

Female Reproductive Health and Contraception Use in CKD: An International Mixed-Methods Study



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Rationale & Objective: Female reproductive health is recognized as a predictor of morbidity, mortality, and quality of life, although data in the setting of chronic kidney disease (CKD) are limited.

Study Design: A mixed-methods study was employed. Phase 1 was an anonymous, internet-based survey. Phase 2 was semistructured interviews offered to all respondents upon survey completion.

Setting & Participants: The survey was disseminated internationally from October 4, 2021, to January 7, 2022, to individuals aged 18-50 years with both a uterus and CKD diagnosis.

Outcomes: Menstrual health and contraceptive use by CKD stage (dialysis, nondialysis CKD, and transplant).

Analytical Approach: Survey data were analyzed using descriptive statistics. Interview data were analyzed using the framework method of analysis.

Results: Of 152 respondents, 98 (mean age 33 ± 0.7 years; $n = 20$ dialysis, $n = 59$ nondialysis CKD, $n = 19$ transplant) satisfied the inclusion criteria, representing 3 continents. The most common causes of CKD among survey respondents

were hereditary causes in dialysis ($n = 6$, 30%) and glomerulonephritis in nondialysis CKD ($n = 22$, 37%) and transplant ($n = 6$, 32%). The majority reported heavy menstrual bleeding ($n = 12$, 86% dialysis; $n = 46$, 94% nondialysis CKD; $n = 14$, 100% transplant). Less than half of participants were consistently able to afford period products. Condoms were the most common contraceptive reported. Most participants reported no contraceptive use ($n = 10$, 50% dialysis; $n = 37$, 63% nondialysis CKD; $n = 7$, 37% transplant), primarily because of “fear”. Interviews ($n = 6$) revealed a perception of a relationship between kidney function and menstrual health, concerns about contraceptive use, and a desire for greater multidisciplinary care to improve kidney and reproductive health.

Limitations: Self-reported outcomes, need for internet access and a device.

Conclusions: Abnormal menstruation and period poverty (ie, inability to afford period products and the socioeconomic consequences of menstruation) were common, and contraceptive use was low among female individuals with CKD, highlighting an important gap in the sex-specific care of this population.

Complete author and article information provided before references.

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The goal of World Kidney Day 2022 was to bridge the knowledge gap to better kidney care¹; however, awareness of sex-specific chronic kidney disease (CKD) considerations remains low.^{2,3} This knowledge gap is especially pronounced around female reproductive and gynecologic health issues⁴⁻⁷ despite the higher prevalence of CKD in women compared with men.^{2,8} In reproductive-aged females, CKD appears to be commonly associated with disruptions of the hypothalamic-pituitary-ovarian axis, resulting in hormonal disturbances and abnormal menstruation.⁹⁻¹³ Abnormal uterine bleeding, defined as any disruption of a healthy menstrual cycle (eg, volume, regularity, frequency, and duration of menses),^{14,15} has only been described in a limited number of small studies in the CKD population, but has been reported as high as 94% ($n = 16$) in the setting of kidney failure.^{9,11,16} Female reproductive health is increasingly recognized as an important predictor of morbidity, mortality, and quality of life.^{17,18} Women with CKD have low survival rates¹⁹ and quality of life,²⁰ highlighting the urgency of identifying female-specific factors contributing to these poor outcomes.

Furthermore, contraceptive use is low in the CKD population²¹ coupled with infrequent contraceptive counseling by health care professionals.⁵⁻⁷ This has important implications, given the high maternal and fetal risks associated with an unplanned pregnancy and CKD progression,^{22,23} particularly in those exposed to teratogenic medications.²⁴ However, most menstruation and contraception data are limited to the dialysis and transplant populations. The growing prevalence of CKD,^{25,26} combined with the awareness that menstrual health is a significantly under-recognized public health issue,¹⁸ highlights that greater understanding of gynecologic and reproductive health across the CKD spectrum is necessary to bridge the knowledge gap for improved kidney care. Therefore, the objective of this study was to describe self-assessed menstrual health and contraceptive use in individuals with CKD.

METHODS

This exploratory mixed-methods study consisted of 2 stages. Stage 1 was an online survey that was disseminated to potential participants internationally. Stage 2 involved

PLAIN-LANGUAGE SUMMARY

Chronic kidney disease (CKD) in female individuals is accompanied by menstrual disorders and low contraceptive use. However, most data are limited to the dialysis and transplant populations. Therefore, this mixed-methods study aimed to describe self-assessed menstruation and contraceptive use across all stages of CKD. People aged 18-50 years with a uterus and CKD diagnosis were invited to participate in an online survey shared internationally as well as an optional telephone interview. Abnormal menstruation and period poverty (ie, inability to afford period products and the socio-economic consequences of menstruation) were common, and contraceptive use was low among female individuals with CKD, highlighting an important gap in the sex-specific care of this population.

optional, semistructured telephone interviews with participants from stage 1. Participants were contacted via email up to 2 times 5 days apart in addition to the initial email confirming their desire to participate in the interview. Ethics approval was obtained from the University of Calgary Conjoint Health Research Ethics Board (REB21-0326). Participation in both stages was voluntary and informed consent was obtained electronically before the survey and electronically and verbally before the interview.

Stage 1: Online Survey

Survey Development

The survey instrument (Item S1) was developed by reviewing the literature and consulting with female individuals with CKD ($n = 6$) from 3 different countries as well as a team of multidisciplinary experts (nephrology [$n = 2$], gynecology, internal medicine, endocrinology, family medicine, in-center hemodialysis nursing, home hemodialysis nursing, nocturnal hemodialysis nursing, peritoneal dialysis nursing, nondialysis CKD nursing, and nephrology research nurse manager [$n = 1$ for all]). Pretesting to assess the validity, clarity, length, and completeness of the survey was performed through semistructured interviews or by obtaining written feedback from all 17 collaborators. After updating the survey, it was pilot tested for item reduction and coherency.²⁷ The Checklist for Reporting Results of Internet E-Surveys²⁸ was applied to guide survey development (Item S2), Qualtrics version 03.2021 (Provo: Qualtrics, 2021) was used for survey distribution, and the Strengthening the Reporting of Observational Studies in Epidemiology Checklist was followed (Item S3).

Survey Dissemination

The sampling frame for the survey was an international population of reproductive-aged female individuals (<51 years) with CKD. Female was defined as being assigned female sex at birth. Included participants were those aged

18-50 years who currently had a uterus and self-reported CKD diagnosis of any stage. Exclusion criteria were current pregnancy or lactating status, surgical menopause (ie, oophorectomy), and the inability to provide informed consent. The anonymous online survey was available in 4 languages (English, French, Hindi, and Spanish), and an incentive to win 1 in 10 Amazon gift cards (\$50 CAD) was offered upon survey completion. An online recruitment banner with a quick response code and link to the survey was created and translated into each language. A snowball sampling²⁹ method of recruitment was employed, where targeted emails were sent to contacts at 112 patient-based kidney organizations asking permission to share the survey on their communications platforms. A total of 20 (18%) organizations confirmed sharing the survey with their membership. Additionally, the survey was broadly disseminated via Twitter and Facebook. The survey was open from October 4, 2021, to January 7, 2022 (13 weeks). Follow-up emails to the groups after initial contact were sent up to 2 times, each at least 2 weeks apart. All participants completing the survey were asked if they would consent to participating in a follow-up telephone interview.

Data Collection and Analysis

Self-reported demographic (age, country, race or ethnicity, sex assigned at birth, and current gender identity), medical history (kidney, gynecologic, and hematologic), menstruation (menarche, menstruation, menopause, ability to afford period products, and menstrual health counseling and education), and contraception (pregnancy, current contraceptive use, types used, and contraceptive counseling and education) data were collected. Participants were stratified into 3 groups (dialysis, nondialysis CKD, and transplant) to compare responses. Data were analyzed with descriptive statistics (mean \pm standard error of the mean [SEM], proportions, and percentages) given the exploratory nature of this study.

Stage 2: Telephone Interviews

Interview Guide Development

The aim of the interviews was to build on survey data to gain a deeper understanding of female reproductive health needs and experiences while living with CKD. A review of survey data was used to develop the topics of the semistructured interview guide (Item S4), such as experiences of menstruation, contraception, and other gynecologic or reproductive factors, to gather richer narrative data than is possible with purely quantitative methodology. As participants were previously stratified into 3 groups, the interviews shed light on the differential experiences of patients in the dialysis, nondialysis CKD, and transplant groups.

Data Collection and Analysis

Interviews were conducted by a master's student (DHC) and PhD social epidemiologist (KR), both women with training in qualitative health research methods. Zoom (version 5.10.4, Zoom Video Communications Inc, 2022) was used

to conduct the interviews, record conversations, and generate transcripts. Transcripts were reviewed immediately after each interview and corrections were made manually to ensure accuracy and remove identifying information. Data were analyzed with NVivo (version 20.6.2, QSR International Pty Ltd, 2022) using the framework method of analysis.^{30,31} After transcription and familiarization with each interview, DHC and KR developed initial codes and an analytic framework, which were applied to all transcripts to chart the data before interpreting the data with SBA. The interview stage was completed when there were no more participants to contact. The Consolidated Criteria for Reporting Qualitative Research Checklist was followed to report findings (Item S5).

RESULTS

Stage 1: Online Survey

Demographics

Tables 1 and 2 summarize participant demographic characteristics. There were a total of 152 respondents, and after eliminating those who did not consent, answer any questions, satisfy inclusion criteria, or provide complete responses, there were 98 participants (Fig S1). Of those, 20 (20%) were currently receiving dialysis, 59 (60%) were not receiving dialysis, and 19 (20%) had a currently functioning kidney transplant. Most participants were from a North American or European country, and most were White. Most identified as cisgender women, and were

assigned female sex at birth. In the nondialysis CKD group, stage 3 CKD was most prevalent. Hereditary diseases were reported as the most common cause of CKD among dialysis participants, whereas glomerulonephritis was most commonly reported cause among nondialysis CKD and transplant participants. Over a third of all participants reported ever receiving a blood transfusion, with half reporting current erythropoietin-stimulating agent (ESA) use. Gynecologic disorders were commonly reported, and over a quarter of all participants reported a diagnosis of endometriosis (n = 26, 27%).

Menstruation

Among dialysis, nondialysis CKD, and transplant groups, nearly all participants experienced menarche and had ongoing menstrual cycles (Table 3). However, a quarter of dialysis (n = 5) and transplant (n = 5) participants reported secondary amenorrhea. Of the 19 participants who experienced secondary amenorrhea, 42% (n = 8) reported menopause, defined as the absence of menses for >12 months,³² with a median age of 40 years at the time of their last menstrual period. For those on dialysis, nearly a third (n = 6) noted cessation of menses followed by a return for a variety of reasons, including kidney transplantation and initiation of nocturnal hemodialysis.

Of the 77 participants (79%) with current menses, most participants with dialysis and nondialysis CKD reported predictable bleeding, though most transplant participants reported usually unpredictable menses (Fig 1). In participants

Table 1. Participant Demographic Characteristics

Characteristics	Pooled (n = 98)	Dialysis (n = 20)	Nondialysis CKD (n = 59)	Transplant (n = 19)
Age (y)	33 ± 0.7	35 ± 1	32 ± 1	35 ± 2
Age at CKD diagnosis (y)	21 ± 1 ^a	20 ± 3 ^b	23 ± 2 ^c	17 ± 3
Age at dialysis initiation (y)	26 ± 2 ^d	26 ± 2 ^d	N/A	N/A
Continent n (%)				
Asia	6 (6)	1 (5)	5 (8)	0 (0)
Europe	31 (32)	9 (45)	7 (12)	15 (79)
North America	61 (62)	10 (50)	47 (80)	4 (21)
Race/ethnicity n (%)				
Non-White	30 (31)	10 (50)	16 (27)	4 (21)
White	57 (58)	8 (40)	36 (61)	13 (68)
Prefer to self-describe/not to say/no response	11 (11)	2 (10)	7 (12)	2 (11)
Sex assigned at birth n (%)				
Female	87 (89)	18 (90)	52 (88)	17 (89)
Prefer to self-describe/not to say/no response	11 (11)	2 (10)	7 (12)	2 (11)
Gender identity n (%)				
Cisgender woman	79 (81)	18 (90)	45 (76)	16 (84)
Non-cisgender	12 (12)	1 (5)	10 (17)	1 (5)
Prefer to self-describe/not to say/no response	7 (7)	1 (5)	4 (7)	2 (11)

Note: Values are means ± SEM where relevant.

Abbreviations: CKD, chronic kidney disease; N/A, not applicable.

^a65 responses included.

^b18 responses included.

^c28 responses included.

^d16 responses included.

Table 2. Participant CKD and Medical Characteristics

Characteristics	Pooled (n = 98)	Dialysis (n = 20)	Nondialysis CKD (n = 59)	Transplant (n = 19)
Stage of CKD n (%)				
1-2	31 (32)	N/A	22 (37)	N/A
3-4	32 (33)	N/A	26 (44)	N/A
5, 5D	21 (21)	20 (100)	0 (0)	N/A
Unsure/no response	14 (14)	N/A	11 (19)	3 (16)
Cause of CKD n (%)				
AKI	13 (14)	1 (5)	9 (15)	3 (16)
DM	9 (9)	1 (5)	7 (12)	1 (5)
GN	33 (34)	5 (25)	22 (37)	6 (32)
Hereditary	9 (9)	6 (30)	1 (2)	2 (11)
HTN	8 (8)	1 (5)	7 (12)	0 (0)
Kidney stones/reflux	12 (12)	3 (15)	8 (14)	1 (5)
PKD	6 (6)	0 (0)	4 (7)	2 (11)
Other/unknown	8 (8)	3 (15)	1 (2)	4 (21)
Type of dialysis n (%)				
Home HD	6 (30) ^a	6 (30)	N/A	N/A
In-center HD	10 (50) ^a	10 (50)	N/A	N/A
Nocturnal HD	1 (5) ^a	1 (5)	N/A	N/A
PD	3 (15) ^a	3 (15)	N/A	N/A
HD heparin use n (%)	7 (35) ^a	7 (35)	N/A	N/A
ESA use n (%)	50 (51)	10 (50)	36 (61)	4 (21)
Needed blood transfusion n (%)	37 (38)	12 (60)	15 (25)	10 (53)
Anticoagulant use n (%)	26 (27)	8 (40)	10 (17)	8 (42)
Medical history n (%)				
Chemotherapy	5 (5)	1 (5)	4 (7)	0 (0)
Immunosuppressant use	37 (38)	8 (40)	14 (24)	15 (79)
Leuprolide use	9 (9)	3 (15)	6 (10)	0 (0)
Radiation to pelvis or abdomen	28 (29)	2 (10)	24 (41)	2 (11)
None/unsure	28 (29)	8 (40)	19 (32)	1 (5)
Gynecologic diagnosis n (%)				
Cancer of female reproductive organs	5 (5)	2 (10)	2 (3)	1 (5)
Endometriosis	26 (27)	1 (5)	23 (39)	2 (11)
History of infertility	9 (9)	2 (10)	6 (10)	1 (5)
PCOS	17 (17)	1 (5)	14 (24)	2 (11)
POI	7 (7)	3 (15)	3 (5)	1 (5)
Uterine fibroids or polyps	13 (13)	3 (15)	8 (14)	2 (11)
Other/none/unsure	43 (44)	11 (55)	21 (36)	11 (58)

Abbreviations: 5D, stage 5 dialysis; AKI, acute kidney injury; CKD, chronic kidney disease; DM, diabetes mellitus; ESA, erythropoietin-stimulating agent; GN, glomerulonephritis; HD, hemodialysis; HTN, hypertension; N/A, not applicable; PCOS, polycystic ovary syndrome; PD, peritoneal dialysis; PKD, polycystic kidney disease; POI, primary ovarian insufficiency.

^a20 responses included.

receiving dialysis, 7-8 days was the most common duration of menses, compared with 5-6 days for participants with nondialysis CKD, and 3-4 or 7-8 days for transplant participants (Fig S2). Figure 2 shows that the majority of dialysis, nondialysis CKD, and transplant participants with current menses experienced heavy menstrual bleeding, defined by the selection of at least 1 clinical indicator (ie, need to change period products at least once an hour for several hours, wear multiple period products at once, wake up at night to change period products, pass blood clots at least the size of a quarter, and menses interfering with daily activities).³³ The most

commonly used period products across all groups were pads (Fig S3). Finally, 39% (n = 30) of all participants with current menses reported they were not always able to afford period products, a condition called period poverty (Fig 3).³⁴

Sexual Activity and Fertility

Almost half of participants reported engaging in heterosexual sex (Table 4). Most of these participants reported trying to conceive, and the majority met the definition of infertility,³⁵ although very few reported receiving fertility treatments.

Table 3. Participant Menstrual Characteristics

Characteristics	Pooled (n = 98)	Dialysis (n = 20)	Nondialysis CKD (n = 59)	Transplant (n = 19)
Menarche n (%)				
Experienced menarche	88 (90)	18 (90)	52 (88)	18 (95)
Age of menarche (y)	14 ± 0.5 ^a	15 ± 2 ^b	13 ± 0 ^c	13 ± 1 ^b
Primary amenorrhea	2 (2)	1 (5)	1 (2)	0 (0)
Unsure	8 (8)	1 (5)	6 (10)	1 (5)
Menstruation n (%)				
Current menstrual cycles	77 (79)	14 (70)	49 (83)	14 (74)
Secondary amenorrhea	19 (19)	5 (25)	9 (15)	5 (26)
Skipped question	2 (2)	1 (5)	1 (2)	0 (0)
Menopause n (%)				
Yes	8 (42) ^d	2 (40) ^e	3 (33) ^f	3 (60) ^e
Median (IQR) age of last menstrual period (y)	40 (35-43) ^g	39 (35-43) ^h	41 (0-0) ⁱ	39 (15-49) ^j
No	10 (53) ^d	2 (40) ^e	6 (67) ^f	2 (40) ^e
Skipped question	1 (5) ^d	1 (20) ^e	0 (0) ^f	0 (0) ^e
Menstruation stopped and then returned n (%)				
Yes	6 (6)	6 (30)	N/A	N/A
Due to transplant	1 (14) ^k	1 (14) ^k	N/A	N/A
Due to nocturnal HD	1 (14) ^k	1 (14) ^k	N/A	N/A
Other reasons	3 (43) ^k	3 (43) ^k	N/A	N/A
Unsure	2 (29) ^k	2 (29) ^k	N/A	N/A
No	12 (12)	12 (60)	N/A	N/A
Unsure, skipped question	80 (82)	2 (10)	59 (100)	19 (100)
Learned about menstruation and CKD from n (%) ^l				
Books, magazines, or newspapers	38 (39)	6 (30)	31 (53)	1 (5)
Educational websites	58 (59)	10 (50)	36 (61)	12 (63)
Movies, podcasts, radio, or television	11 (11)	0 (0)	10 (17)	1 (5)
Nephrologist	51 (52)	13 (65)	32 (54)	6 (32)
Other health care providers	9 (9)	2 (10)	5 (8)	2 (11)
Other people living with CKD	17 (17)	3 (15)	6 (10)	8 (42)
Social media	47 (48)	7 (35)	35 (59)	5 (26)
Nowhere	5 (5)	1 (5)	2 (3)	2 (11)

Note: Values are means ± SEM where relevant.

Abbreviations: CKD, chronic kidney disease; HD, hemodialysis; IQR, interquartile range.

^a88 responses included.

^b18 responses included.

^c52 responses included.

^d19 responses included.

^e5 responses included.

^f9 response included.

^g6 responses included.

^h2 responses included.

ⁱ1 response included.

^j3 responses included.

^k7 responses included.

^lNumbers add up to more than 100% as participants were able to submit multiple responses.

Contraception

Less than half of participants in each group reported currently using contraception (Table 4). The most common reason for using contraception across all groups was to prevent pregnancy, although almost half of participants reported contraceptive use for menstrual management. In participants receiving dialysis and nondialysis-dependent CKD, the most common form of contraception was the condom, whereas the implant or injectable, intrauterine device, oral contraceptive pill, and vasectomy in the male partner were equally common within transplant participants

(Fig 4). There were 11 participants who reported more than 1 reason for not using contraception, with an average of 2.7 reasons per person. The most common reason for not using contraception among participants receiving dialysis and transplant was desired pregnancy, compared with “fear” among nondialysis CKD participants (Fig S4).

Reproductive Health Education

Participants reported gathering menstrual health and contraceptive information from nephrologists, educational websites, social media, and other people living with CKD

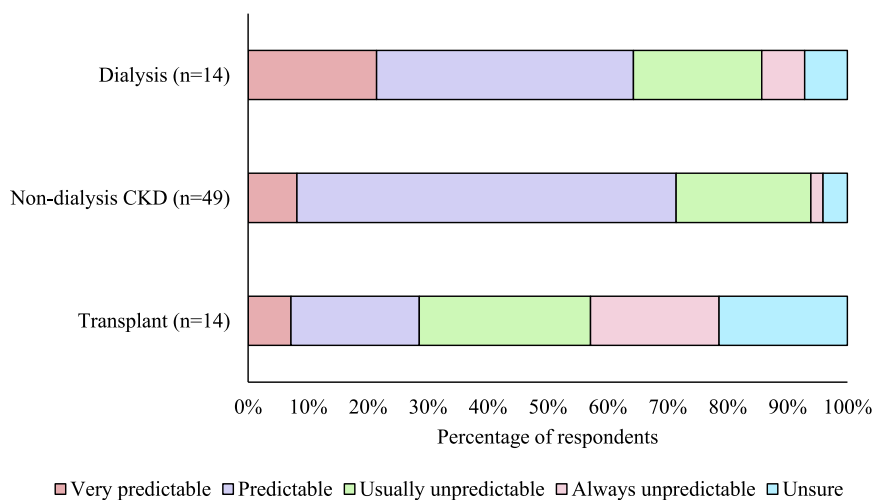


Figure 1. Predictability of periods among participants with current menses. Very predictable was defined as being able to predict menses within 0-4 days; predictable was defined as being able to predict menses within 5-7 days; unsure represents skipped, not applicable, and unsure responses. CKD, chronic kidney disease.

(Tables 3 and 4). Participants often reported discussing menstrual health and contraception with their family members, friends, gynecologist, and nephrologist but reported wishing to have more discussions with other health care providers (Fig S5).

Stage 2: Telephone Interviews

Demographics

Forty-three participants consented to be contacted for a telephone interview, although 1 subsequently declined participating and 36 did not respond to the initial email confirming their participation or to 2 reminder emails. Interviews were conducted with 6 participants, including 1 (17%) dialysis, 3 (50%) nondialysis CKD, and 2 (33%) kidney transplant participants (Table S1). Interviews lasted

40-60 minutes. Framework analysis of interviews revealed 3 major themes related to female reproductive health and CKD, supported by exemplar quotes (Table 5).

Theme 1: Abnormal Uterine Bleeding and Kidney Health

Participants described how the absence or presence of menses seemed to correlate with kidney function and overall health. Kidney transplantation was also reported to influence the regularity and flow of menstruation.

Theme 2: Decision-Making in Contraceptive Use

Interviewees reported using their preferred form of contraception based on benefits to menstrual health and

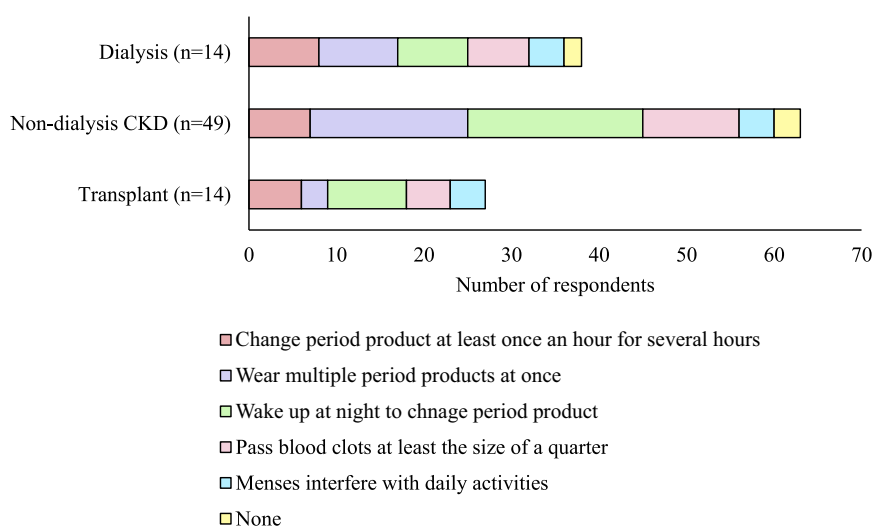


Figure 2. Clinical indicators of heavy menstrual bleeding among participants with current menses.³³ Numbers add up to more than 100% as participants were able to submit multiple responses. CKD, chronic kidney disease.

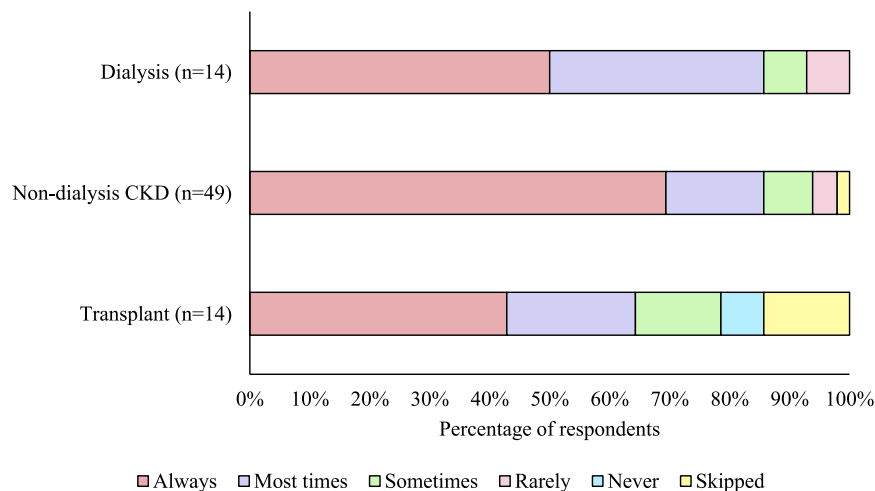


Figure 3. Ability to afford period products among participants with current menses. CKD, chronic kidney disease.

compatibility with treatment of their CKD. The oral contraceptive pill was appealing for some participants because they were already taking other oral medications. Conversely, some discussed a fear of injectable contraceptives, intrauterine devices, and the risk of pregnancy with inconsistent pill use, deterring them from these options.

Theme 3: Experience with Health Care Professionals

Participants described frustration with the perceived reluctance of health care professionals to take their abnormal menses seriously and reported a lack of holistic, multidisciplinary teams for their kidney and gynecologic concerns. Participants shared that their nephrologists recognized the importance of contraception with teratogenic medication use, but discussions around menstrual health were uncommon, and that multidisciplinary teamwork among nephrologists, gynecologists, and other health professionals was needed to improve their kidney and reproductive health.

DISCUSSION

This international mixed-methods study combined a cross-sectional survey and qualitative interviews to describe menstrual health and contraception use among reproductive-aged female individuals across all stages of CKD. Our key findings were as follows: (1) most participants reported current predictable menstrual cycles, although heavy menstrual bleeding was common; (2) a significant proportion reported absent menses; (3) period poverty was common; (4) infertility was common; and (5) while the condom was the most commonly used contraceptive, contraceptive use overall was not common, primarily because of wanting to conceive or fear. Participant interviews further revealed a desire for greater discussion of reproductive health with

nephrologists with advocacy for greater multidisciplinary care.

CKD is often accompanied by menstrual and fertility disorders because of kidney-mediated endocrine disturbances,^{22,36} although much of the literature is derived from patients with kidney failure treated with dialysis or transplantation rather than those at earlier CKD stages. In reproductive-aged female individuals treated with dialysis, secondary amenorrhea has been reported as between 42%-59% (n = 10-56).^{9,11,37} By contrast, our results suggest that most female individuals with CKD, including those treated with dialysis, have predictable menstrual cycles with heavy menstrual bleeding. Differences between our results and others may reflect differing study methodologies (eg, international survey vs single-center studies). In addition, our sample was heterogeneous given the use of various kidney replacement modalities, with a large proportion of participants being treated with nocturnal or home hemodialysis, which has been associated with the resumption of menses.^{38,39}

Notably, over a third of participants reported ever needing a blood transfusion, and half were currently using an ESA. Given the risk of antibody sensitization with blood transfusion, and venous thromboembolism and hypertension with ESA use, attention to heavy menstrual bleeding may result in improved health outcomes for female individuals with CKD. This is particularly relevant to participants using heparin with dialysis or anticoagulant medications.

Our findings align with previous work describing low contraceptive use across the spectrum of CKD, including those treated with dialysis, those with nondialysis-dependent CKD, and those with a kidney transplant.^{9,21,40} Although previous studies have reported infrequent contraceptive counseling by nephrologists or other health care providers,^{5-7,41} our results suggest a need for greater discussions around reproductive care in the

Table 4. Participants' Current Contraceptive Use

Characteristics	Pooled (n = 98)	Dialysis (n = 20)	Nondialysis CKD (n = 59)	Transplant (n = 19)
Having heterosexual sex n (%)				
Yes	45 (46)	5 (25)	35 (59)	5 (26)
No	43 (44)	12 (60)	20 (34)	11 (58)
Unsure, skipped question	10 (10)	3 (15)	4 (7)	3 (16)
Trying to get pregnant n (%)				
Yes	30 (31)	3 (15)	24 (41)	3 (16)
For <12 mo	5 (16) ^a	1 (33) ^b	2 (8) ^c	2 (50) ^d
For ≥12 mo	21 (65) ^a	2 (67) ^b	18 (72) ^c	1 (25) ^d
Skipped question	6 (19) ^a	0 (0) ^b	5 (20) ^c	1 (25) ^d
Receiving fertility treatment	1 (3) ^a	0 (0) ^b	1 (4) ^c	0 (0) ^d
Not receiving fertility treatment	31 (97) ^a	3 (100) ^b	24 (96) ^c	4 (100) ^d
No	62 (63)	16 (80)	33 (56)	13 (68)
Unsure, skipped question	6 (6)	1 (5)	2 (3)	3 (16)
Using contraception n (%)				
Yes	37 (38)	9 (45)	19 (32)	9 (47)
No	54 (55)	10 (50)	37 (63)	7 (37)
Unsure, skipped question	7 (7)	1 (5)	3 (5)	3 (16)
Reasons for using contraception n (%)				
Prevent pregnancy	27 (68) ^e	7 (78) ^f	15 (71) ^g	5 (50) ^h
Manage periods	16 (40) ^e	2 (22) ^f	10 (48) ^g	4 (40) ^h
Other, unsure	6 (15) ^e	1 (11) ^f	3 (14) ^g	2 (20) ^h
Learned about contraception and CKD from n (%)				
Books, magazines, or newspapers	38 (39)	6 (30)	31 (53)	1 (5)
Educational websites	58 (59)	10 (50)	36 (61)	12 (63)
Movies, podcasts, radio, or television	11 (11)	0 (0)	10 (17)	1 (5)
Nephrologist	51 (52)	13 (65)	32 (54)	6 (32)
Other health care providers	9 (9)	2 (10)	5 (8)	2 (11)
Other people living with CKD	17 (17)	3 (15)	6 (10)	8 (42)
Social media	47 (48)	7 (35)	35 (59)	5 (26)
Nowhere	5 (5)	1 (5)	2 (3)	2 (11)

Abbreviations: CKD, chronic kidney disease; IQR, interquartile range; N/A, not applicable.

^a32 responses included.

^b3 responses included.

^c25 responses included.

^d4 responses included.

^e40 responses included.

^f9 responses included.

^g21 responses included.

^h10 responses included.

ⁱNumbers add up to more than 100% as participants were able to submit multiple responses.

context of CKD, particularly given the literature describing sexual dysfunction among women with kidney failure.^{42,43} In one study, half of the 76 reproductive-aged women treated with dialysis reported being sexually active, but only 36% (n = 14) of those were using contraception, and only 13% (n = 5) had discussed contraception with their nephrologist.⁹ Similarly, an American retrospective cohort study of 35,732 dialysis-dependent reproductive-aged women reported that the proportion of contraceptive use was only 5.3% (n = 1,894),²¹ with the intrauterine device and oral contraceptive pills being most common. The proportion of contraceptive use in the US kidney transplant population (n = 13,150) between 2005-2014 was similarly low at

9.5% (n = 1,249), again with the oral contraceptive pill and intrauterine device being most used.⁴⁰ However, owing to the administrative nature of both of these studies,^{21,40} condom use was not captured. Among our sample, condoms were the most commonly used contraceptive, although less so among transplant recipients. While a person's sexual history and activity needs to be taken into account in contraceptive choices, this is of particular concern in the kidney transplant population given their immunosuppressed status and the higher risk of sexually transmitted infections,^{44,45} although CKD itself is also an immunosuppressed state. Many participants reported not using contraception because of wishing to conceive, which is concerning if maternal and fetal risks

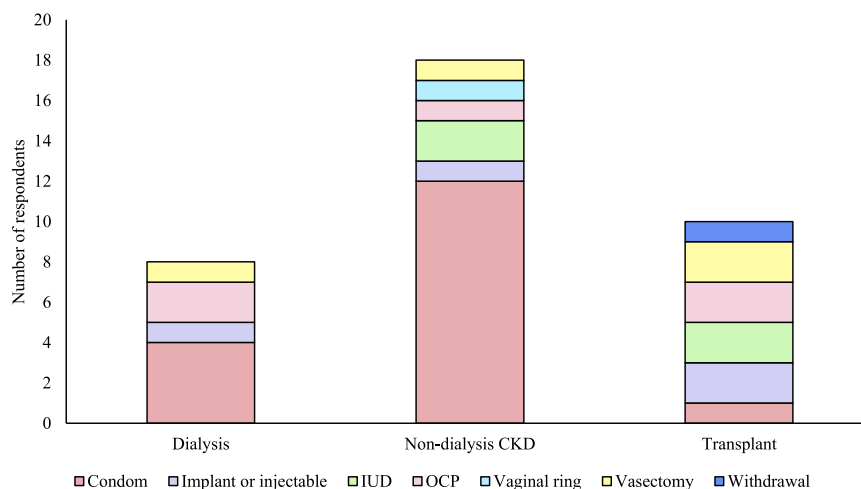


Figure 4. Contraception use among dialysis, nondialysis CKD, and transplant participants. Numbers do not add up to 100% (dialysis, n = 9; nondialysis CKD, n = 21; transplant, n = 10) as participants were able to submit multiple responses or skip this question entirely. Condom includes both female and male condoms; IUD includes both hormonal and copper IUDs; OCP includes both progestin-only and combined OCPs. CKD, chronic kidney disease; IUD, intrauterine device; OCP, oral contraceptive pill.

have not been discussed with the health care team, while others reported avoiding contraception because of fear. Our results suggest that greater discussion about contraception in routine nephrology practice is urgently warranted. The Centers for Disease Control and Prevention previously reported that ~35% (n = 25,270,000) of women aged 15-49 years were not using contraception.⁴⁶ However, our study suggests that in the female CKD population in high-income countries, contraceptive use is lower compared with the general population. Although sexual activity was low in our study sample and a majority of sexually active respondents reported actively trying to conceive, there are multiple reasons to use contraception other than pregnancy prevention, such as control of abnormal uterine bleeding and pelvic pain, treatment of acne and hirsutism, and to reduce the risk of endometrial, ovarian, and colorectal cancers.⁴⁷

CKD is associated with significant socioeconomic disparities.^{5,37} The high prevalence of period poverty and endometriosis in our study population emphasizes the importance of understanding the female-specific burdens of CKD. Period poverty includes the inability to afford period products and lost school or work hours because of menstruation.⁴⁸ Similarly, endometriosis has a negative effect on education, employment, finances, and home life, where the severity and number of symptoms are associated with reduced productivity.^{49,50} Given the financial burden associated with these conditions, coupled with the understanding that our study was inaccessible to those without internet or a device, suggests that our findings may actually be an underestimate of the true global prevalence of period poverty in individuals with CKD.

Our study has important limitations. Our data were self-reported, which may have introduced recall bias; however, previous studies found recall of menstrual and

contraceptive characteristics reliable and valid.⁵¹⁻⁵⁴ Also, our survey did not further explore specific reasons why participants were not using contraception, including if they cited fear, but results from our qualitative interviews suggest fear of unintended pregnancy with the use of oral contraceptives and fear of ill-defined nonreproductive effects of contraceptives as possible reasons. In addition, we did not collect data on participants' previous pregnancy experiences or losses, which may have had an effect on current contraceptive use. Individuals who had undergone hysterectomy or oophorectomy and those who were currently pregnant or lactating were not included in the analysis. However, the goal of this study was to determine the frequency of menstrual abnormalities and contraceptive use among those who were physiologically capable of menstruating. Furthermore, given that fertility rates in the female population with CKD are low²² and international hysterectomy rates are low in individuals aged <50 years,⁵⁵⁻⁵⁹ it is likely that very few individuals did not participate in the study because of pregnancy or hysterectomy. Snowball sampling to recruit participants may have yielded a sample that does not accurately represent all female individuals with CKD; however, while building partnerships with international patient groups during recruitment, we attempted to capture a diverse sample to improve representativeness. Furthermore, our study was unable to capture people without access to internet or a device, the survey was only available in 4 languages, and interviews were conducted only in English. Finally, the interviews were limited by the number of available participants, resulting in a low number of themes generated, although this is the only study to our knowledge that employs a mixed-methods framework to examine menstruation and contraceptive use across all stages of CKD.

Table 5. Themes Generated From Participant Interviews

Theme	Subtheme	Exemplar Quotes	Participant
Abnormal uterine bleeding and kidney health			
	Absence of menses	"...when I lost my kidney function around [age] 20... the menstruation stopped, so I have not been having periods for like I think three or four years. And... when I had a new kidney again, then the menstruation started to [come] back."	P5
		"...because of like all the medications I was starting and the fact that I got sick, and I lost a lot of weight initially... I didn't have my period for probably like six or seven months when I first got sick."	P4
	Irregular menses	"...the transplant wasn't perfect, so I still was having my ups and downs, and my period was still irregular due to the rejections and just not having a good transplant."	P1
	Heavy bleeding	"...after the kidney transplant, I started having heavy period[s], but it was too much, so [my hemoglobin levels] dropped to 7-8 [g/dL], very tiring really."	P6
		"...my periods were very sporadic. They were very heavy with large - and again TMI - very large clots... at 14... after starting dialysis after a few months."	P1
	Prolonged bleeding	"My period didn't stop let's say [for] like six, almost six months or five months. I used to have like a period for two weeks or three weeks, stopped for a few days, and come back again. That was horrible, horrible experience."	P6
Decision-making in contraceptive use			
	Reasons to use preferred form of contraception	"I really like not having a period which is probably the main reason why I have continued to have the IUD... [I]t's just nice to not have to like manage a period and... not have underwear get accidentally ruined, not have to buy period products, not have to worry about having a period like when you're on vacation or something like that... and it's also just nice for [my husband and my] sex life."	P2
		"I was on the Depo [since] before my kidney disease, and the reason I was on Depo was because I was getting periods every week for a year... I'm on birth control, but it's to control my periods, not for the birth control aspect."	P3
		"I was already taking medication every day when I started the pill, so taking a pill every day was not a big deal to me."	P4
	Reasons not to use other forms of contraception	"I don't use any other [contraception] because it scares me. There's... a shot... with hormones... I've been stabbed by needles way too much, so no needles for me... I think [the] IUD is very scary; it doesn't appeal to me."	P5
		"...with the pill... even if you're perfect about it, you still kind of worry that one day you miss [it], or something like that, right? So, there's always kind of a... low level background concern that there might be an unplanned pregnancy."	P2
Experience with health care professionals			
	Feeling frustrated	"I find with younger women... doctors, mostly, they tend to just be like, "oh, you know what women go through, it's normal", and like, this isn't normal. So, there's a lot of... stigma about... periods and we all have them."	P3
		"...the transplant nephrologists specifically... they don't know much of how the female body and your periods and the transplant medications and everything with kidneys work."	P1
		"I'm quite lucky the kidney team [is] amazing... but... it's not [an] integrated team, so they deal with kidney[s], they don't deal with period[s]."	P6

(Continued)

Table 5 (Cont'd). Themes Generated From Participant Interviews

Theme	Subtheme	Exemplar Quotes	Participant
Nephrologists' knowledge about female reproductive health issues		"...only discussion I've had with my nephrologist in terms of like birth control was him wanting to make sure I was on it and not trying to get pregnant... with the drugs that I'm taking, especially with this [cyclophosphamide]."	P2
		"...maybe the doctor should invite you... just ask, "do you have any questions about your period? Is everything all normal? Do you have pains?""	P5
Expectations of health care professionals		"...now that I have a better team like [nephrologist's name] and stuff, she does ask [period-related] questions which is a breath of fresh air but that's only one doctor out of the whole department."	P3
		"...getting educated by those professionals, the gynecologist professionals, and working as a team is really important, because that teamwork sometimes isn't there and that communication isn't always there because again, [different health care professionals] come from different worlds and they focus on different aspects of the patient's body. But coming together to work as a team, again in any aspect, is really, really important, and it makes the patient feel that they're being heard, that their concerns are valid."	P1
		"...cisgender women's endocrine system...impacts all like our health and, all in all, a ton of ways that we don't really understand... so it's probably really important for all health professionals to talk about it."	P4

This study also has several strengths. Involving individuals with CKD and kidney and gynecology health care professionals in the design and interpretation of the study ensured that the results filled a meaningful knowledge gap in nephrology. To our knowledge, this is the first study examining menstruation and contraception including female individuals across all stages of CKD rather than focusing only on those with kidney failure treated with dialysis or transplantation, but it is worth noting that this has also been examined in the glomerular disease population.^{60,61} Finally, although most participants identified as cisgender women, we collaborated with experts to have multiple gender identity options supported by definitions including the ability to self-identify to increase the inclusivity of this study. Therefore, our study population may be the most representative sample of female individuals with CKD.

In summary, this international study suggests that abnormal menstruation, infertility, and low contraceptive use are highly prevalent among reproductive-aged female individuals across the CKD spectrum. Although the physiologic explanations regarding menstrual abnormalities, infertility, and early menopause in CKD may not be fully understood, these factors are associated with poor health outcomes,⁵⁴ as is unplanned pregnancy.⁶² Given increasing recognition that menstrual and reproductive health and period poverty are important public health issues that affect morbidity, mortality, and quality of life,^{17,18,54} these topics represent an unmet need in nephrology education. However, this also serves as an opportunity for multidisciplinary teamwork to advance the reproductive health of female individuals with CKD.⁴ As such, initiating conversations with patients and reporting patient and study participant characteristics related to menstruation, period poverty, sexual health, contraception, fertility, and pregnancy would be important steps towards filling this critical knowledge gap in person-centered kidney care and research.⁴

SUPPLEMENTARY MATERIAL

Supplementary File (PDF)

Figure S1: Flow diagram of total survey respondents.

Figure S2: Duration of periods (days) among participants with current menses.

Figure S3: Period products used among participants with current menses.

Figure S4: Reasons for not using contraception.

Figure S5: People or groups that participants discussed and wished to discuss menstruation and contraception with among those receiving dialysis, not receiving dialysis, and with a current kidney transplant.

Item S1. Online survey developed on Qualtrics.

Item S2. Checklist for Reporting Results of Internet E-Surveys.²⁸

Item S3. STROBE statement—checklist of items that should be included in reports of cross-sectional studies.

Item S4. Qualitative interview guide.

Item S5. COREQ (COnsolidated criteria for REporting Qualitative research) checklist.

Table S1: Interviewee demographic characteristics.

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