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Utilisation, effectiveness, and safety of immediate postpartum intrauterine device insertion: a systematic literature review

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ABSTRACT

Background Intrauterine devices (IUDs) are highly effective contraception. IUDs inserted directly following delivery provide immediate birth control and may decrease unintended pregnancies, including short-interval pregnancies, thereby mitigating health risks and associated economic burden.

Methods This systematic literature review included published global data on the utilisation, effectiveness, and safety of postpartum intrauterine devices (PPIUDs) of any type. English language articles indexed in MEDLINE, Embase, and Cochrane from January 2010–October 2021 were included.

Results 133 articles met the inclusion criteria (46% interventional studies; 54% observational; n=87 from lower-income countries; n=46 from higher-income countries). PPIUD use was low in higher-income countries (6/10 000 US deliveries in 2013–2016) and varied widely in lower-income countries (2%-46%). Across both higher- and lower-income countries, in most studies (79%), >80% of women with PPIUDs had an IUD in place by 3 months; at 6 and 12 months, 76% and 54% of included studies reported that >80% of women had an IUD in place; reason for discontinuation was infrequently reported. Pregnancies were rare (96 pregnancies across 12 191 women from 37 studies reporting data) and were generally unrelated to device failure, but rather occurred in women no longer using a PPIUD. Expulsions occurred mainly in the early outpatient period and ranged widely (within 3 months: 0–41%). Abnormal bleeding, infections, or perforations were rare.

Conclusions PPIUDs are safe and effective. Long-term follow-up data are limited. Future research elucidating reasons underlying lack of PPIUD use is warranted.

WHAT IS ALREADY KNOWN ON THIS TOPIC

⇒ Intrauterine devices (IUDs) inserted early postpartum provide the advantage of immediate contraception.
⇒ Immediate postpartum contraception may decrease unintended pregnancies and short-interval pregnancies, potentially lessening both economic burden and poor maternal and infant health outcomes.

WHAT THIS STUDY ADDS

⇒ This systematic literature review suggests that early postpartum IUD use is effective and safe, but it is an underutilised contraceptive method in both higher- and lower-income countries.

HOW THIS STUDY MIGHT AFFECT RESEARCH, PRACTICE OR POLICY

⇒ Studies to further the understanding of reasons for low utilisation are warranted.

INTRODUCTION

Unintended pregnancy (UIP)[1 2] rates have declined over the past three decades, decreasing from 79 pregnancies per 1000 women of reproductive age worldwide from 1990 to 1994 to 64 per 1000 women from 2015 to 2019.[3] Still, approximately 121 million UIPs occur annually,[3] accounting for over half of all yearly pregnancies globally.[4] UIPs are associated with substantive individual and societal economic burden[5 6] and disproportionately occur in low-income countries and among women of colour within

the USA.[3 7] Use of long-acting reversible contraception (LARC), although more effective than other forms of birth control,[8 9] is also less prevalent in low- versus high-income countries[7] and among African American versus white US women. Intrauterine devices (IUDs) can be inserted during a caesarean delivery or immediately following a vaginal delivery, but are typically placed 4–6 weeks post-delivery.[9 10] Insertion delay mainly reflects concerns of expulsion risk. Inconsistent findings regarding expulsion risk for postpartum intrauterine devices (PPIUDs) have been reported. In two systematic literature reviews (SLRs) that included all study types, early-placed IUDs posed greater expulsion risk compared with those placed 6–8 weeks postpartum,[11 12] while an earlier Cochrane meta-analysis that included randomised controlled trial (RCT) data suggested similar occurrence of expulsions for early versus later insertion.[13] PPIUD insertion protects against short-interval pregnancy and attendant risk for poor maternal and birth outcomes.[14] Given that prior SLRs are dated, have focused solely on expulsions,[11 12] and do not include the impact of country-level economic factors on IUD use and outcomes, we sought to characterise current global evidence regarding PPIUD utilisation, safety, and effectiveness.

METHODS

The SLR methodology followed the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guidance.[15] Embase, MEDLINE, and Cochrane CDSR and CENTRAL were searched for English language publications indexed from 1 January 2010 to October 2021 meeting protocol-defined eligibility criteria (search strategy in online supplemental table 1). Bibliographies of relevant SLRs were handsearched for additional citations.

Articles were included if they met predefined PICOS (Population, Intervention, Comparison, Outcomes and Study) criteria:

- Population: Females undergoing PPIUD placement
- Intervention/comparator: No limits
- Outcomes:
  - IUD utilisation and/or safety within 12 months
  - Efficacy/effectiveness (UIPs within 18 months)
- Study design: Interventional or observational studies

Abstracts and full-text publications were independently screened by two investigators (KK, EGE), with discrepancies adjudicated by a third investigator (BAM). Data were extracted by one researcher and validated by a second researcher. The American College of Obstetricians and Gynecologists (ACOG) endorses a best practice for immediate PPIUD as placement 'in the delivery room, within 10 min of placental delivery in vaginal and caesarean births, when possible',[16] and the WHO advises insertion at <48 hours or >4 weeks. In an effort to capture all peri-delivery, in-hospital, IUD insertions we a priori defined PPIUD as that occurring up to 72 hours following delivery, while in hospital; studies describing IUD insertion as 'immediate' but without a specific timeframe reported were also included.

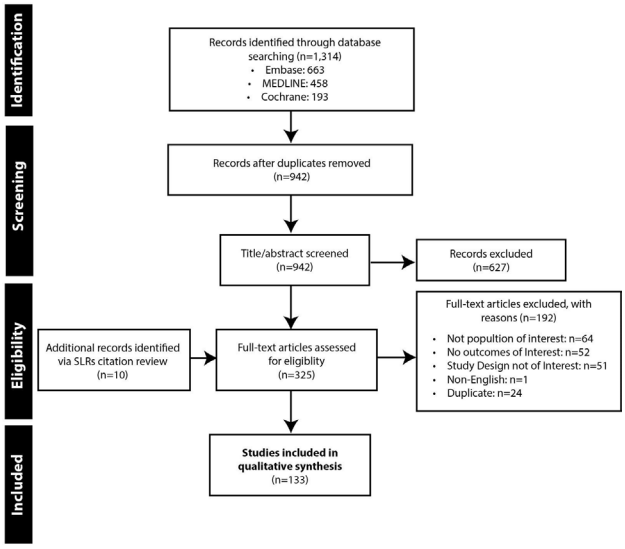

Figure 1 Study selection flow diagram. SLR, systematic literature review.

Results were qualitatively summarised within country income strata, based on 2021 World Bank classifications.[17] Groups were defined on a gross national income per capita basis using the World Bank Atlas method in 2019 US$ (per person in 1 year (2019): low income: ≤$1035; lower-middle income: $1036–$4045; upper-middle income: $4046–$12 535; high income: >$12 536).[17] Two income groups were defined: 'lower income' for low- and lower-middle-income countries and 'higher income' for upper-middle and high-income countries.

Risk of bias/quality assessment

Two investigators independently performed quality assessment of included studies using best-practices instruments[18–23]; discrepancies were adjudicated by a third investigator.

Patient and public involvement

No patient involvement.

RESULTS

Nine hundred and forty-two unique records were identified via database searches and screened; 325 full-text publications were reviewed, including 10 records identified from the SLR bibliography searches; 133 publications were included (figure 1).

Study characteristics

Slightly more than half of included studies were observational (n=72; 54%) and 46% were interventional (n=61) (online supplemental table 2). Studies were conducted worldwide, with India (n=35) and the USA (n=23) having the largest representation; data were captured between 1995–2020. Most studies (n=87) were conducted at a single centre, while 44 studies

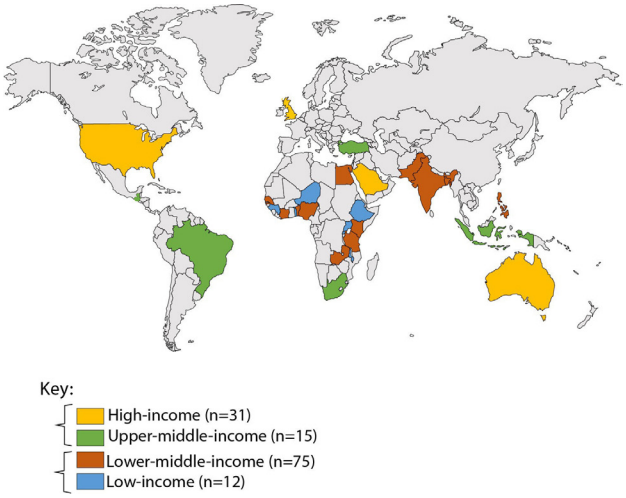

Figure 2 Geographic distribution of included studies by economic status. World Bank Country and Lending Groups Country Classification for the fiscal year 2021. Low-income economies are defined as those with a gross national income per capita of $1035 or less in 2019; lower middle-income economies are those with a gross national income per capita between $1036 and $4045; upper middle-income economies are those with a gross national income per capita between $4046 and $12 535; high-income economies are those with a gross national income per capita of $12 536 or more. *Some studies report on more than 1 country in different economic groups.

included multiple centres (2–137 sites); two studies used data from claims databases. Twelve studies were from low-income countries, 75 from lower-middle-income countries, 15 in upper-middle-income countries, and 31 studies were from high-income countries (figure 2).

Quality assessment

RCTs followed best practices for random sequence generation, with low likelihood of attrition bias; however, in three studies,[24–26] attrition information was not reported. Of the non-randomised interventional studies, 90% were good quality overall (online supplemental table 3a-e), with outcomes reliably measured and appropriate statistical analyses conducted. The main limitation in those studies was lack of a control group. In observational prospective studies, many women were lost to follow-up (only 20% of studies reported completed follow-up), with greater attrition as follow-up time increased, but despite this attrition, the studies were generally of good quality. In retrospective studies, participant eligibility and inclusion/exclusion criteria were adequately described, and valid statistical techniques were used with justification of the analyses conducted. Almost all (88%) of the cross-sectional studies were good or fair quality (30% considered good quality) with objective, standard criteria used for outcome measurement. No studies were excluded based on quality.

Population characteristics

Data from 4 200 343 women worldwide were included. Mean age ranged from 18.3 to 37.5 years. Studies in the lower-income group tended to have younger participants. Sample size across studies varied greatly, with the largest samples from lower-income countries.

The proportion of women with vaginal versus caesarean deliveries was similar across income strata.

In terms of timing of PPIUD placement across the included studies, in 125/133 (94%) IUD timing was explicitly ≤48 hours. In seven studies, while the timing was not reported in terms of hours or days, it was inferred by the timing description that insertion was within 48 hours (eg, 'immediately after childbirth', 'immediate post-pregnancy IUD placement'). In one study the IUD insertion time was potentially beyond 48 hours,[27] as the authors reported: 'Inpatient postpartum refers to insertions of IUDs and implants occurring during the same hospitalisation as a delivery up to 7 days after delivery.' Table 1 displays the definitions used in each of the 133 studies.

PPIUD utilisation

Higher-income countries

A study utilising US claims data suggested that in-hospital PPIUD insertion has increased over time (0.10/10 000 deliveries from 2001 to 2002,[28] 0.55/10 000 deliveries from 2007 to 2008,[28] and 6/10 000 from 2013 to 2016).[29] Evidence from two non-randomised interventional studies in Scotland between 2015–2019 suggested higher utilisation of PPIUD following caesarean (12.9%[30]) versus vaginal (4.7%[31]) delivery. In contrast, in a prospective observational study conducted between 2006–2008 in Guatemala, none of the women who had a caesarean delivery opted for a PPIUD compared with 0.16% of women with a vaginal delivery (table 2).[32]

Lower-income countries

Across 38 studies from lower-income countries, PPIUD utilisation ranged from 2.1%[33] of all the deliveries in Nepal during 2015–2017 to 46% of 127 women in Kenya participating in an RCT in which intensive or usual family-planning counselling was given.[34] An analysis of multiple countries in Africa found an increase in the proportion of women choosing PPIUDs over time, from 8.6% (748 of 8687 women receiving PPIUD counselling) in 2014 to 22.7% (1521 of 6707 women counselled) in 2015.[35] Likewise, in a large real-world retrospective study in India, PPIUD use increased from 4.7% (1264 of 26 678 deliveries at a single hospital) in 2010 to 21.4% (5974 of 27 939 deliveries) in 2017.[36] An analysis of PPIUD use across Sri Lanka, India, Nepal, Bangladesh, Tanzania, and Kenya revealed country-level differences in utilisation; considering all deliveries from 2014 to 2017 from participating hospitals, PPIUD use was similar in Nepal (2.1%; 2503/119 884 deliveries), Kenya (2.3%; 1651/72 340 deliveries), and Sri Lanka (2.7%; 8055/291 861 deliveries); slightly higher in Bangladesh (5.9%; 5255/87

Table 1 Sample characteristics of included studies in the global systematic literature review examining postpartum intrauterine device use and effectiveness and safety outcomes (n=133)

First author, publication year	Income category	Study arms/groups	Sample size	Age mean (SD)	Age median (range)	IUD type	Delivery type	IUD provider	IUD insertion technique	Timing of IUD insertion postpartum
Braniff, 2015[61]	High	Insertion time: 10 min	25	31.0 (4.9)	NR	Hormonal	Caesarean	Doctor/consultant/ surgeon	IUD inserter	At caesarean delivery
Boydell, 2020[62]	High	Overall	35	NR	NR	Both	Both	Any delivering obstetrical provider	NR	Within 48 hours
Chen, 2010[63]	High	Insertion time: 10 min	51	25.4 (5.3)	NR	Hormonal	Vaginal	NR	IUD inserter, ring forceps or manually	10 min
Cohen, 2016[56]	High	Overall	82	18.8 (1.6)	NR	Both	Both	NR	NR	10 min
Cole, 2019[42]	High	Overall	116	NR	26 (IQR 22–30)	Hormonal	Both	Doctor/consultant/ surgeon	Manually, ring forceps or IUD inserter	10 min
Colwill, 2018[39]	High	Delivery type: CS	73	NR	NR	Copper	Caesarean	NR	Manually	10 min
Colwill, 2018[39]	High	Delivery type: VD	137	NR	NR	Copper	Vaginal	NR	Ring forceps	10 min
Colwill, 2018[39]	High	Overall	210	28.3 (5.7)	NR	Copper	Both	NR	Ring forceps or manually	10 min
Cooper, 2020[31]	High	Overall	379	30 (NR)	NR (16–44)	Both	Vaginal	Any delivering obstetrical provider	Kelly's forceps	First 48 hours
Dahlke, 2011[64]	High	Insertion time: 10 min	15	24.8	NR	Hormonal	Vaginal	NR	Ring forceps	10 min
Dahlke, 2011[64]	High	Insertion time: 10 min to 48 hours	15	26	NR	Hormonal	Vaginal	NR	Ring forceps	10 min to 48 hours
Eggebroten, 2017[65]	High	IUD type: copper	88	NR	NR	Copper	Both	Doctor/consultant/ surgeon	NR	10 min
Eggebroten, 2017[65]	High	IUD type: hormonal	123	NR	NR	Hormonal	Both	Doctor/consultant/ surgeon	NR	10 min
Gallagher, 2019[66]	High	Overall	195	NR	NR	Both	NR	NR	NR	Intra-caesarean
Goldthwaite, 2017[67]	High	IUD type: hormonal	68	26.2 (5.3)	NR	Hormonal	Vaginal	Any delivering obstetrical provider	Ring forceps or manually	10–46 min
Goldthwaite, 2017[67]	High	IUD type: copper	55	27.4 (5.4)	NR	Copper	Vaginal	Any delivering obstetrical provider	Ring forceps or manually	10–46 min
Gonzalez, 2020[68]	High	Overall	93	31.35 (4.96)	NR	Both	Caesarean	Doctor/consultant/ surgeon	IUD inserter or ring forceps	During caesarean
Gurney, 2018[47]	High	Overall	200	27.7 (5.1)	NR	Copper	Vaginal	Any delivering obstetrical provider	Kelly's forceps, manually or ring forceps	10 min
Gurney, 2020[69]	High	Overall	109	27.9 (4.8)	NR	Copper	Caesarean	NR	NR	Intra-caesarean
Heller, 2017[30]	High	Overall	877	NR	33 (21–41)	Both	Caesarean	Doctor/consultant/ surgeon	IUD inserter	Intra-caesarean
Hinz, 2019[49]	High	Overall	114	NR	NR	Both	Both	Doctor/consultant/ surgeon	Ring forceps	10 min
Hinz, 2019[49]	High	IUD type: hormonal	75	30.3 (5.2)	NR	Both	Both	Doctor/consultant/ surgeon	Ring forceps	10 min

Continued

Table 1 Continued

First author, publication year	Income category	Study arms/groups	Sample size	Age mean (SD)	Age median (range)	IUD type	Delivery type	IUD provider	IUD insertion technique	Timing of IUD insertion postpartum
Hinz, 2019[49]	High	IUD type: copper	39	31.5 (6.2)	NR	Both	Both	Doctor/consultant/ surgeon	Ring forceps	10 min
Jatlaoui, 2014[43]	High	Overall	99	23.7 (4.6)	NR	Both	Vaginal	Doctor/consultant/ surgeon	IUD inserter or ring forceps	10 min
Levi, 2012[70]	High	Overall	90	NR	30 (NR)	Copper	Caesarean	Any delivering obstetrical provider	Ring forceps	10 min
Levi, 2015[70]	High	Overall	112	28 (5.7)	NR	Both	Caesarean	Doctor/consultant/ surgeon	Ring forceps or IUD inserter	10 min
Moniz, 2019[71]	High	Overall	396 073	NR	NR	NR	NR	NR	NR	36 hours
Ritter, 2021[72]	High	Overall	87 193	NR	NR	NR	NR	NR	NR	'Immediate postpregnancy IUD placement'
Sinkey, 2021[73]	High	Overall	159	NR	NR	NR	NR	NR	NR	10 min to discharge
Smith, 2021[27]	High	Overall	700	NR	NR	NR	NR	NR	NR	10 min to 7 days
Soon, 2018[74]	High	Overall	6	18.33 (1.03)	NR	Hormonal	Vaginal	Investigators	Manually	10 min
Stuart, 2015[38]	High	Overall	17	NR	28 (IQR 25–30)	Hormonal	Vaginal	NR	IUD inserter or ring forceps	6–48 hours
Turok, 2017[75]	High	Overall	319	NR	NR	Hormonal	Both	Doctor/consultant/ surgeon	Ring forceps or Kelly's forceps	30 min
Wallace Huff, 2021[76]	High	Overall	199	NR	NR (18–44)	NR	NR	NR	NR	Before discharge
Whitaker, 2014[55]	High	Overall	42	27.1 (6.2)	NR	Hormonal	Caesarean	Doctor/consultant/ surgeon	Ring forceps	10 min
Whiteman, 2012[28]	High	Overall	920	27.4 (NR)	NR	Both	Both	NR	NR	Before discharge
Woo, 2015[77]	High	Overall	133	27 (NR)	NR	NR	NR	NR	NR	'Immediate postpartum period'
Wu, 2020[78]	High	Overall	9561	28.4 (6.0)	NR	Both	Both	NR	NR	Before discharge
Ariadi, 2017[79]	Upper-middle	Insertion technique: non-sutured CS	44	27.75 (5.22)	NR	NR	Caesarean	NR	NR	Intra-caesarean
Ariadi, 2017[79]	Upper-middle	Insertion technique: sutured CS	44	27.95 (5.05)	NR	NR	Caesarean	NR	NR	Intra-caesarean
Çelen, 2011[58]	Upper-middle	Overall	245	26.4 (5.6)	26 (range 18–41)	Copper	Caesarean	Investigators	Ring forceps	10 min
da Silva, 2020[80]	Upper-middle	Overall	184	NR	NR	NR	Both	NR	NR	'Immediate postpartum period'
da Silva Nobrega, 2021[81]	Upper-middle	Overall	997	27.2 (6.9)	NR	Copper	Both	Doctor/consultant/ surgeon	Manually	10 min

Continued

Table 1 Continued

First author, publication year	Income category	Study arms/groups	Sample size	Age mean (SD)	Age median (range)	IUD type	Delivery type	IUD provider	IUD insertion technique	Timing of IUD insertion postpartum
Eser 2018[82]	Upper-middle	Overall	100	NR	30 (18–40)	Copper	Caesarean	Investigators	Ring forceps	10 min
Gunardi, 2021[83]	Upper-middle	Overall	94	NR	NR	Copper	Both	Doctor/consultant/ surgeon	Kelly's forceps	10 min
Hochmuller, 2020[84]	Upper-middle	Overall	124	26 (IQR 22–32)	NR	Copper	Both	Doctor/consultant/ surgeon	Manually, Foerster or De Lee Forceps	10 min to 48 hours
Kestler, 2011[85]	Upper-middle	Delivery type: CS	63 188	NR	NR	Copper	Caesarean	NR	NR	'Before hospital discharge'
Kestler, 2011[85]	Upper-middle	Delivery type: VD	155 468	NR	NR	Copper	Vaginal	NR	NR	'Before hospital discharge'
Laporte, 2020[86]	Upper-middle	IUD type: copper	70	NR	NR	Copper	Both	Doctor/consultant/ surgeon	IUD inserter or manually	10 min
Laporte, 2020[86]	Upper-middle	IUD type: hormonal	70	NR	NR	Hormonal	Both	Doctor/consultant/ surgeon	Kelly's forceps or manually	10 min
Marangoni, 2021[87]	Upper-middle	Overall	70	NR	NR	Copper	Both	NR	Kelly's forceps or manually	10 min or intracaesarean
Singata-Madliki 2016[88]	Upper-middle	Overall	123	NR	26.5 (IQR 11–22)	Copper	NR	Any delivering obstetrical provider	NR	'Inserted the IUDs according to standard protocols in the immediate postnatal period'
Sucak, 2015[89]	Upper-middle	Delivery type: CS (emergency)	47	25.3 (5.2)	NR	Copper	Caesarean	Investigators	Ring forceps	10 min
Sucak, 2015[89]	Upper-middle	Delivery type: VD	62	26.6 (4.4)	NR	Copper	Vaginal	Investigators	IUD inserter	10 min
Sucak, 2015[89]	Upper-middle	Delivery type: CS (planned)	51	27.7 (5.1)	NR	Copper	Caesarean	Investigators	Ring forceps	10 min
Trigueiro, 2021[90]	Upper-middle	Overall	828	25.9 (6.27)	NR (14–44)	Copper	Both	NR	NR	10 min to 48 hours
Unal 2018[91]	Upper-middle	Insertion technique: GyneFix	70	NR	30 (22–40)	Copper	Caesarean	Investigators	IUD inserter	10 min
Unal 2018[91]	Upper-middle	Insertion technique: sponge forceps	70	NR	32 (20–41)	Copper	Caesarean	Investigators	Sponge-holding forceps	10 min
Zaconeta, 2019[92]	Upper-middle	Overall	100	27.7 (5.6) (95% CI 26.6 to 28.7 years)	NR	Copper	Caesarean	Doctor/consultant/ surgeon	Manually	10 min

Continued

Table 1 Continued

First author, publication year	Income category	Study arms/groups	Sample size	Age mean (SD)	Age median (range)	IUD type	Delivery type	IUD provider	IUD insertion technique	Timing of IUD insertion postpartum
Abro 2018[93]	Lower-middle	Overall	220	29.66 (3.89)	NR; 95% CI 29.14 to 30.18	NR	Vaginal	NR	NR	10 min
Agarwal, 2017[94]	Lower-middle	IUD type: copper	50	22.85 (2.59)	NR	Copper	Caesarean	Investigators	Manually	Intra-caesarean
Agarwal, 2017[94]	Lower-middle	IUD type: CuT380A	50	23.4 (2.26)	NR	Copper	Caesarean	Investigators	Manually	Intra-caesarean
Agrawal, 2021[95]	Lower-middle	NR	NR	NR	NR	NR	NR	NR	NR	Within 48 hours
Akram, 2018[96]	Lower-middle	Overall	100	29.42 (3.96)	NR	NR	Caesarean	Doctor/consultant/ surgeon	NR	10 min
Alam, 2014[97]	Lower-middle	Overall	100	28.1 (4.2)	28 (21–39)	Copper	NR	NR	Manually or IUD inserter	10 min
Bayoumi, 2020[98]	Lower-middle	Overall	500	31.5 (4.3)	NR	Copper	Caesarean	Doctor/consultant/ surgeon	Ring forceps	Within 48 hours
Bhadra 2018[99]	Lower-middle	Overall	19 170	NR	NR	NR	Both	Any delivering obstetrical provider	NR	10 min
Bhat 2016[40]	Lower-middle	Insertion time: 10 min Delivery type: VD	130	NR	NR	Copper	Vaginal	NR	Kelly's forceps	10 min
Bhat 2016[40]	Lower-middle	Insertion time: 48 hours Delivery type: VD	211	NR	NR	Copper	Vaginal	NR	Kelly's forceps	10 min to 48 hours
Bhat 2016[40]	Lower-middle	Delivery type: CS	339	NR	NR	Copper	Caesarean	NR	Manually, ring forceps or IUD inserter	10 min
Bhat 2016[40]	Lower-middle	Overall	680	NR	NR	Copper	Both	NR	Kelly's forceps	10 min to 48 hours
Bhutta, 2011[45]	Lower-middle	Delivery type: CS	50	NR	NR	Copper	Caesarean	NR	Manually	10 min
Blumenthal 2018[100]	Lower-middle	Insertion technique: PPIUD inserter	241	25 (4)	NR	Copper	Vaginal	Doctor/consultant/ surgeon	IUD inserter	10 min to 48 hours
Blumenthal 2018[100]	Lower-middle	Insertion technique: Kelly forceps	239	25 (4.6)	NR	Copper	Vaginal	Doctor/consultant/ surgeon	Kelly's forceps	10 min to 48 hours
Blumenthal, 2016[101]	Lower-middle	Insertion time: 10 to 15 min	74	NR	NR	NR	NR	Trained nurse/midwife	Ring forceps or sponge-holding forceps	10 min

Continued

Table 1 Continued

First author, publication year	Income category	Study arms/groups	Sample size	Age mean (SD)	Age median (range)	IUD type	Delivery type	IUD provider	IUD insertion technique	Timing of IUD insertion postpartum
Blumenthal, 2016[101]	Lower-middle	Insertion time: 15 min to 48 hours	217	NR	NR	NR	NR	Trained nurse/midwife	Ring forceps or sponge-holding forceps	10 min to 48 hours
Blumenthal, 2016[101]	Lower-middle	Overall	305	NR	NR	NR	NR	Trained nurse/midwife	Ring forceps or sponge-holding forceps	10 min to 48 hours
Butt, 2020[102]	Lower-middle	Overall	324	NR	NR	Copper	Both	NR	NR	10 min to 48 hours
Chakheni, 2017[103]	Lower-middle	Insertion technique: Kelly forceps	50	24.5	NR	Copper	Caesarean	NR	Kelly's forceps	Intra-caesarean
Dewan, 2017[104]	Lower-middle	Vaginal	63	24.9 (3.6)	NR	Copper	Vaginal	Doctor/consultant/ surgeon	Kelly's forceps	10 min
Dewan, 2017[104]	Lower-middle	Caesarean	285	24.9 (3.6)	NR	Copper	Caesarean	Doctor/consultant/ surgeon	ring forceps	10 min
Dewan, 2019[36]	Lower-middle	Insertion time: 10 min to 48 hours	208 210	NR	NR	NR	Both	NR	NR	10 min to 48 hours
Dias, 2016[105]	Lower-middle	Delivery type: VD	60	26.4 (5.6)	NR	Copper	Vaginal	Doctor/consultant/ surgeon	Manually	Immediately after delivery
Dias, 2016[105]	Lower-middle	Delivery type: CS	31	29.7 (5.9)	NR	Copper	Caesarean	Doctor/consultant/ surgeon	Manually	Immediately after delivery
Divakar, 2019[106]	Lower-middle	Overall	66 508	24.5 (4.3)	NR	Copper	Both	Any delivering obstetrical provider	Kelly's forceps	Up to 48 hours
El Beltagy, 2011[107]	Lower-middle	IUD type: copper	150	25.27 (5.5)	NR	Copper	Vaginal	NR	Kelly's forceps	10 min to 48 hours
El Beltagy, 2011[107]	Lower-middle	IUD type: hormonal	150	25.37 (5.74)	NR	Hormonal	Vaginal	NR	Kelly's forceps	10 min to 48 hours
Elshamy, 2021[108]	Lower-middle	IUD type: copper	550	29.2 (3.4)	NR	Copper	Vaginal	NR	NR	10 min to 48 hours
Elshamy, 2021[108]	Lower-middle	IUD type: hormonal	550	29.5 (3.3)	NR	Hormonal	Vaginal	NR	NR	10 min to 48 hours
Elsedeek, 2012[109]	Lower-middle	IUD type: copper	75	31.0 (3.8)	NR	Copper	Caesarean	NR	Manually	During caesarean
Elsedeek, 2012[109]	Lower-middle	IUD type: hormonal	65	32.7 (2.7)	NR	Hormonal	Caesarean	NR	Manually	During caesarean
Elsedeek, 2015[110]	Lower-middle	IUD type: copper	63	32.3 (4.7)	NR	Copper	Caesarean	NR	Manually	During caesarean

Continued

Table 1 Continued

First author, publication year	Income category	Study arms/groups	Sample size	Age mean (SD)	Age median (range)	IUD type	Delivery type	IUD provider	IUD insertion technique	Timing of IUD insertion postpartum
Elsedeek, 2015[110]	Lower-middle	IUD type: hormonal	80	37.5 (3.3)	NR	Hormonal	Caesarean	NR	Manually	During caesarean
Eluwa 2016[111]	Lower-middle	Overall	728	NR	28 (24–32)	Copper	NR	Any delivering obstetrical provider	Kelly's forceps or manually	10 min to 48 hours
Eluwa 2016[111]	Lower-middle	Insertion technique: manual	77	NR	NR	Copper	NR	Any delivering obstetrical provider	Manually	10 min
Eluwa 2016[111]	Lower-middle	Insertion technique: Kelly forceps	223	NR	NR	Copper	NR	Any delivering obstetrical provider	Kelly's forceps	10 min to 48 hours
Fatema, 2018[112]	Lower-middle	Overall	370	NR	NR	NR	Both	NR	NR	Within 48 hours
Fatima 2018[113]	Lower-middle	Intervention: post-insertion training	16 359	NR	25.0 (21.0–28.0)	Copper	NR	NR	NR	Up to 48 hours
Fatima 2018[113]	Lower-middle	Intervention: pre-insertion training	16 359	NR	25.0 (21.0–28.0)	Copper	NR	NR	NR	Up to 48 hours
Ghafoor, 2020[114]	Lower-middle	Overall	108	26.7 (4.4)	NR	NR	NR	NR	NR	Within 48 hours
Gueye, 2013[115]	Lower-middle	Overall	59	28 (16–44)	NR	Copper	Caesarean	Any delivering obstetrical provider	Manually or IUD inserter	10 min
Gupta, 2018[116]	Lower-middle	Delivery type: VD Insertion time: 10 min to 48 hours	247	NR	NR	Copper	Vaginal	Doctor/consultant/ surgeon	Kelly's forceps	10 min to 48 hours
Gupta, 2018[116]	Lower-middle	Delivery type: CS	355	NR	NR	Copper	Caesarean	Doctor/consultant/ surgeon	NR	10 min
Gupta, 2018[116]	Lower-middle	Delivery type: VD Insertion time: up to 10 min	814	NR	NR	Copper	Vaginal	Doctor/consultant/ surgeon	Kelly's forceps	10 min
Gupta, 2015[117]	Lower-middle	Overall	150	NR	NR	Copper	Both	Any delivering obstetrical provider	Kelly's forceps	10 min
Gupta, 2014[118]	Lower-middle	Overall	100	25.21 (3.41	NR (18–35)	Copper	Both	NR	Kelly's forceps or manually	10 min
Habib, 2020[119]	Lower-middle	Delivery type: VD	60	27.6 (6.9)	NR	Copper	Vaginal	NR	NR	10 min to 48 hours
Habib, 2020[119]	Lower-middle	Delivery type: CS	60	27.6 (6.9)	NR	Copper	Caesarean	NR	NR	10 min to 48 hours
Halder 2016[120]	Lower-middle	Delivery type: CS	100	NR	NR	Copper	Caesarean	NR	Manually	10 min

Continued

Table 1 Continued

First author, publication year	Income category	Study arms/groups	Sample size	Age mean (SD)	Age median (range)	IUD type	Delivery type	IUD provider	IUD insertion technique	Timing of IUD insertion postpartum
Halder 2016[120]	Lower-middle	Delivery type: VD Insertion time: 10 min to 48 hours	10	NR	NR	Copper	Vaginal	NR	Kelly's forceps	10 min to 48 hours
Halder 2016[120]	Lower-middle	Delivery type: VD Insertion time: Up to 10 min	90	NR	NR	Copper	Vaginal	NR	Kelly's forceps	10 min
Harani, 2019[121]	Lower-middle	Delivery type: VD	127	23.6 (3.85)	NR	Copper	Vaginal	NR	Kelly's forceps	10 min
Harani, 2019[121]	Lower-middle	Delivery type: CS	127	25.1 (4.34)	NR	Copper	Caesarean	NR	Manually	10 min
Hooda, 2016[122]	Lower-middle	Overall	593	NR	NR	Copper	Both	NR	Kelly's forceps or ring forceps	Post-placental delivery or intra-caesarean
Huber-Krum, 2020[123]	Lower-middle	Date: May 2016–Apr 2018	69 210	NR	NR	NR	Both	Any delivering obstetrical provider	NR	Within 48 hours
Ifitikhar, 2019[124]	Lower-middle	Overall	372	NR	NR	NR	Both	NR	NR	Within 48 hours
Jairaj, 2016[54]	Lower-middle	Overall	370	23.70 (2.95)	NR	NR	Both	NR	Manually	After placental removal
Jakhar, 2019[125]	Lower-middle	Overall	200	24.87 (3.85)	NR	Copper	Caesarean	Doctor/consultant/ surgeon	Manually	Intra-caesarean
Kant, 2016[126]	Lower-middle	Overall	611	NR	NR	Copper	Vaginal	Trained nurse/midwife	NR	48 hours
Karra, 2017[127]	Lower-middle	Overall	13 731	28.68 (5.5)	NR	NR	Both	NR	NR	'All women who consented to receiving a PPIUD were interviewed in postnatal recovery wards'
Khan, 2018[128]	Lower-middle	Delivery type: CS	155	NR	NR	Copper	Both	Doctor/consultant/ surgeon	Manually	10 min
Khan, 2018[128]	Lower-middle	Delivery type: VD	345	NR	NR	Copper	Both	Any delivering obstetrical provider	Kelly's forceps	10 min
Khan, 2018[128]	Lower-middle	Overall	500	28.47 (8.51)	NR	Copper	Both	NR	Kelly's forceps or manually	10 min
Khan, 2020[50]	Lower-middle	Delivery type: VD	76	29.9 (5.2)	NR (20–42)	Copper	Vaginal	Doctor/consultant/ surgeon	Kelly's forceps	10 min
Khan, 2020[50]	Lower-middle	Delivery type: CD	76	29.9 (5.2)	NR (20–42)	Copper	Caesarean	Doctor/consultant/ surgeon	Ring forceps	10 min

Continued

Table 1 Continued

First author, publication year	Income category	Study arms/groups	Sample size	Age mean (SD)	Age median (range)	IUD type	Delivery type	IUD provider	IUD insertion technique	Timing of IUD insertion postpartum
Khurshid, 2020[129]	Lower-middle	Insertion time: 10 min to 48 hours	238	27.9 (9.33)	NR (19–35)	Copper	Vaginal	NR	Manually	10 min
Kumar, 2014[130]	Lower-middle	Overall	2733	24 (4)	NR	Copper	Both	NR	NR	10 min to 48 hours
Kumar, 2019[131]	Lower-middle	Delivery type: VD Insertion time: 10 min to 48 hours	141	NR	NR	Copper	Caesarean	Doctor/consultant/ surgeon	Kelly's forceps	10 min
Kumar, 2019[131]	Lower-middle	Delivery type: VD Insertion time: 10 min to 48 hours	171	NR	NR	Copper	Vaginal	Trained nurse/midwife	Kelly's forceps	10 min to 48 hours
Kumar, 2019[131]	Lower-middle	Delivery type: CS	532	NR	NR	Copper	Vaginal	Trained nurse/midwife	Kelly's forceps	10 min
Kumar, 2019[131]	Lower-middle	Overall	844	NR	NR	Copper	Both	Any delivering obstetrical provider	Kelly's forceps	10 min to 48 hours
Lerma, 2020[33]	Lower-middle	Insertion time: 10 min	93	NR	24 (19–40)	Copper	Vaginal	NR	IUD inserter or Kelly forceps	10 min
Lerma, 2020[33]	Lower-middle	Insertion time: 10 min to 48 hours	467	NR	25 (18–45)	Copper	Vaginal	NR	IUD inserter or Kelly forceps	10 min to 48 hours
Makins 2018[33]	Lower-middle	Country: India	72 195	NR	NR	Copper	Both	Doctor/consultant/ surgeon	Kelly's forceps or manually	10 min to 48 hours
Makins 2018[33]	Lower-middle	Country: Kenya	72 340	NR	NR	Copper	Both	Trained nurse/midwife	Kelly's forceps or manually	10 min to 48 hours
Makins 2018[33]	Lower-middle	Country: Tanzania	81 456	NR	NR	Copper	Both	Trained nurse/midwife	Kelly's forceps or manually	10 min to 48 hours
Makins 2018[33]	Lower-middle	Country: Bangladesh	87 951	NR	NR	Copper	Both	Doctor/consultant/ surgeon	Kelly's forceps or manually	10 min to 48 hours
Makins 2018[33]	Lower-middle	Country: Nepal	119 844	NR	NR	Copper	Both	Any delivering obstetrical provider	Kelly's forceps or manually	10 min to 48 hours
Makins 2018[33]	Lower-middle	Country: Sri Lanka	291 861	NR	NR	Copper	Both	Doctor/consultant/ surgeon	Kelly's forceps or manually	10 min to 48 hours
Makins 2018[33]	Lower-middle	Overall	725 647	NR	NR	Copper	Both	Any delivering obstetrical provider	Kelly's forceps, manually or ring forceps	10 min to 48 hours
Mani, 2018[132]	Lower-middle	Insertion time: 10 min to 48 hours	100	NR	NR	Copper	Both	Trained nurse/midwife	Kelly's forceps	10 min

Continued

Table 1 Continued

First author, publication year	Income category	Study arms/groups	Sample size	Age mean (SD)	Age median (range)	IUD type	Delivery type	IUD provider	IUD insertion technique	Timing of IUD insertion postpartum
Mani, 2018[132]	Lower-middle	Insertion time: 10 min	100	NR	NR	Copper	Both	Trained nurse/midwife	Kelly's forceps	10 min to 48 hours
Mishra, 2014[133]	Lower-middle	Overall	564	NR	NR	Copper	Both	Doctor/consultant/ surgeon	Kelly's forceps or manually	10 min
Mishra, 2017[48]	Lower-middle	Delivery type: CS	357	NR	NR	Copper	Caesarean	NR	NR	Intra-caesarean
Mishra, 2017[48]	Lower-middle	Delivery type: VD	379	NR	NR	Copper	Vaginal	NR	NR	Post-placental delivery
Mishra, 2017[48]	Lower-middle	Overall	736	NR	NR	Copper	Both	NR	NR	Post-placental delivery or intra-caesarean
Muganyizi 2018[134]	Lower-middle	Overall	40 470	NR	NR	Copper	Vaginal	Trained nurse/midwife	NR	10 min to 48 hours
Ndegwa, 2014[34]	Lower-middle	Overall	127	NR	NR	NR	NR	NR	NR	10 min
N'Guessan, 2020[46]	Lower-middle	Overall (subgroup HIV patients only)	128	NR	NR	Copper	Both	NR	NR	Post-placental delivery or intra-caesarean
Nigam 2018[135]	Lower-middle	Overall	550	NR	NR	Copper	Both	NR	NR	10 min
Nisar, 2020[136]	Lower-middle	Overall	8003	29.8 (3.7)	NR (19–40)	NR	Both	NR	NR	10 min to 24 hours
Pfitzer, 2015[137]	Lower-middle	Country: Philippines	33 900	NR	NR	Copper	Both	Any delivering obstetrical provider	Kelly's forceps	10 min to 48 hours
Pfitzer, 2015[137]	Lower-middle	Country: Pakistan	34 502	NR	NR	Copper	Both	Any delivering obstetrical provider	Kelly's forceps	10 min to 48 hours
Pfitzer, 2015[137]	Lower-middle	Country: India	1 767 880	NR	NR	Copper	Both	Any delivering obstetrical provider	Kelly's forceps	10 min to 48 hours
Pleah 2016[35]	Lower-middle	Country: Senegal	820	NR	NR	NR	Both	NR	NR	10 min to 48 hours
Pleah 2016[35]	Lower-middle	Country: Benin	2934	NR	NR	NR	Both	NR	NR	10 min to 48 hours
Pleah 2016[35]	Lower-middle	Country: Benin	4858	NR	NR	NR	Both	NR	NR	10 min to 48 hours
Pleah 2016[35]	Lower-middle	Country: Ivory Coast	6782	NR	NR	NR	Both	NR	NR	10 min to 48 hours
Pradhan, 2019[25]	Lower-middle	Overall	15 607	NR	NR	NR	Both	Doctor/consultant/ surgeon	NR	'Following delivery'

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Table 1 Continued

First author, publication year	Income category	Study arms/groups	Sample size	Age mean (SD)	Age median (range)	IUD type	Delivery type	IUD provider	IUD insertion technique	Timing of IUD insertion postpartum
Prager, 2012[138]	Lower-middle	Overall	38	NR	NR	NR	Both	Trained nurse/midwife	Ring forceps	'PPIUDs were inserted in postpartum women. Women were generally discharged after 12–24 hours, which was well within the 48- hour window recommended for PPIUD insertion'
Puri, 2020[139]	Lower-middle	Overall	75 571	NR	NR	Copper	Both	Any delivering obstetrical provider	NR	Within 48 hours
Qazi, 2020[140]	Lower-middle	Overall	6283	NR	NR	Copper	Both	NR	NR	10 min to 48 hours
Rani, 2015[141]	Lower-middle	Delivery type: VD	49	24.8 (NR)	NR (19–40)	Copper	Vaginal	Any delivering obstetrical provider	Forceps	10 min
Rani, 2015[141]	Lower-middle	Delivery type: CD	50	24.9 (NR)	NR (19–40)	Copper	Caesarean	Any delivering obstetrical provider	Forceps	10 min
Rwegoshora, 2020[142]	Lower-middle	Overall	20 276	NR	NR	Copper	Both	Any delivering obstetrical provider	NR	Within 48 hours
Shukla, 2012[143]	Lower-middle	Overall	1317	NR	NR (22–30)	Copper	Both	NR	Sponge-holding forceps	10 min
Singal, 2014[144]	Lower-middle	Overall	300	23.12 (2.42)	NR	Copper	Caesarean	NR	Ring forceps	10 min
Singal, 2021[145]	Lower-middle	Overall	4012	25.1 (NR)	NR	NR	NR	Any delivering obstetrical provider	NR	Within 48 hours
Singh 2016[146]	Lower-middle	Overall	80	NR	NR (18–37)	NR	Vaginal	Any delivering obstetrical provider	NR	10 min to 48 hours
Singh, 2021[147]	Lower-middle	Insertion technique: long inserter	292	NR	NR (range 20–40)	Copper	Vaginal	Any delivering obstetrical provider	IUD inserter (long)	10 min to 48 hours
Singh, 2021[147]	Lower-middle	Insertion technique: conventional method	301	NR	NR (range 20–40)	Copper	Vaginal	Any delivering obstetrical provider	Kelly's forceps or manually	10 min to 48 hours
Sodje, 2016[148]	Lower-middle	Overall	374	NR	38 (19–49)	Copper	Both	Any delivering obstetrical provider	Kelly's forceps	10 min
Thapa, 2020[149]	Lower-middle	Overall	29 072	NR	NR	NR	Both	NR	NR	'Immediate postpartum family planning… immediately after childbirth'

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Table 1 Continued

First author, publication year	Income category	Study arms/groups	Sample size	Age mean (SD)	Age median (range)	IUD type	Delivery type	IUD provider	IUD insertion technique	Timing of IUD insertion postpartum
Vishwakarma, 2020[150]	Lower-middle	Overall	1029	NR	NR	Copper	Caesarean	Doctor/consultant/ surgeon	Manually	10 min to 48 hours
Wasim, 2018[151]	Lower-middle	Delivery type: CS	350	NR	NR	Copper	Caesarean	Doctor/consultant/ surgeon	Manually	10 min
Wasim, 2018[151]	Lower-middle	Delivery type: VD	900	NR	NR	Copper	Vaginal	Doctor/consultant/ surgeon	Kelly's forceps	10 min
Wasim, 2018[151]	Lower-middle	Overall	3012	NR	NR	Copper	Both	Doctor/consultant/ surgeon	Kelly's forceps or manually	10 min
Weerasekera 2018[152]	Lower-middle	Overall	184 433	NR	NR	NR	Both	Doctor/consultant/ surgeon	NR	Immediately after delivery
Yadav, 2016[153]	Lower-middle	Overall	28 688	NR	NR	Copper	Both	Any delivering obstetrical provider	NR	10 min to 48 hours
Yadav, 2020[154]	Lower-middle	Overall	20 418	NR	NR	Copper	Both	NR	NR	10 min to 48 hours
Zaman, 2020[155]	Lower-middle	Overall	140	NR	NR (20–45)	Copper	NR	NR	NR	10 min to 48 hours
Ragab, 2015[26]	Lower-middle and high	Overall	120	29 (5)	NR	Copper	Caesarean	NR	IUD inserter	10 min
Bryant, 2013[156]	Low	Insertion time: 10 min to 48 hours	26	NR	26 (IQR 22–30)	Copper	Vaginal	Trained nurse/midwife	Ring forceps	10 min to 48 hours
Espey, 2021[157]	Low	Overall	12 068	28.3 (NR)	NR	Copper	Both	Any delivering obstetrical provider	NR	Postplacental
Geda, 2021[158]	Low	Overall	286	NR	NR	NR	Both	NR	NR	Within 48 hours
Ingabire, 2018[159]	Low	Overall	9020	28.3 (6.0)	NR	Copper	Both	Any delivering obstetrical provider	NR	10 min to 48 hours
Kanakuze, 2020[160]	Low	Overall	383	28.9 (4.3)	NR	Copper	Both	Trained nurse/midwife	NR	10 min to 48 hours
Lester, 2015[161]	Low	Insertion time: 10 min	34	24.6 (5.2)	NR	Copper	Caesarean	NR	Ring forceps	10 min
Melkie, 2021[162]	Low	Overall	423	29.5 (4.2)	NR	NR	Both	NR	NR	10 min to 48 hours
Ngonzi, 2021[163]	Low	Overall	167	NR	NR	Copper	Vaginal	NR	Ring forceps	10 min to 48 hours
Omona, 2020[164]	Low	Overall	202	NR	NR	Copper	Both	NR	NR	10 min to 48 hours
Pfitzer, 2015[137]	Low	Country: Ethiopia	16 389	NR	NR	Copper	Both	Any delivering obstetrical provider	Kelly's forceps	10 min to 48 hours
Pfitzer, 2015[137]	Low	Country: Guinea	20 699	NR	NR	Copper	Both	Any delivering obstetrical provider	Kelly's forceps	10 min to 48 hours

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Table 1 Continued

First author, publication year	Income category	Study arms/groups	Sample size	Age mean (SD)	Age median (range)	IUD type	Delivery type	IUD provider	IUD insertion technique	Timing of IUD insertion postpartum
Pfitzer, 2015[137]	Low	Country: Rwanda	NR	NR	NR	Copper	Both	Any delivering obstetrical provider	Kelly's forceps	10 min to 48 hours
Pleah 2016[35]	Low	Country: Niger	NR	NR	NR	NR	Both	NR	NR	10 min to 48 hours
Pleah 2016[35]	Low	Country: Togo	NR	NR	NR	NR	Both	NR	NR	10 min to 48 hours
Wayessa, 2020[165]	Low	Non-randomised intervention	471	NR	NR	NR	NR	Any delivering obstetrical provider	NR	Up to 48 hours
Wayessa, 2020[165]	Low	Non-randomised intervention	237	NR	NR	NR	NR	Any delivering obstetrical provider	NR	Up to 48 hours

CD, caesarean delivery; CS, caesarean section; IUD, intrauterine device; NR, not reported; PPIUD, postpartum intrauterine device; VD, vaginal delivery.

951 deliveries); and much higher in India (23%; 16 643/72 195 deliveries) (table 2).[33]

Continuation of IUD use within 3, 6, and 12 months postpartum

Continuation of IUD use over the 12 months following immediate PPIUD insertion was reported in 67 studies and appeared similar across country-level income groups. The proportion of women with PPIUDs in place at early follow-up periods tended to be high, with a decrease by 12 months. In 41 of 52 (79%) studies, regardless of income group, >80% of women still had their IUD in place by 6 weeks to 3 months post-insertion; by 6 and 12 months, the proportion of studies reporting that >80% of women had their IUD in place was 76% (35 of 46 studies) and 54% (13 of 24 studies), respectively. However, only 24 studies reported utilisation beyond 6 months (table 2).

Higher-income countries

Across 16 studies from higher-income countries, 44–100% of women who had an immediate PPIUD inserted continued to have an IUD at 6 weeks to 3 months post-insertion (in 14 of 16 studies, >80% of women had an IUD in place between 6 weeks and 3 months). Across 24 studies, IUD utilisation at 6 months post-insertion ranged from 56–100%. Across the 11 studies from higher-income countries in which it was reported, IUD utilisation at 12 months ranged from 29–87%.

Lower-income countries

Across 36 studies from lower-income countries, 44–99% of women who had an immediate PPIUD continued to have an IUD at 6 weeks to 3 months following insertion (in 27 of 36 studies, >80% of women had an IUD in place for 6 weeks to 3 months). Across 22 studies, IUD utilisation at 6 months post-insertion ranged from 75–97%. Across the 13 studies from lower-income countries in which it was reported, IUD utilisation at 12 months ranged from 60–97%.

PPIUD effectiveness

Pregnancies following PPIUD insertion were reported in only 37 studies, and only two studies had follow-up data up to 18 months; the remaining studies reported pregnancies occurring by 12 (n=11), 6 (n=17), and 3 (n=7) months following PPIUD insertion. Across 15 studies from higher-income countries, including a total of 2516 women with a PPIUD, 60 pregnancies occurred and appeared to arise following IUD removal rather than device failure. Across 22 studies from lower-income countries in which pregnancies were reported, 36 pregnancies occurred among 9675 women who received PPIUDs. Similar to higher-income countries, pregnancies following PPIUD placement were more

Table 2 Postpartum intrauterine device use utilisation and continued use at 3, 6, and 12 months post-insertion

First author, publication year	Study design	Data source standard	Country	Years of data collection	Sample size	IUD type	Delivery type	Utilisation (%)	IUD in at 3 months	IUD in at 6 months	IUD in at 12 months
Higher-Income											
Kestler, 2011[85]	Prospective observational	Multicentre (n=34)	Guatemala	2006–2008	63 188	Copper	Caesarean	0	NR	NR	NR
Kestler, 2011[85]	Prospective observational	Multicentre (n=34)	Guatemala	2006–2008	155 468	Copper	Vaginal	0.16	NR	NR	NR
Moniz, 2019[71]	Retrospective	Claims database	USA	2013–2016	396 073	NR	NR	0.06	NR	NR	NR
Whiteman, 2012[28]	Retrospective	Claims database	USA	2001–2008	920	Both	Both	2001–2001: 0.10 per 10 000 deliveries. 2007–2008: 0.55 per 10 000 deliveries P for trend: <0.01	NR	NR	NR
Ritter, 2021[72]	Retrospective	The Kids' Inpatient Database, HCUP	USA	2016	87 193	NR	NR	1.3% (4.3% had IUD or implant)	NR	NR	NR
Sinkey, 2021[73]	Retrospective	Single centre	USA	2015–2019	159	NR	NR	Pre-LARC programme: 1.6%; post-LARC programme: 10.4%	NR	NR	NR
Cooper, 2020[31]	Non-randomised intervention	Multicentre (n=2)	UK (Scotland)	2017–2019	379	Both	Vaginal	4.7	88%	84%	80%
Wu, 2020[78]	Retrospective	Single centre	USA	2015–2016	9561	Both	Both	6.2	NR	NR	NR
Cole, 2019[42]	Retrospective	Single centre	USA	2016–2017	116 IUDs (out of 1506 deliveries)	Hormonal	Both	7.7	NR	77%	NR
Wallace Huff, 2021[76]	Prospective observational	Single centre	USA	2015	199	NR	NR	12	91.6	87.5	NR
Heller, 2017[30]	Non-randomised intervention	Multicentre (n=2)	UK (Scotland)	2015–2016	877	Both	Caesarean	Consented: 13.7 Inserted: 12.9	At 6 weeks: 111/120 (99%)	99%	72%
Trigueiro, 2021[90]	Retrospective	Single centre	Brazil	2016–2017	828	Copper	NR	27.9 (of women who received IUDs)	NR	NR	NR
Smith, 2021[27]	Cross-sectional	Multicentre (n=NR)	USA	2015–2017	5648	NR	NR	700/5,648=12.4 (note: includes IUDs and implants)	NR	NR	NR
da Silva, 2020[80]	Cross-sectional	Single centre	Brazil	2018	184	NR	Both	46	NR	NR	NR
da Silva Nobrega, 2021[81]	Non-randomised intervention	Single centre	Brazil	2017–2018	997	Copper	Both	70.7	Of 574 at 45–90 days visit: 84.8%	Of 371 at 6–9 months visit: 99.4%	NR
Colwill, 2018[39]	Retrospective	Single centre	USA	2014–2015	210	Copper	Both	NR	At 6 weeks: 89%	NR	NR

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Table 2 Continued

First author, publication year	Study design	Data source standard	Country	Years of data collection	Sample size	IUD type	Delivery type	Utilisation (%)	IUD in at 3 months	IUD in at 6 months	IUD in at 12 months
Gurney, 2018[47]	Prospective observational	Single centre	USA	2015–2017	200	Copper	Vaginal	NR	75% (112/149 patients who completed visit had IUDs in place and correctly positioned at 6 weeks)	56% (90/162 patients who completed visit had IUD in place and correctly positioned)	
Goldthwaite, 2017[67]	Prospective observational	Multicentre (n=2)	USA	2014–2015	55	Copper	Vaginal	NR	93%	NR	NR
Goldthwaite, 2017[67]	Prospective observational	Multicentre (n=2)	USA	2014–2015	68	Hormonal	Vaginal	NR	80%	NR	NR
Levi, 2012[70]	Prospective observational	Multicentre (n=2)	USA	2008–2009	90	Copper	Caesarean	NR	NR (6 weeks: 100%)	100%	NR
Dahlke, 2011[64]	RCT	Single centre	USA	2009–2013	15	Hormonal	Vaginal	N/A	87%	87%	NR
Dahlke, 2011[64]	RCT	Single centre	USA	2009–2013	15	Hormonal	Vaginal	N/A	93%	93%	NR
Gunardi, 2021[83]	Prospective observational	Single centre	Indonesia	2018–2019	94	Copper	Both	NR	93.1	98.6	NR
Levi, 2015[37]	RCT	Single centre	USA	2012–2014	112	Both	Caesarean	N/A	NR	83%	NR
Hinz, 2019[49]	Prospective observational	Single centre	USA	2016–2018	114	Both	Both	NR	NR	94%	NR
Cohen, 2016[56]	Prospective observational	Single centre	USA	2010–2011	82	Both	Both	NR	NR	71% (49/69 patients with 6 month follow-up)	76% (51/67 patients with 12 month follow-up)
Eggebroten, 2017[65]	Prospective observational	Single centre	USA	2013–2016	88	Copper	Both	NR	NR	83%	NR
Eggebroten, 2017[65]	Prospective observational	Single centre	USA	2013–2016	123	Hormonal	Both	NR	NR	81%	NR
Woo, 2015[77]	Prospective observational	Single centre	USA	2011–2012	133	NR	NR	NR	NR	91%	81%
Gonzalez, 2020[68]	Prospective observational	Multicentre (n=2)	USA	2013–2017	93	Both	Caesarean	NR	NR	NR	76%
Chen, 2010[63]	RCT	Single centre	USA	2007–2008	51	Hormonal	Vaginal	N/A	NR	74%	NR
Soon, 2018[74]	RCT	Single centre	USA	2013–2015	6	Hormonal	Vaginal	N/A	NR	67%	NR
Whitaker, 2014[55]	RCT	Single centre	USA	2007–2011	42	Hormonal	Caesarean	N/A	NR	70%	60%
Stuart, 2015[38]	RCT	Single centre	USA	2012–2013	17	Hormonal	Vaginal	N/A	NR	NR	29% (within 8 months)
Zaconeta, 2019[92]	Prospective observational	Single centre	Brazil	2012–2013	100	Copper	Caesarean	NR	At 6 weeks: 91%	84%	NR
Çelen, 2011[58]	Non-randomised intervention	Single centre	Turkey	2006–2008	245	Copper	Caesarean	NR	NR (6 weeks: 93%)	82%	62%
Sucak, 2015[89]	Non-randomised intervention	Single centre	Turkey	2009–2012	51	Copper	Caesarean (planned)	NR	NR	NR	87%
Sucak, 2015[89]	Non-randomised intervention	Single centre	Turkey	2009–2012	62	Copper	Vaginal	NR	NR	NR	77%

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Table 2 Continued

First author, publication year	Study design	Data source standard	Country	Years of data collection	Sample size	IUD type	Delivery type	Utilisation (%)	IUD in at 3 months	IUD in at 6 months	IUD in at 12 months
Sucak, 2015[89]	Non-randomised intervention	Single centre	Turkey	2009–2012	47	Copper	Caesarean (emergent)	NR	NR	NR	84%
Unal 2018[91]	RCT	Single centre	Turkey	2016–2017	70	Copper (IUD inserter)	Caesarean	N/A	NR	At median 96 days: 88%	NR
Unal 2018[91]	RCT	Single centre	Turkey	2016–2017	70	Copper (sponge-holding forceps)	Caesarean	N/A	NR	At median 96 days: 79%	NR
Laporte, 2020[86]	RCT	Single centre	Brazil	2018–2019	70	Copper	Both	N/A	Vaginal delivery: 44% Caesarean delivery: 65%	NR	NR
Laporte, 2020[86]	RCT	Single centre	Brazil	2018–2019	70	Hormonal	Both	N/A	Vaginal delivery: 60% Caesarean delivery: 89%	NR	NR
Braniff, 2015[61]	RCT	Single centre	Australia	2011–2012	25	Hormonal	Caesarean	N/A	NR	96%	NR
Lower income											
Makins 2018[33]	Non-randomised intervention	Multicentre (n=6)	Nepal	2016–2017	119 844	Copper	Both	2.1	6 weeks: 93%	NR	NR
Puri, 2020[166]	RCT (same data source as Huber-Krum, 2020)	Multicentre (n=6)	Nepal	Sep 2015–Mar 2017	75 571	Copper	Both	2	81.5	NR	68.8
Huber-Krum, 2020[123]	RCT (same data source as Puri, 2020)	Multicentre (n=6)	Nepal	2016–2018	69 210	NR	Both	2.2	NR	NR	NR
Makins 2018[33]	Non-randomised intervention	Multicentre (n=NR)	Sri Lanka	2015–2017	291 861	Copper	Both	2.7	6 weeks: 96%	NR	NR
Makins 2018[33]	Non-randomised intervention	Multicentre (n=6)	Tanzania	2015–2017	81 456	Copper	Both	3.2	6 weeks: 92%	NR	NR
Dasanayake, 2020[167]	Retrospective	Single centre	Sri Lanka	2014–2019	14 051	NR	Both	3.4	NR	NR	80%
Weerasekera 2018[152]	Non-randomised intervention	Multicentre (n=18)	Sri Lanka	2014–2017	184 433	NR	Both	3.7%	NR (4–6 weeks: 93%)	NR	NR
Pfitzer, 2015[137]	Cross-sectional	Multicentre (n=NR)	Ethiopia	2012–2013	16 389	Copper	Both	3.8	NR	NR	NR
Dewan, 2019[36]	Retrospective	Single centre	India	2010–2017	208 210	NR	Both	2010: 4.7 2011: 5.03 2012: 6.7 2013: 7.6 2014: 13.4 2015: 17.2 2016: 17.7 2017: 21.4	NR	NR	NR

Continued

Table 2 Continued

First author, publication year	Study design	Data source standard	Country	Years of data collection	Sample size	IUD type	Delivery type	Utilisation (%)	IUD in at 3 months	IUD in at 6 months	IUD in at 12 months
Melkie, 2021[162]	Cross-sectional	Multicentre (n=4)	Ethiopia	2019	423	NR	Both	4.0	NR	NR	NR
Agrawal, 2021[95]	Non-randomised intervention	Single centre	India	2019–2020	NR	NR	NR	4.5–35% over a year and a half time of a PPIUD quality improvement initiative to increase the PPIUD coverage	NR	NR	NR
Wayessa, 2020[165]	Non-randomised intervention	Multicentre (n=NR)	Ethiopia	2017	No PPIUD counselling: 471 PPIUD counselling: 237	NR	NR	No PPIUD counselling: 4.8 PPIUD counselling: 12.4	NR	NR	NR
Karra, 2017[127]	Cross-sectional	Multicentre (n=NR)	Sri Lanka	2015–2015	13 731	NR	NR	4.9	NR	NR	NR
Makins 2018[33]	Non-randomised intervention	Multicentre (n=48)	Sri Lanka, India, Nepal, Bangladesh, Tanzania, Kenya	2014–2017	725 647	Copper	Both	Consent: 5.1 Inserted: 5.0	6 weeks: 96%	NR	NR
Thapa, 2020[149]	Cross-sectional	Multicentre (n=7)	Nepal	2018–2019	29 072	NR	NR	5.4	NR	NR	NR
Rwegoshora, 2020[142]	Non-randomised intervention	Multicentre (n=6)	Tanzania	Dec 2017–Apr 2018	20 276	Copper	Both	5.5	NR	NR	86 (note: only 46% of sample available at 1 year)
Muganyizi 2018[134]	Prospective observational	Multicentre (n=6)	Tanzania	2016–2017	40 470	Copper	Vaginal	5.8%	NR (6 weeks: 94%)	NR	NR
Fatima 2018[113]	Non-randomised intervention	Multicentre (n=6)	Bangladesh	2017	16 359	Copper	NR	Inserted: 6.5 Consent: 9.5	NR (4–6 weeks: 98.2%)	NR	NR
Pleah 2016[35]	Cross-sectional	Multicentre (n=5)	Benin, Ivory Coast, Niger, Senegal, Togo	2014–2015	15 394	NR	Both	2014: 8.6 2015: 22.7	NR	NR	NR
Nigam 2018[135]	Non-randomised intervention	Single centre	India	2013	550	Copper	Both	9.1	NR	NR	NR
Pradhan, 2019[25]	RCT	Multicentre (n=6)	Nepal	2015–2017	15 607	NR	Both	10.8	NR	NR	NR
Pfitzer, 2015[137]	Cross-sectional	Multicentre (n=NR)	Guinea	2011–2013	20 699	Copper	Both	11.8	NR	NR	NR
Butt, 2020[102]	Prospective observational	Single centre	Pakistan	2016–2018	324	Copper	Both	15.4	NR	NR	88.8
Qazi, 2020[140]	Prospective observational	Single centre	Pakistan	2018–2019	6283	Copper	Both	15.9	NR	NR	NR
Omona, 2020[164]	Retrospective	Single centre	Uganda	2018	202	Copper	Both	16.3	NR	NR	NR

Continued

Table 2 Continued

First author, publication year	Study design	Data source standard	Country	Years of data collection	Sample size	IUD type	Delivery type	Utilisation (%)	IUD in at 3 months	IUD in at 6 months	IUD in at 12 months
Mishra, 2014[133]	Non-randomised intervention	Single centre	India	2012–2013	564	Copper	Both	17.6	NR	81	NR
Halder, 2016[120]	Non-randomised intervention	Single centre	India	2012–2013	100	Copper	Caesarean	17.9	NR (6 weeks: 99%)	97%	96%
Yadav, 2020[154]	Retrospective	Single centre	India	2013–2019	20 418	Copper	Both	18.4	NR	NR	NR
Halder, 2016[120]	Non-randomised intervention	Single centre	India	2012–2013	10	Copper	Vaginal	Inserted: 18.2 Consent: 32.7	NR	NR	NR
Halder, 2016[120]	Non-randomised intervention	Single centre	India	2012–2013	90	Copper	Vaginal	19.2	NR (6 weeks: 97%)	94%	92%
Jairaj, 2016[54]	Non-randomised intervention	Single centre	India	2015–2015	370	NR	Both	19.7	NR (at 6 weeks: 43.5%)	NR	NR
Nisar, 2020[136]	Retrospective	Single centre	Pakistan	2014–2016	8003	NR	Both	25.1	NR	NR	NR
Divakar, 2019[106]	Non-randomised intervention	Multicentre (n=6)	India	2015–2017	66 508	Copper	Both	25.5	NR	NR	NR
Geda, 2021[158]	Cross-sectional	Multicentre (n=13)	Ethiopia	2019	286	NR	Both	26.6	NR	NR	NR
Espey, 2021[157]	Non-randomised intervention	Multicentre (n=6)	Rwanda	2017–2018	12 068	Copper	Both	27.9	NR	NR	NR
Kanakuze, 2020[160]	Cross-sectional	Single centre	Rwanda	2019–2019	383	Copper	Both	28.1	NR	NR	NR
Ingabire, 2018[159]	Non-randomised intervention	Multicentre (n=2)	Rwanda	2017–2018	9020	Copper	Both	28.5	NR	NR	NR
Ghafoor, 2020[114]	Cross-sectional	Single centre	Pakistan	2019–2019	108	NR	NR	32.5	NR	NR	NR
Fatema, 2018[112]	Non-randomised intervention	Single centre	Bangladesh	2013–2013	370	NR	Both	35.7	NR	NR	NR
Bhadra 2018[99]	Prospective observational	Single centre	India	2015–2017	19 170	NR	Both	37.4	NR (at 6 weeks: 93.7%)	NR	NR
Wasim, 2018[151]	Non-randomised intervention	Single centre	Pakistan	2015–2017	8000	Copper	Both	37.6	NR	NR	NR
Kant, 2016[126]	Retrospective	Multicentre (n=2)	India	2014–2014	611	Copper	Vaginal	38.9	NR	NR	NR
Eluwa 2016[111]	Cross-sectional	Multicentre (n=11)	Nigeria	2014–2015	728	Copper	NR	41	NR	NR	NR
Ndegwa, 2014[34]	RCT	Single centre	Kenya	NR	127	NR	NR	45.7	NR (6 weeks: 98.3%)	NR	NR
Vishwakarma, 2020[150]	Non-randomised intervention	Single centre	India	2016–2019	1029	Copper	Caesarean	NR	NR (6 weeks: 98.3%)	88.7	NR
Lerma, 2020[33]	Cross-sectional	Multicentre (n=5)	India	2015–2016	93	Copper	Vaginal	NR	NR (6–8 weeks: 83%)	NR	NR

Continued

Table 2 Continued

First author, publication year	Study design	Data source standard	Country	Years of data collection	Sample size	IUD type	Delivery type	Utilisation (%)	IUD in at 3 months	IUD in at 6 months	IUD in at 12 months
Lerma, 2020[33]	Cross-sectional	Multicentre (n=5)	India	2015–2016	467	Copper	Vaginal	NR	NR (6–8 weeks: 77%)	NR	NR
Ngonzi, 2021[163]	Prospective observational	Single centre	Uganda	2014–2015	167	Copper	Vaginal	NR	NR (6–8 weeks: 91%)	NR	NR
Khurshid, 2020[129]	Prospective observational	Single centre	India	2015–2016	238	Copper	Vaginal	NR	NR (at 6 weeks: 96%)	97%	94%
Jakhar, 2019[125]	Prospective observational	Single centre	India	2013–2014	200	Copper	Caesarean	NR	NR (at 6 weeks: 'wanted to continue': 89%)	'Wanted to continue': 82%	NR
Blumenthal, 2018[100]	RCT	Multicentre (n=5)	India	2015–2016	239	Copper (Kelly's forceps)	Vaginal	N/A	NR (6–8 weeks: 84%)	NR	NR
Blumenthal, 2018[100]	RCT	Multicentre (n=5)	India	2015–2016	241	Copper (IUD inserter)	Vaginal	N/A	NR (6–8 weeks: 72%)	NR	NR
Mishra, 2017[48]	Retrospective	Single centre	India	2010–2012	736	Copper	Both	NR	NR (at 4 weeks: 94%)	NR	79%
Chakheni, 2017[103]	Non-randomised intervention	Single centre	India	2013–2014	50	Copper (manual insertion)	Caesarean	NR	94%	NR	NR
Chakheni, 2017[103]	Non-randomised intervention	Single centre	India	2013–2014	50	Copper (Kelly's forceps)	Caesarean	NR	92%	NR	NR
Singh, 2016[146]	Non-randomised intervention	Multicentre (n=2)	India	2015–2015	80	NR	Vaginal	NR	NR (6–8 weeks: 76.3%)	NR	NR
Dias, 2016[105]	Prospective observational	Single centre	Sri Lanka	2012–2013	60	Copper	Vaginal	NR	NR (at 6 weeks: 75%)	NR	NR
Dias, 2016[105]	Prospective observational	Single centre	Sri Lanka	2012–2013	31	Copper	Caesarean	NR	NR (at 6 weeks: 74%)	NR	NR
Singal, 2014[144]	Prospective observational	Single centre	India	2012–2012	300	Copper	Caesarean	NR	98%	96%	91%
Khan, 2020[50]	RCT	Single centre	Pakistan	2019–2020	152	Copper	Both	NR	NR	97	NR
Bryant, 2013[156]	RCT	Single centre	Malawi	2010–2011	12	Copper	Vaginal	N/A	83%	NR	NR
Shukla, 2012[143]	Prospective observational	Single centre	India	1995–2000	1317	Copper	Both	NR	NR (4–6 weeks: 80%	NR	NR
Bhutta, 2011[45]	Cross-sectional	Single centre	Pakistan	2006–2007	50	Copper	Caesarean	NR	92% (willingness to continue)	82% (willingness to continue)	NR
El Beltagy, 2011[107]	RCT	Single centre	Egypt	NR	150	Copper	Vaginal	N/A	At 6 weeks: 97%	At 6 months: 94%	NR
El Beltagy, 2011[107]	RCT	Single centre	Egypt	NR	150	Hormonal	Vaginal	N/A	At 6 weeks: 98%	At 6 months: 94%	NR
Elsedeek, 2015[110]	Non-randomised intervention	Single centre	Egypt	2006–2011	80	Hormonal	Caesarean	NR	NR (at 6 weeks, centrally placed: 54%)	NR	NR
Elsedeek, 2015[110]	Non-randomised intervention	Single centre	Egypt	2006–2011	63	Copper	Caesarean	NR	NR (at 6 weeks, centrally placed: 65%)	NR	NR
Singal, 2021[145]	Cross-sectional	Multicentre (n=20)	India	2019	4012	NR	NR	NR	78.5	74.5	70.7

Continued

Table 2 Continued

First author, publication year	Study design	Data source standard	Country	Years of data collection	Sample size	IUD type	Delivery type	Utilisation (%)	IUD in at 3 months	IUD in at 6 months	IUD in at 12 months
Zaman, 2020[155]	Non-randomised intervention	Single centre	Pakistan	2015	140	Copper	NR	NR	NR	84	NR
Elshamy, 2021[108]	Non-randomised intervention	Single centre	Egypt	2018–2019	1100	Both	Vaginal	NR	NR	88	NR
Rani, 2015[141]	Non-randomised intervention	Single centre	India	NR	99	Copper	Both	NR	NR	92.9	NR
Elsedeek, 2012[109]	Non-randomised intervention	Multicentre (n=3)	Egypt	2007–2009	65	Hormonal	Caesarean	NR	NR	NR	97%
Elsedeek, 2012[109]	Non-randomised intervention	Multicentre (n=3)	Egypt	2007–2009	75	Copper	Caesarean	NR	NR	NR	88%
Bhat 2016[40]	Non-randomised intervention	Single centre	India	2011–2014	680	Copper	Both	N/A	NR	86%	NR
Abro 2018[93]	Non-randomised intervention	Single centre	Pakistan	2016–2017	220	NR	NR	NR	NR	91%	NR
Bhat, 2016[40]	Non-randomised intervention	Single centre	India	2011–2014	339	Copper	Caesarean	NR	NR	96%	NR
Bhat, 2016[40]	Non-randomised intervention	Single centre	India	2011–2014	130	Copper	Vaginal	NR	NR	78%	NR
Bhat, 2016[40]	Non-randomised intervention	Single centre	India	2011–2014	211	Copper	Vaginal	NR	NR	75%	NR
Blumenthal, 2016[101]	Prospective observational	Single centre	Zambia	2010	305	NR	NR	NR	NR	94%	NR
Lester, 2015[161]	RCT	Single centre	Uganda	2011	34	Copper	Caesarean	N/A	NR	ITT: 79%; with 6 month follow-up data: 93% (7/29)	NR
Kumar, 2019[131]	Retrospective	Multicentre (n=12)	India	2015	844	Copper	Both	NR	NR	NR	63% (60–68% depending on subgroup)

ITT, intent-to-treat; IUD, intrauterine device; LARC, long-acting reversible contraception; N/A, not applicable; NR, not reported; PPIUD, postpartum intrauterine device; RCT, randomised controlled trial.

commonly associated with subsequent removal, not device failure (online supplemental table 4).

PPIUD expulsions

Across studies from both higher-income and lower-income countries, data on expulsions (either partial or complete) were most often reported at 6–8 weeks following PPIUD insertion. In our synthesis we categorised expulsions occurring by 3, 6, and 12 months. Across the 137 arms in which expulsions were reported, most (102/137 (74%)) were reported by ≤3 months; in 59 and 23 study arms, expulsions occurring by 6 months and 12 months, respectively, were reported. Only 11 studies reported all three time points, allowing for a direct comparison in expulsion timing. From those 11 studies, results suggested expulsions occur earlier rather than later after insertion. Specifically, the proportion of women with expulsions ranged from 0–23% by 3 months compared with 0–14.5% and 0–11.3% by 6 and 12 months, respectively. Corroborating those results, the data from all study arms (ie, including those in which all three time points were not reported in the same study) also suggested a greater proportion of expulsions by 3 months (0–46.2%) versus 6 (0–26.7%) and 12 months (0–11.3%) (online supplemental tables 5 and 6).

Safety

PPIUDs were associated with infrequent occurrence of abnormal bleeding, uterine infections, or perforations.

Abnormal bleeding

Definitions and severity of bleeding events following PPIUD insertion varied across studies and included spotting to haemorrhage. Bleeding complications following PPIUD insertion were infrequent across the 42 studies in which they were reported; most studies reported occurrences in <10% of women. Bleeding complications appeared more frequent in lower- versus higher-income countries.

Higher-income countries

Bleeding complications were reported in 11 studies (three RCT, two non-randomised interventional, four prospective cohort, and two retrospective cohort studies). Overall, the proportion of women experiencing bleeding at any time point ranged from 0–10%. In one RCT, a case of postpartum haemorrhage occurred in the operating room following IUD placement and hysterotomy closure.[37] In that same RCT, five women (10%) underwent IUD removal due to side effects (primarily bleeding, pelvic pain, or both).[37] In another RCT, a woman had a retained clot with bleeding immediately on placement of the PPIUD; no further bleeding occurred following IUD removal at approximately 5 min after initial placement.[38] In a retrospective study, IUDs were removed in three of 169 women (2%) due to postpartum haemorrhage.[39] No other peri-insertion bleeding events were reported. In an RCT from Australia, 'frequent' bleeding (not further defined) occurred at 6 weeks of follow-up in 12 of the 24 women with intra-caesarean insertion and available follow-up data, and in 26% and 9.5% of the women at 3- and 6-month follow-up, respectively. Other bleeding events at 3 months reported across three studies included spotting (1%), 'bothersome bleeding' (3%), and bleeding associated with an IUD rotated to transverse position (2%). At 6 months post-insertion, bleeding events were reported in five studies, including abnormal bleeding (0–3% of women), removal of IUD due to bleeding (1–4%), IUD rotation to transverse position with bleeding (4%), and the aforementioned 'frequent bleeding' (9.5%). At 12 months post-insertion, bleeding was reported in one study and occurred among 2% and 5% of women with caesarean and vaginal deliveries, respectively.

Lower-income countries

Thirty-one of 33 studies from lower-income countries reported bleeding complications in <20% of women; most bleeding events were not well defined. Exceptions arose from one study from India in which 89% of 680 women who had copper IUDs inserted reported 'spotting' (blood-stained vaginal discharge apart from menstruation).[40] In that study, 10% of women requested IUD removal due to bleeding. Another study, involving 3753 women who received copper IUDs, reported that 28.1% had 'irregular bleeding'.[41]

Infections

Evidence from 53 studies indicated infrequent development of infections following PPIUD insertion.

Higher-income countries

Across 14 studies reporting infections, the proportion of women with infections ranged from 0–3% in 12 of the 14 studies. In one of the remaining two studies, four (5%) women had infections (type not defined)[42] and in the other, 10 women (11%) had cervicitis or pelvic inflammatory disease (PID): seven women received empiric treatment for cervicitis or PID, and three women reported having an infection that was diagnosed outside of the study centre.[43]

Lower-income countries

Infection following PPIUD use was reported in 39 studies from lower-income countries. In the eight studies reporting immediate PPIUD insertion infections data, two studies reported wound infections immediately after insertion of a copper IUD during caesarean deliveries (in 1.7%[44] and 10% of women[45]) while the remaining six reported no infections. Within 3 months post-insertion, across 21 studies, the proportion of women with infections ranged from 0% (eight studies) to 7.5%.[41] By 6 months follow-up, the proportion of PPIUD-related infections was very similar to earlier

follow-up, from 0% in five studies to 5.4%.[46] The latter was reported in a retrospective study that included all postpartum genital infections in 128 women in Ivory Coast.[46] In the few studies (n=5) in which infection occurrence at 12 months was reported, the proportion of women with infections was ≤3.3%.[26]

Perforation

Across 41 studies reporting on this outcome, perforations following PPIUD insertion were rare. Seven perforations were reported: three from real-world studies after copper IUD insertion, and four in an RCT using copper IUDs. The reported cases include perforations with delayed diagnoses, but details on the perforations were largely missing.[47 48]

Higher-income countries

Across twelve studies from higher-income countries, two perforations were reported and both were diagnosed at 6 months post-PPIUD insertion. One of the affected women required laparoscopic removal[49]; in the other, the copper IUD was found, by ultrasound, to be partially perforated through the anterior lower segment of the uterus following insertion.[47]

Lower-income countries

Across 29 studies from lower-income countries, one of 736 patients from a retrospective study in India experienced a perforation diagnosed at the 6-week follow-up visit, with the device located in the abdominal cavity.[48] In one RCT from Pakistan using copper IUDs, it was reported that three (2%) of 76 women who underwent vaginal delivery had perforation, and one of 75 (0.7%) women who underwent caesarean section had perforation[50 51]

DISCUSSION

Results from this SLR of globally published data on PPIUD use suggest an increase in PPIUD utilisation over time in both higher- and lower-income countries, with a greater increase in lower-income countries. This trend may reflect more concerted focus on promoting PPIUDs in lower-income countries; promotion of PPIUDs was the aim of 21% of the lower-income country group studies versus only 6% of the higher-income country group studies. Still, PPIUD appears to be underutilised. LARCs are significantly more effective at preventing UIPs versus other contraceptive methods,[8] are recommended for use by the WHO, and are categorised in the top tier of contraceptive effectiveness by the US Centers for Disease Control and Prevention.[9] However, in 2019, only 6.5% of reproductive-age women in higher-income countries and 3.0% of women in lower-income countries used an IUD.[7–9] In several studies, the proportion of women consenting to PPIUD insertion prenatally was higher than the proportion later receiving the intervention; better characterisation of reasons for opting against PPIUD use is needed.

Increasing IUD use may help mitigate the excessive economic burden of UIPs. In the USA, 2011 annual direct medical costs of UIPs were estimated at $4.6 billion; half of the costs were attributable to imperfect contraceptive adherence.[6] Direct medical costs of UIPs to the National Health Service in the UK were estimated at >US$300 million in 2010.[8] Use of PPIUDs may also improve subsequent clinical outcomes. Postpartum is a particularly crucial time for contraceptives, as short-interval pregnancies are associated with poor maternal and birth outcomes. The ACOG recommends avoiding interpregnancy periods shorter than 6 months and considering the benefits of waiting ≥18 months between pregnancies, while the WHO recommends a 24-month interval between a live birth and next pregnancy.[14 52 53] Whether to use contraception and the type and timing of contraception is a woman's personal choice and may be influenced by factors such as healthcare access, socioeconomic status, culture, and perceptions regarding various contraceptive options.

Our findings suggest that increasing time from PPIUD insertion is associated with a decrease in PPIUD prevalence, although long-term follow-up data were limited. Nonetheless, reported pregnancies across studies were very low. A limitation to the effectiveness information is the sparse availability of published data out to 18 months. Whether an IUD was not in place due to expulsion or voluntarily removal was inconsistently reported. In lower-income countries, the most common reason for IUD removal was inclination to other methods.[54] The occurrence of IUD expulsions varied widely across studies; however, the timing of expulsions was consistently primarily in the early postpartum period. In one trial, the mean time to expulsion was 12.6 days.[37] In another trial, all expulsions occurred by 3 months post-insertion.[55] In a prospective cohort study, median time to expulsion was 4.1 weeks.[56] Another observational prospective study found that 86% of expulsions occurred within 6 weeks.[57] In one study, 88% of women with expulsions requested re-insertion.[58]

A limitation in some studies was conducting follow-up appointments via the phone, and, in some cases, ultrasounds were not routinely offered unless there were symptoms indicative of expulsion or misplacement. Consequently, continuation of IUD use over time may not be accurately reported, and expulsions may be under-recognised and under-recorded. A Cochrane review of RCTs did not find evidence supporting a significant difference in expulsion rates based on timing of insertion.[13] Likewise, in a recent SLR and meta-analysis including observational and interventional studies, there was no significant difference in expulsions between IUDs placed from >10 min to <72 hours versus >4 weeks post-delivery, although IUD placement ≤10 min was associated

with a significantly increased risk of expulsion versus >4 weeks.[11] A recent estimate suggested immediate insertion would prevent an additional 88 UIPs per 1000 women over 2 years compared with routine placement.[59] Thus, the benefit of earlier insertion likely outweighs a potential small increased expulsion risk. Additional evidence points to a variety of factors that may affect expulsion risk, including the device type, delivery mode, age, parity, and provider experience.[11 12]

The data compiled suggest that PPIUDs are associated with infrequent occurrences of abnormal bleeding, uterine infections, and perforations. A limitation to the safety data includes inconsistent definitions of safety events across studies. Additionally, follow-up was often conducted with the IUD user, sometimes over the phone; accordingly, reported outcomes would need validation by a healthcare professional. As with any literature review, relevant studies may have been missed; similarly, the exclusion of non-English language papers may have omitted relevant data. Our analysis of IUD perforation rates does not distinguish between complete perforations (which resulted in the IUD moving to the abdominal cavity and required surgical management for removal) and partial perforations (which may have been managed in an outpatient setting). It also includes reports where the event was detected at later timepoints. Uterine perforation may occur, most often during insertion, but may not be noticed until much later since it can be asymptomatic. It is therefore possible that the limited follow-up in the studies may have led to underestimation of the event rate, as a relevant portion of women present with little or no symptoms and may only be diagnosed after several years of use or when presenting for IUD removal[60]—emphasising the need for appropriate patient counselling and surveillance.

CONCLUSION

Evidence from this SLR suggests that IUDs inserted in the immediate postpartum period are safe and effective. Future research to better characterise reasons for opting against PPIUD use is needed to permit development of more effective interventions to increase appropriate utilisation of PPIUDs.

Additional resources

⇒ Faculty of Sexual and Reproductive Healthcare (FSRH) clinical guideline: contraception after pregnancy. (January 2017, amended October 2020) (https://www.fsrh.org/standards-and-guidance/documents/contraception-after-pregnancy-guideline-january-2017/).

⇒ American College of Obstetrics and Gynecology (ACOG) Committee Opinion No. 670: immediate postpartum long-acting reversible contraception. *Obstet Gynecol* 2016;128(2):e32–7.

Contributors EG-E, BM, and KK participated in developing the study methodology, study conduction, and reporting. KRB planned the study, provided epidemiologic review, and submitted the study. YW planned the study and provided medical expert review. NW provided medical expert review. JL planned the study and provided medical expert review. SJ provided compliance review. FP provided statistical review.

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