > 6months	12 (30%)					
Sikora-Grabka (2016)	NR	NR	25	HD	Irregular Menses	Cycles < or > 29 ± 3 days	19 (41%)
					Amenorrhea	Lack of menstrual cycle >6 months	6 (13%)

Teuwafeu (2016)	NR	NR	26	HD	Irregular Menses	N/A	14 (45%)
					Non-Gravid Amenorrhea	N/A	12 (39%)
					Polymenorrhea	N/A	8 (26%)
					Oligomenorrhea	N/A	8 (26%)
					Menomentrorragia	N/A	3 (10%)
Serret-Montoya (2020)	0	5	25	HD	Menstrual Disorder	N/A	15 (60%)
				PD	Menstrual Disorder	N/A	10 (53%)

Notes: KRT: kidney replacement therapy; HD: hemodialysis; PD: peritoneal dialysis; FSH: follicle-stimulating hormone; NR: not reported; NHD: nocturnal hemodialysis. % of pre-menopausal sample size within dialysis modality. ^anot included in meta-analyses.

Supplemental Table 3: Menstrual Disturbances in Transplanted Females Living with CKD

Author (year)	KRT	Type of Disturbance	Definition	Pre-Transplantation Disturbances, n (%)	Post-Transplantation Disturbances, n (%)
Bierman (1977)	Transplantation	Amenorrhea	NR	12 (52%)	0 (0%)
		Irregular Menses	NR	9 (39%)	8 (38%)
Morley (1979)		Amenorrhea	NR	1 (20%)	1 (20%)
		Menorrhagia	NR	2 (40%)	0 (0%)
		Oligomenorrhea	NR	0 (0%)	1 (20%)
El-Sheikh (1987)		Amenorrhea	No period for more than 6 months	32 (67%)	0 (0%)
Schover (1990)		Irregular Menses	NR	2 (10%)	5 (20%)
		No Menses	NR	10 (48%)	4 (16%)
Kim (1998)		Irregular Menses	NR	24 (34%)	24 (35%)
		No Menses	NR	30 (42%)	11 (16%)
Guazzelli (2008)	Irregular Menses	Excessive menses (bleeding >5 days), short cycles (<20 days) or long cycles (>45 days)	139 (71%)	99 (50%)	
Filocamo (2009)	Amenorrhea	No cycle for ≥ 6 months	15 (38%)	6 (15%)	
	Oligomenorrhea	Cycle lasting >32 days	12 (31%)	9 (23%)	

	Polymenorrhea	Cycle lasting <28 days	2 (5%)	3 (8%)
Kramer (Sept. 2003)	Amenorrhea	≥6 months before transplantation	7 (18%)	0 (0%)
	Irregular and Sporadic	NR	14 (37%)	12 (29%)
Karayalcin (2010)	Amenorrhea	'I do not have a period'	11 (22%)	7 (14%)
	Irregular Menses	NR	15 (30%)	13 (26%)
Yu (2013)	Amenorrhea	>6 months without period	18 (43%)	7 (17%)
	Oligomenorrhea	Cycle lasting >32 days	10 (24%)	5 (12%)
	Polymenorrhea	Cycle lasting <28 days	5 (12%)	6 (14%)
Chakhtoura (2015)	Amenorrhea	No menstrual period for 6 months	56 (43%)	24 (24%)
	Oligomenorrhea	>35 days	33 (26%)	20 (20%)
Lin (2016)^b	Amenorrhea	Absence of menses for > 6months	NR	11 (61%)
	Oligomenorrhea	Cycle >35 days	NR	0 (0%)
	Polymenorrhea	Cycle <22 days	NR	7 (39%)
Sikora-Grabka (2018)	Irregular Menses	NR	5 (50%)	2 (20%)
Dines (2021)	Amenorrhea	'Did your period stop before transplant? Did your period start after transplant?'	63 (35%)	15 (8%)

Notes: KRT: kidney replacement therapy; NR: not reported; % of pre-menopausal sample size pre- and post-transplantation. ^bNot included in meta-analysis since no reporting of pre-transplantation disturbances.

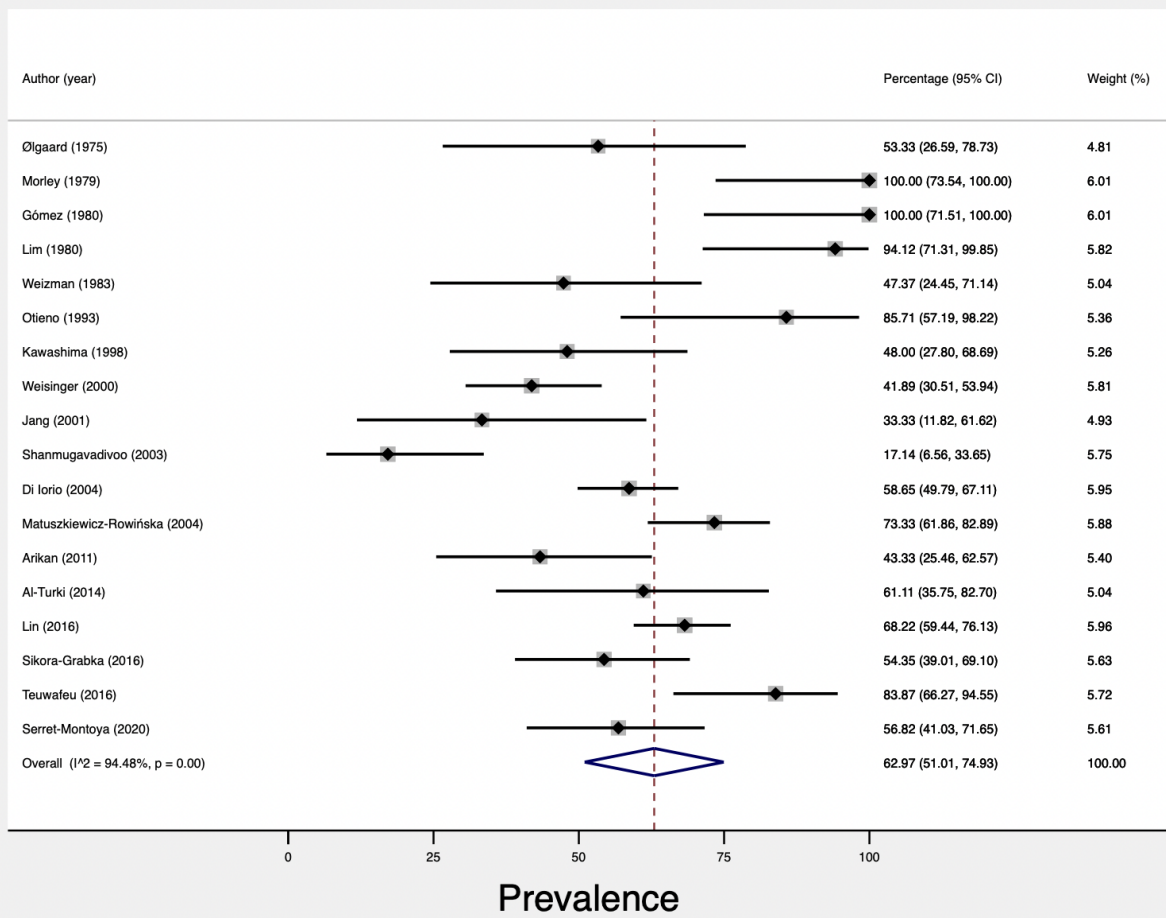
Supplemental Table 4: Study Quality Assessment.

Author (Year)	Study Quality Questions for Observational Studies												Study Quality Questions for Case-Control Studies Only				Overall Assessment
	Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8	Q11	Q12	Q13	Q14	Q4	Q6	Q7	Q8	
Ølgaard (1975)	yes	yes	CD	CD	no	yes	yes	yes	yes	NR	NA	no	-	-	-	-	fair
Bierman (1977)	yes	yes	yes	yes	no	yes	yes	yes	no	NR	yes	no	-	-	-	-	fair
Morley (1979)	yes	yes	yes	CD	no	yes	yes	yes	no	NR	yes	no	-	-	-	-	fair
Lim (1980)	yes	yes	yes	CD	no	yes	yes	yes	yes	NR	NA	no	-	-	-	-	fair
Gómez (1980)	no	no	yes	yes	no	yes	yes	yes	no	NR	NA	no	-	-	-	-	fair
Weizman (1983)	yes	yes	CD	no	no	yes	yes	yes	no	NR	NA	no	-	-	-	-	fair
El-Sheikh (1987)	no	no	yes	yes	no	yes	yes	yes	no	NR	yes	no	-	-	-	-	fair
Schover (1990)	yes	yes	no	yes	no	yes	yes	yes	no	NR	NA	no	-	-	-	-	fair
Bianchi (1992)	no	yes	yes	CD	no	yes	yes	yes	yes	NR	NA	no	-	-	-	-	fair
Otieno (1993)	yes	yes	yes	yes	no	yes	yes	yes	no	NR	yes	no	-	-	-	-	fair
Milde (1996)	yes	yes	no	yes	no	yes	yes	yes	no	NR	NA	no	-	-	-	-	fair
Cochrane (1997)	yes	yes	yes	yes	no	yes	yes	yes	yes	NR	yes	no	-	-	-	-	good
Holley (1997)	yes	yes	yes	yes	no	yes	yes	yes	yes	NR	no	yes	-	-	-	-	good

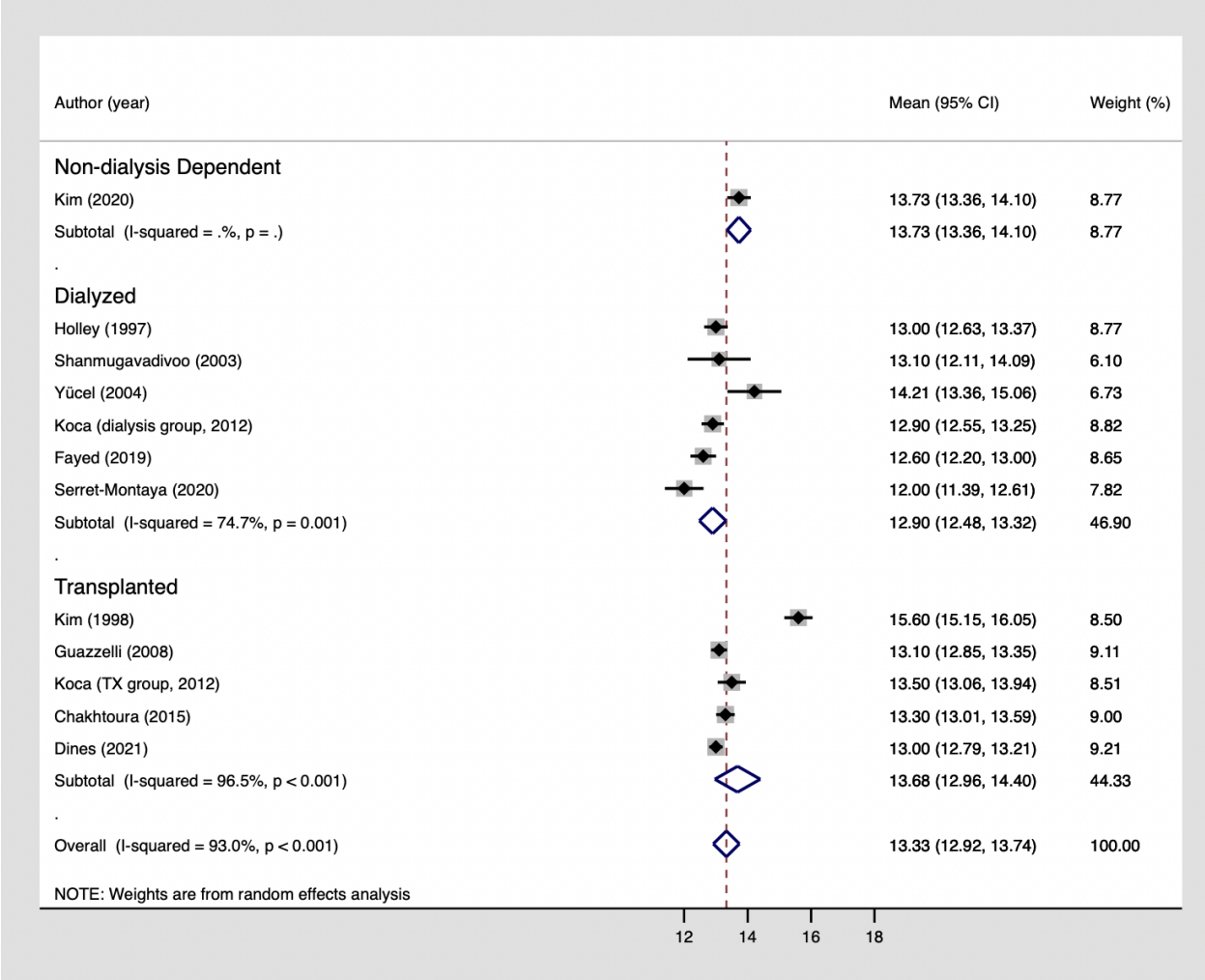
Kim (1998)	yes	yes	yes	NR	no	yes	yes	yes	no	NR	yes	yes	-	-	-	-	fair
Kawashima (1998)	yes	yes	CD	CD	no	yes	yes	yes	yes	NR	yes	no	-	-	-	-	fair
Rush (2000)	yes	yes	yes	yes	no	yes	yes	yes	yes	NR	yes	no	-	-	-	-	good
Weisinger (2000)	yes	yes	no	yes	no	yes	yes	yes	yes	NR	NA	no	-	-	-	-	fair
Jang (2001)	yes	yes	yes	yes	no	yes	yes	yes	no	NR	NA	no	-	-	-	-	fair
Shanmugavadivoo (2003)	yes	no	yes	yes	no	yes	yes	yes	no	NR	yes	no	-	-	-	-	fair
Kramer (Sept. 2003)	yes	yes	CD	yes	no	yes	yes	yes	no	NR	NA	no	-	-	-	-	fair
Matuszkiewicz-Rowińska (2004)	yes	yes	yes	yes	no	yes	yes	yes	yes	NR	NA	no	-	-	-	-	fair
Kramer (March 2003)	yes	yes	yes	yes	no	yes	yes	yes	yes	NR	yes	no	-	-	-	-	good
Di Iorio (2004)	yes	yes	yes	yes	no	yes	yes	yes	no	NR	NA	no	-	-	-	-	fair
Yücel (2004)	yes	yes	yes	yes	no	yes	yes	yes	yes	NR	yes	no	-	-	-	-	good
Pezeshki (2004)	yes	yes	CD	yes	no	yes	yes	yes	no	NR	yes	no	CD	yes	NA	yes	fair
Guazzelli (2008)	yes	yes	yes	yes	no	yes	yes	yes	yes	NR	yes	no	-	-	-	-	good
Song (2008)	yes	yes	yes	no	no	yes	yes	yes	no	NR	yes	no	CD	yes	NA	CD	fair
Filocamo (2009)	yes	yes	yes	yes	no	yes	yes	yes	yes	yes	no	no	-	-	-	-	good
Karayalcin (2010)	yes	yes	CD	yes	no	yes	yes	yes	yes	NR	yes	no	-	-	-	-	fair
Arikan (2011)	yes	yes	yes	yes	no	yes	yes	yes	yes	NR	yes	no	-	-	-	-	good
Koca (2012)	yes	yes	yes	CD	no	yes	yes	yes	yes	NR	yes	no	-	-	-	-	fair

van Eps (2012)	yes	yes	CD	yes	no	yes	yes	yes	no	NR	yes	no	-	-	-	-	fair
Yu (2013)	yes	yes	yes	yes	no	yes	yes	yes	yes	NR	yes	no	-	-	-	-	good
Al-Turki (2014)	yes	yes	yes	yes	no	yes	yes	yes	no	NR	NA	no	-	-	-	-	fair
Chakhtoura (2015)	yes	yes	yes	yes	no	yes	yes	yes	yes	NR	yes	no	-	-	-	-	good
Cheung (2015)	yes	yes	yes	yes	no	yes	yes	yes	yes	NR	yes	no	-	-	-	-	good
Teuwafeu (2016)	yes	yes	yes	yes	no	yes	yes	yes	yes	NR	NA	no	-	-	-	-	fair
Sikora-Grabka (2016)	yes	yes	yes	yes	no	yes	yes	yes	no	NR	yes	no	-	-	-	-	fair
Lin (2016)	yes	yes	yes	yes	no	yes	yes	yes	yes	NR	NA	no	-	-	-	-	fair
Coelho Gonçalves (2019)	yes	no	yes	yes	no	yes	yes	yes	no	NR	NA	no	-	-	-	-	fair
Yaprak (2019)	yes	yes	yes	yes	no	yes	yes	yes	no	NR	yes	no	-	-	-	-	fair
Fayed (2019)	yes	yes	CD	yes	no	yes	yes	yes	no	NR	yes	no	-	-	-	-	fair
Ramesh (2020)	yes	yes	yes	yes	no	yes	yes	yes	yes	NR	yes	yes	-	-	-	-	good
Serret-Montaya (2020)	yes	yes	yes	yes	no	yes	yes	yes	yes	NR	yes	no	-	-	-	-	good
Kim (2020)	yes	yes	yes	yes	no	yes	yes	yes	yes	NR	yes	yes	-	-	-	-	good
Dines (2021)	yes	yes	no	yes	no	yes	yes	no	no	NR	NA	yes	-	-	-	-	fair

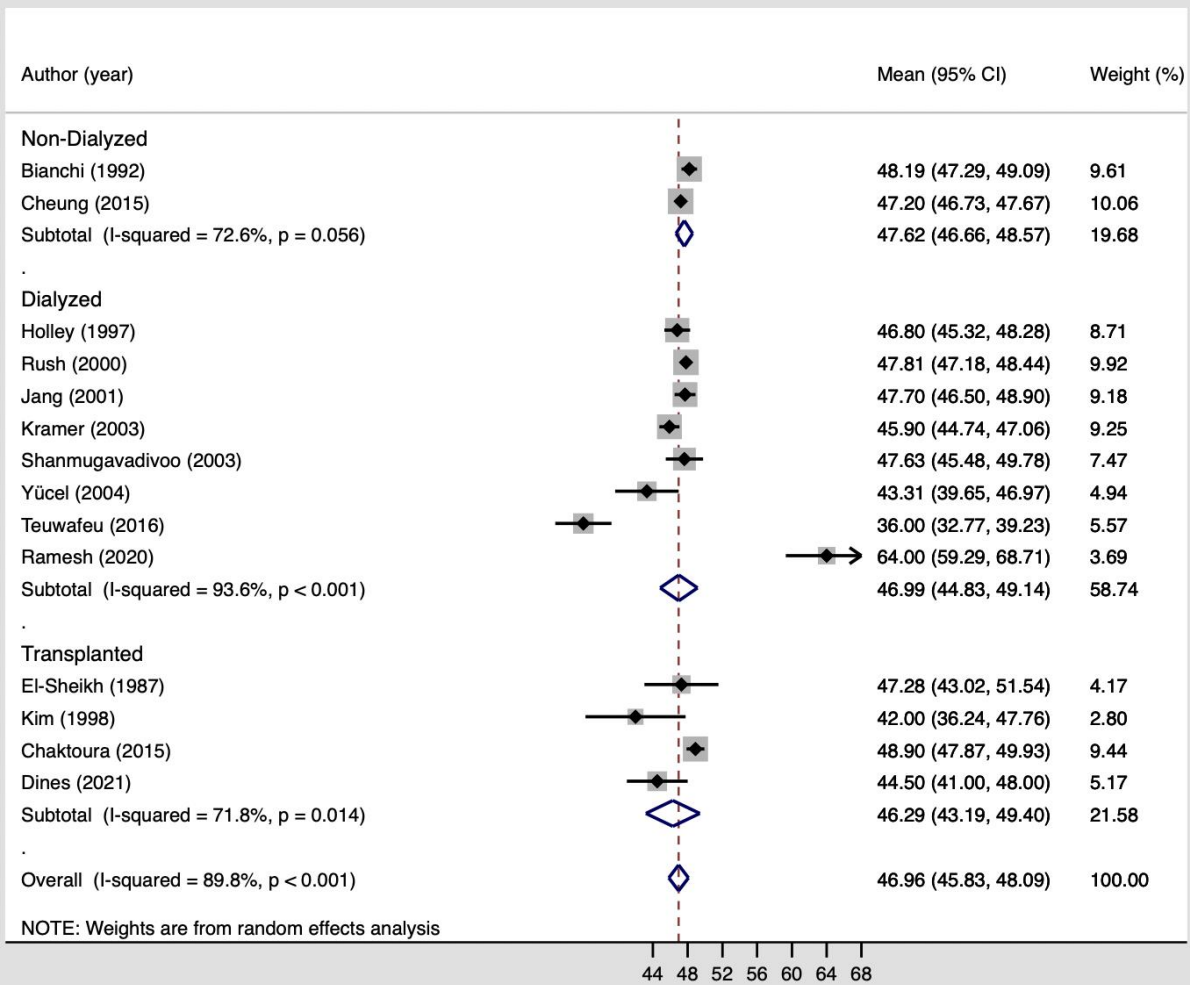
Notes: CD: cannot determine; NR: not reported; NA: Not applicable.



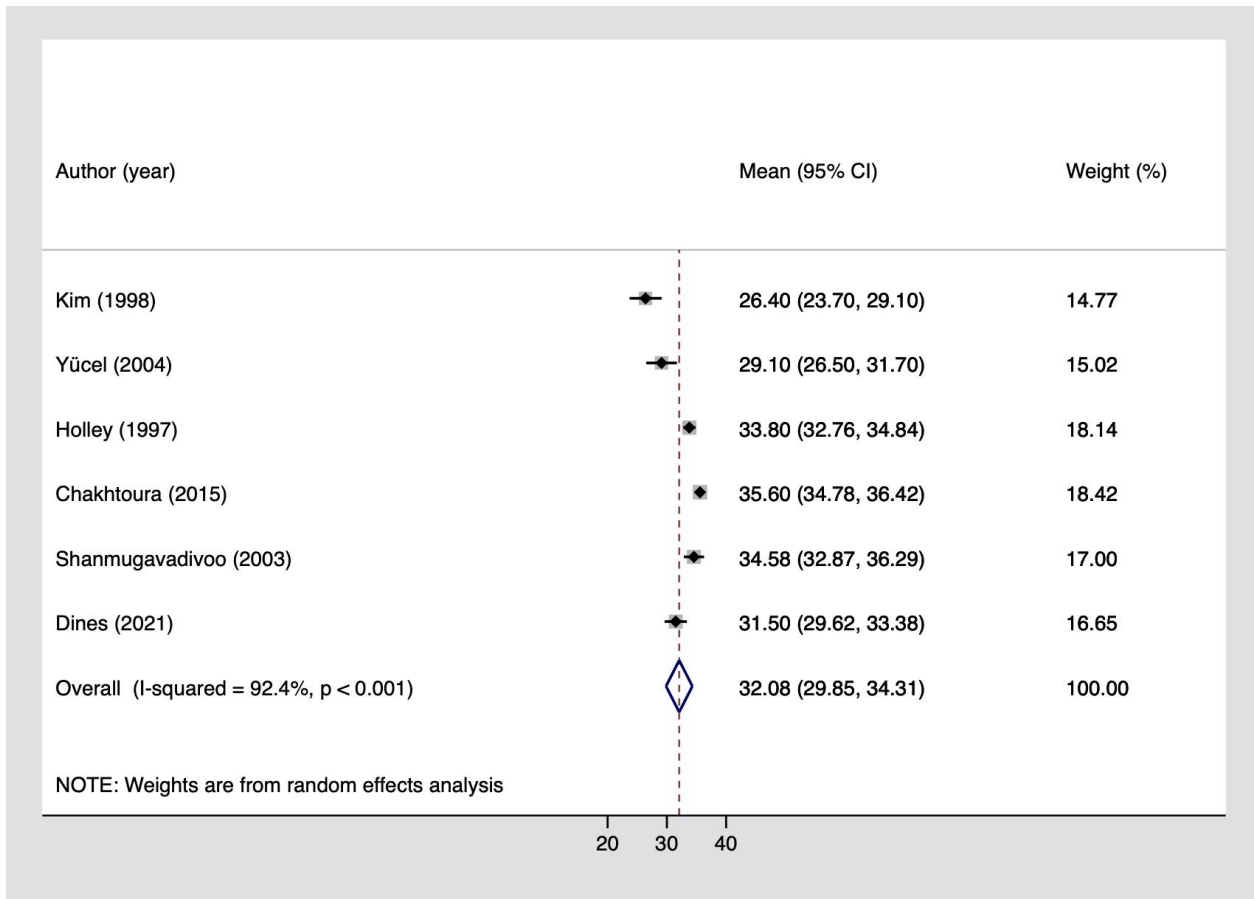
Supplemental Figure 1. Prevalence of menstrual disturbances in dialyzed females.



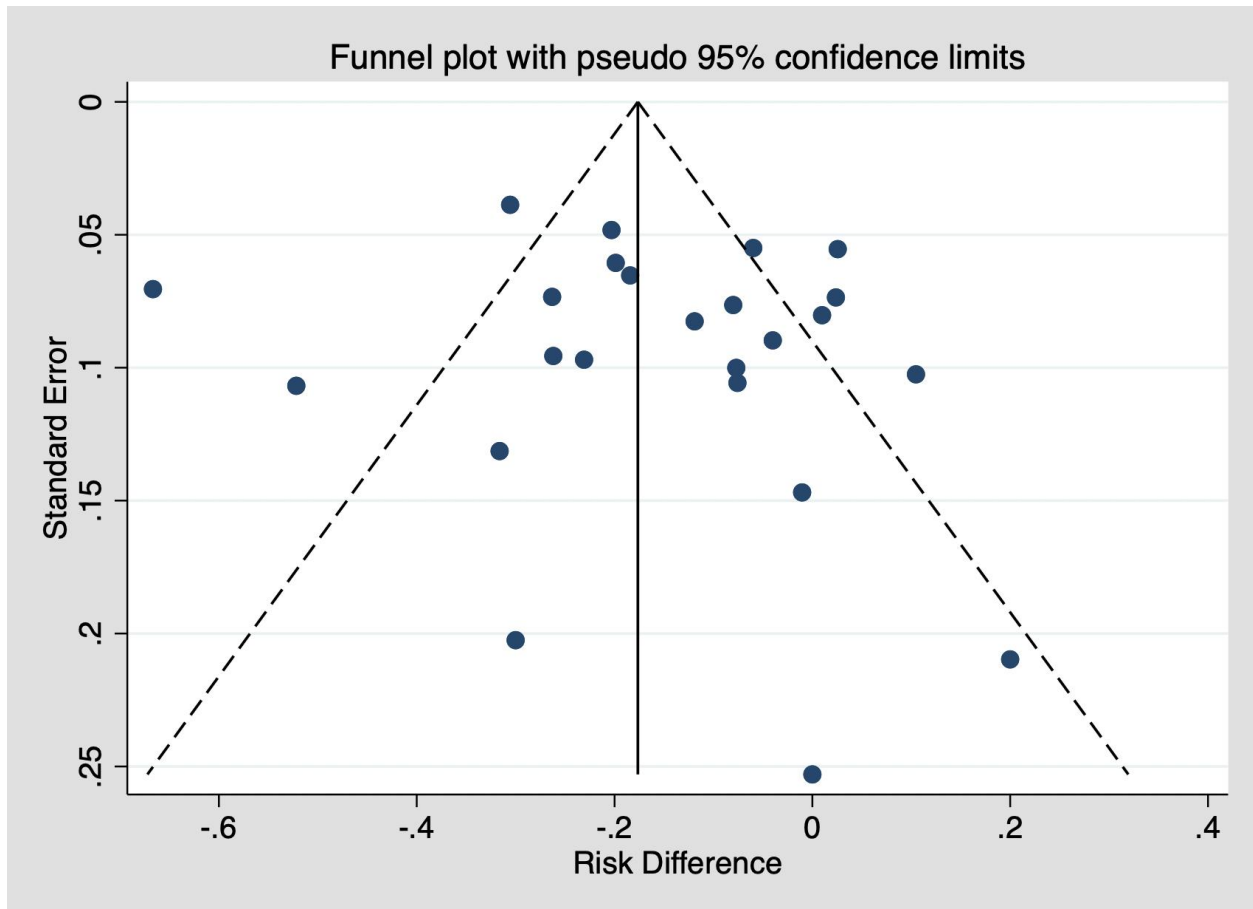
Supplemental Figure 2. Pooled age of menarche, stratified by kidney replacement therapy type, in females with chronic kidney disease.



Supplemental Figure 3. Pooled age of menopause, stratified by kidney replacement therapy type, in females with chronic kidney disease.



Supplemental Figure 4. Pooled reproductive lifespan in females with chronic kidney disease.



Supplemental Figure 5. Funnel plot for assessment of publication bias of pooled risk difference of menstrual disturbance in females with chronic kidney disease pre- and post- kidney transplantation.