Using a validated instrument to assess pregnancy planning and preconception care at antenatal booking visits: a retrospective cohort study

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The known: Preconception health shapes the wellbeing of future parents and their children in both the short and longer terms.

The new: Preconception health behaviour can be monitored by incorporating the London Measure of Unplanned Pregnancy (LMUP) into the antenatal booking visit. In our study, LMUP scores indicated that 71% of women had planned their pregnancies, but 54% had not undertaken any health-related actions prior to pregnancy. The likelihood of pregnancy planning declined as the number of previous births increased.

The implications: Better postpartum contraception advice could reduce the number of women who have multiple unplanned pregnancies. Broader use of the LMUP could improve the management of preconception health.

Abstract

Objective: To determine the completion rate for the London Measure of Unplanned Pregnancy (LMUP), a psychometrically validated measure of a woman's intention with regard to a current or recent pregnancy, during booking visits at two metropolitan antenatal care clinics; to identify socio-demographic characteristics associated with unplanned pregnancy.

Design, setting, participants: Retrospective cohort study; analysis of LMUP data for women attending antenatal care booking consultations as public patients in the Sydney Local Health District, 31 December 2019 – 30 November 2020.

Main outcome measures: Proportions of women with LMUP scores indicating unplanned (0–9) or planned pregnancies (10–12); associations between planned pregnancy and socio-demographic characteristics, crude and adjusted for age, parity, and socio-economic status (Index of Relative Socioeconomic Disadvantage).

Results: Of 4993 women with antenatal care bookings, the LMUP was completed by 2385 (47.8%; 1142 of 3564 women at the tertiary referral hospital [32.0%], 1118 of 1160 at the secondary hospital [96.3%]). Planned pregnancies were indicated by the total LMUP scores of 1684 women (70.6%); 1290 women (59.1%) reported no health actions in preparation for pregnancy. In multivariable analyses, planned pregnancies were more likely in all age groups than for women aged 24 years or younger (30–34 years: adjusted odds ratio [aOR], 2.54; 95% confidence interval [CI], 1.76–3.66; 35–39 years: aOR, 2.91; 95% CI, 1.95–4.33). The likelihood of planned pregnancy declined with increasing parity (*v* no previous births: three previous births: aOR, 0.25; 95% CI, 0.16–0.40; four or more previous births: aOR, 0.10; 95% CI, 0.05–0.19).

Conclusion: Seven in ten women who completed the LMUP had planned their pregnancies, but fewer than half had undertaken health-related actions prior to conceiving. Higher parity was associated with unplanned pregnancy, indicating the importance of postpartum contraception advice. Overcoming barriers to implementing the LMUP more widely would enhance preconception health monitoring.

The health and health behaviours of both women and men prior to pregnancy are key predictors of pregnancy outcomes.[1-3] Further, parental health around the time of conception shapes the health and wellbeing of the parents and their children in the short and longer term, helps prevent non-communicable diseases, and may benefit overall health for several generations.[2-4] Nevertheless, progress in the provision and monitoring of preconception care has been limited. A recent systematic review identified eleven preconception care guidelines in various countries, only one of which was classified as high quality (the Canadian HIV Pregnancy Planning Guidelines).[5]

In Australia, the Preconception Health Network was established in 2021 to promote best practice in preconception health care by "promoting collaboration and integration on a national level across the domains of research, policy, consumer engagement, health, social care and advocacy."[6] The network has identified priority areas for attention, including optimising health behaviour, understanding and managing general medical needs (including obstetric medical history, chronic disease history, medication use, and genetic information), achieving a healthy weight, optimising reproductive health (including birth spacing and pregnancy planning), and optimising mental health. Taking time to plan a pregnancy and improve health prior to conceiving is vital for achieving goals in these areas.

An instrument for assessing pregnancy planning or intention that takes social, emotional, financial, cultural, and other contextual factors into account can be helpful for monitoring progress in preconception health programs.[7] It can be used to assess patterns of need for contraception and to document preconception readiness and health.[8] Pregnancy intention is not reported in Australian perinatal data reports, although this information is often assessed during antenatal booking visits with a simple question about whether the pregnancy was planned or not.

Since 2019, the London Measure of Unplanned Pregnancy (LMUP) has been included in Sydney Local Health District (LHD) electronic medical records for antenatal booking visits. The LMUP is a psychometrically validated measure of intention with regard to a current or recent pregnancy[8] that has also been validated for use in Australia.[9] The six-item measure assesses behaviour around the time of conception, and can be used to evaluate family planning or preconception care programs; it is recommended for this purpose in the United States[10] and the United Kingdom.[11]

In this article, we report our analysis of twelve months of Sydney LHD LMUP data. We determined the LMUP completion rate during this period, and examined socio-demographic characteristics associated with unplanned pregnancies.

Methods

We analysed data for women who gave birth in the Sydney LHD during 1 December 2019 – 30 November 2020. About 8% of New South Wales births take place in this LHD.[12] The LHD includes two public maternity services: a tertiary referral hospital and a secondary metropolitan facility. At the start of the study, we provided training at the two sites on the use of the LMUP; we also provided a video describing the purpose and components of the LMUP that was retained on the antenatal clinic computers. About 15% of women are admitted as private patients and receive antenatal care from private obstetricians; as their booking visit details are not included in the LHD database, they were not included in this study.

Demographic and parity information for included women was obtained from the Sydney LHD electronic maternity medical record system, into which routine pregnancy, birth, and postpartum data can be entered by all health care providers. De-identified data were supplied to the investigators for analysis. We defined residential socio-economic status according to the Index of Relative Socioeconomic Disadvantage (IRSD), a national census-based index of measures of area-level disadvantage, such as low educational attainment, low household income, and high unemployment.[13]

Outcome

The primary outcome was the LMUP score recorded at the first antenatal visit, derived from responses to six questions regarding contraception use prior to conception, timing of motherhood, intendedness of the pregnancy, desire for a baby, discussion with the partner about having a child, and actions taken to prepare for pregnancy (eg, folate supplementation, avoidance of alcohol). Two points are allocated to each question, yielding a total score of 0 to 12. Using the original LMUP version, we classified responses as indicating an unplanned (score, 0–9) or a planned pregnancy (10–12).

Statistical analysis

In complete case analyses, crude (univariable) associations between planned pregnancy (LMUP score, 10–12) and socio-demographic characteristics were assessed using logistic regression models; we report odds ratios (ORs) with 95% confidence intervals (CIs). Multivariable analyses were adjusted for age, parity, and socio-economic status (greatest disadvantage: IRSD deciles 1–4; intermediate disadvantage, deciles 5–7; least disadvantage: deciles 8–10); we report adjusted ORs (aORs) with 95% CIs. We determined the LMUP completion rate at each hospital, and assessed in χ^2 tests whether the socio-demographic characteristics of women who completed the LMUP differed from those who did not. For women who completed the LMUP, we also examined whether LMUP findings differed between those for whom age or socio-economic status data were or were not available. Analyses were conducted in SPSS 28 (IBM).

Ethics approval

The Sydney Local Health District Ethics Review Committee (RPAH zone) approved our study (X20-0428; 2020/ETH02453).

Results

During 1 December 2019 – 30 November 2020, 4993 women had antenatal care bookings as public patients at the two Sydney LHD hospitals. The LMUP was completed in 2385 cases (47.8%; 1142 of 3564 women at the tertiary referral hospital [32.0%], 1118 of 1160 women at the secondary hospital [96.3%], and 125 of 269 women for whom the hospital was not specified [46.5%]). At the tertiary hospital, the LMUP was completed by smaller proportions of women born overseas (549 of 1949, 28.2%) than of those born in Australia (593 of 1615, 36.7%), and of women whose preferred language was not English (185 of 753, 24.6%) than of those for whom it was English (957 of 2811, 34.0%). The LMUP completion rate at the tertiary hospital increased with socio-economic status (deciles 1–4: 125 of 463, 26.9%; deciles 5–7: 375 of 1265, 29.6%; deciles 8–10: 571 of 1582, 36.0%). The characteristics of the women at the secondary hospital who did or did not complete the LMUP were similar (data not shown).

The age group including the largest proportion of women who completed the LMUP in the Sydney LHD was that of women aged 30–34 years (842 women; 35.3%); 1405 were born overseas (58.9%), 487 preferred a language other than English (20.4%), 1137 had residential postcodes in the three least socio-economically disadvantaged deciles (47.6%), and for 1171 women it was their first ongoing pregnancy (Box 1).

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1 Characteristics of the 2385 women seeking antenatal care in the Sydney Local Health District who completed the London Measure of Unplanned Pregnancy, 1 December 2019 – 30 November 2020

Characteristic	Value
Age (years)	
24 or younger	193 (8.1%)
25–29	596 (25.0%)
30–34	842 (35.3%)
35–39	534 (22.4%)
40 or older	95 (4.0%)
Missing data	125 (5.2%)
Country of birth	
Australia	980 (41.1%)
Other	1405 (58.9%)
Preferred language	
English	1898 (79.6%)
Other	487 (20.4%)
Socio-economic status* (decile)	
1–4 (most disadvantage)	873 (36.6%)
5–7	172 (7.2%)
8–10 (least disadvantage)	1135 (47.6%)
Missing data	205 (8.6%)
Parity	
0	1171 (49.1%)
1	727 (30.5%)
2	317 (13.3%)
3	115 (4.8%)
4 or more	55 (2.3%)

* Index of Relative Socio-economic Disadvantage.[13] ◆

2 Responses of the 2385 women seeking antenatal care in the Sydney Local Health District who completed the London Measure of Unplanned Pregnancy, 1 December 2019 – 30 November 2020

Questions/response options (score)	Number
Contraception	
Always used contraception (0)	86 (3.6%)
Inconsistently used (1)	149 (6.2%)
Not using contraception (2)	2150 (90.1%)
Timing	
Wrong time (0)	51 (2.1%)
OK, but not quite right (1)	378 (15.8%)
Right time (2)	1956 (82.0%)
Intention	
Did not intent to get pregnant (0)	393 (16.5%)
Intentions kept changing (1)	234 (9.8%)
Intended to get pregnant (2)	1758 (73.7%)
Desire	
Did not want a baby (0)	72 (3.0%)
Mixed feelings about having a baby (1)	244 (10.2%)
Wanted a baby (2)	2069 (86.8%)
Partner	
Never discussed getting pregnant (0)	75 (3.1%)
Discussed but no firm agreement (1)	387 (16.2%)
Agreed pregnancy with partner (2)	1923 (80.6%)
Preparations*	
No actions	1290 (54.1%)
Health preparations: one action	548 (23.0%)
Health preparations: two actions	547 (22.9%)
Total London Measure of Unplanned Pregnancy score	
Unintended (0–3)	62 (2.6%)
Ambivalent (4–9)	639 (26.8%)
Planned (10–12)	1684 (70.6%)

* For example: folic acid supplementation, smoking cessation or reduction, alcohol cessation or reduction, seeking medical advice. ◆

Planned pregnancies were indicated by the total LMUP scores of 1684 women (70.6%); 1290 women (59.1%) reported taking no health actions in preparation for pregnancy (Box 2). The proportions of planned pregnancies among women for whom complete socio-demographic data were available (age: 1595 of 2260, 70.6%; socio-economic status, 1540 of 2180, 70.6%) were similar to those among women for whom age (89 of 125, 71.2%; χ^2 test: $P = 0.88$) or socio-economic information were missing (142 of 205, 70.2%; χ^2 test: $P = 0.90$).

In multivariable analyses, planned pregnancies were more likely in all other age groups than for women aged 24 years or younger (30–34 years: aOR, 2.54; 95% CI, 1.76–3.66; 35–39 years: aOR, 2.91; 95% CI, 1.95–4.33). Women living in areas in the three least socio-economically disadvantaged deciles were more likely

to plan their pregnancies than women living in the four deciles of greatest disadvantage (aOR, 1.49; 95% CI, 1.12–1.97). The proportions of planned pregnancies declined with increasing parity (v no previous births: three previous births: aOR, 0.25; 95% CI, 0.16–0.40; four or more previous births: aOR, 0.10; 95% CI, 0.05–0.19) (Box 3).

Discussion

We report the first study of the integration of the LMUP, a validated measure of the prior pregnancy intention of pregnant women, into antenatal routine data collection in Australia. Completing the measure was not mandatory for women, and was undertaken at about half the antenatal booking visits over a 12-month period, but the completion rate was markedly different at the tertiary and secondary hospitals in this study. In the secondary hospital, in-person booking visits continued during the coronavirus disease 2019 (COVID-19) pandemic, and support from midwives for the measure was strong. In contrast, as booking consultations at the tertiary hospital shifted to telehealth during this period and leadership support was less strong, the completion rate was much lower, particularly among women whose preferred language was not English. Our qualitative study of how midwives experienced the introduction of the LMUP found that many supported its use, but they also noted barriers, including time constraints, the impact of COVID-19, and uncertainty about referral pathways.[14]

We found that, according to LMUP responses, 29% of pregnancies were unplanned, and planned pregnancies were less likely for women aged 24 years or less, living in postcodes of greater socio-economic disadvantage, or pregnant with a third or later child. These findings are consistent with those of our 2010–11 study in the Sydney LHD tertiary hospital, for which women were invited to complete questionnaires during antenatal clinic visits other than the midwifery booking, in which 67.6% of pregnancies were planned (824 of 1218). Unplanned pregnancies were more frequent for women under 25 years of age, but postcode-based socio-economic status did not influence intention; information on parity was not collected.[15] In a validation study in the Netherlands, LMUP responses by 515 women indicated that 84.4% of pregnancies had been planned.[16]

The peri-conception period is critically important for fetal development, and suboptimal maternal health and diet at this time can lead to impaired fetal growth, poorer birth outcomes, and long term effects on the child's cardiovascular and metabolic health.[2] Among the best established preconception interventions is folate supplementation, which reduces the risk of neural tube defects (including spina bifida and anencephaly) by 70%.[17] In our study, only 46% of women who completed the LMUP undertook any health-related precautions prior to pregnancy, including folate supplementation. In a United Kingdom study of women who had used the online Tommy's Pregnancy Planning tool, adherence to preconception recommendations was also generally poor, including recommended vitamin supplementation by women with planned pregnancies (44%); 20% of women reported smoking, 54% alcohol use, and 42% inadequate exercise levels.[18]

In 2021, 51% of Australian mothers were overweight or obese (based on standard body mass index definitions) when they gave birth.[19] Awareness of the implications of unhealthy weight, both during pregnancy (for the mother: gestational diabetes, hypertension in pregnancy, pre-eclampsia, need for caesarean delivery; for the child: prematurity, stillbirth, congenital

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3 Socio-demographic characteristics and planned pregnancies (London Measure of Unplanned Pregnancy scores of 10–12) among 2385 women, 1 December 2019 – 30 November 2020: univariable and multivariable analyses

Characteristic	Planned pregnancy	Odds ratio (95% CI)	Adjusted odds ratio (95% CI)*
Age (years)			
24 or younger	113 (58.5%)	1	1
25–29	386 (64.8%)	1.30 (0.94–1.81)	1.60 (1.12–2.30)
30–34	628 (74.6%)	2.08 (1.50–2.88)	2.54 (1.76–3.66)
35–39	408 (76.4%)	2.29 (1.62–3.25)	2.91 (1.94–4.33)
40 or older	60 (63.2%)	1.21 (0.73–2.01)	2.07 (1.16–3.69)
Missing data	89	—	—
Country of birth			
Australia	699 (71.3%)	1	NA
Other	985 (70.1%)	0.94 (0.79-1.13)	
Preferred language			
English	1343 (70.8%)	1	NA
Other	341 (70.0%)	0.96 (0.77–1.20)	
Socio-economic status (decile)†			
1–4 (most disadvantage)	616 (62.1%)	1	1
5–7	424 (73.9%)	1.69 (1.35–2.12)	1.16 (0.89–1.51)
8–10 (least disadvantage)	500 (80.4%)	2.45 (1.93–3.10)	1.49 (1.12–1.97)
Missing data	144		
Parity			
0	888 (75.8%)	1	1
1	558 (76.8%)	1.05 (0.85–1.31)	1.01 (0.80–1.29)
2	168 (53.0%)	0.36 (0.28–0.47)	0.33 (0.25–0.39)
3	55 (47.8%)	0.29 (0.20–0.43)	0.25 (0.16–0.40)
4 or more	15 (27.3%)	0.12 (0.07–0.22)	0.10 (0.05–0.19)

CI = confidence interval; NA = not applicable (not statistically significant in univariate analysis). * Adjusted for age, parity, and socio-economic status. Data for 2070 women were included in the final analysis † Index of Relative Socio-economic Disadvantage.[13] ◆

anomalies, macrosomia)[20] and longer term (for the child: overweight, cardiovascular and metabolic disease)[2] should be improved by public health campaigns.

Of the variables that influence pregnancy planning, parity perhaps warrants the most attention. Many women return to health services with successive unplanned pregnancies, suggesting that postpartum advice regarding contraception could be improved. A comprehensive postpartum contraception service is not generally provided by Australian hospitals, as it is expected that contraception will be discussed at the routine six-week postpartum general practice consultation. In the United States, however, about 50% of women do not attend such appointments.[21] In an Australian study, women reported receiving inconsistent information about the time and details of the postnatal general practice visit, and general practitioners commented that they lacked the resources to advise women about postpartum care.[22] Comprehensive postpartum care guidelines could reduce these problems, as well as ensuring that contraception is more accessible and affordable, as recommended by a recent Senate enquiry into sexual, maternity, and reproductive health care.[23]

Increasing the uptake of preconception care can be challenging. International leaders in this field have recently described an evidence-based model of preconception care, including contraception advice. They specifically recommend that public education about preconception health should begin in schools and include social media and other national campaigns, as well as recommending that training and system-level support for health care professionals to implement the care model.[24]

Limitations

Our study was limited to public patients in a single New South Wales LHD over twelve months and coincided with the first year of the COVID-19 pandemic in Sydney. Further, only half the eligible women completed the LMUP. Less than one-third of the women attending the tertiary site completed the LMUP, and differences in completion rates by country of birth, preferred language, and socio-economic status were noted; only socio-economic status influenced the likelihood of pregnancy planning. The generalisability of our findings is consequently uncertain.

We modified the final LMUP question to broadly assess the number of behaviour changes, but we did not assess the specific actions women undertook. In 2020, the LMUP question about the mother's partner was modified in the United Kingdom to reflect changes in family composition over the preceding two decades

(eg, same sex relationships, co-parenting, pregnancy without a partner).[25] The new wording would also be appropriate in Australia, but its use would not have affected our overall findings.

Conclusion

We document the first twelve months of the integration of the LMUP into routine antenatal bookings visit at two Sydney hospitals. Higher parity was the factor most closely associated with unplanned pregnancies, and improved access to postpartum contraception could help reduce the likelihood of unplanned pregnancies after a previous birth. If Australia is to develop preconception health indicators, as in the United Kingdom,[26] overcoming service barriers to implementing the LMUP will be important. Specifically, public awareness of the importance of pregnancy planning should be raised, and senior midwifery leaders should be educated about the purpose of the LMUP, including its facilitation of personalised care and early consideration of postnatal contraception.

1 Stephenson J, Heslehurst N, Hall J, et al. Before the beginning: nutrition and lifestyle in the preconception period and its importance for future health. *Lancet* 2018; 391: 1830-1841.

2 Fleming TP, Watkins AJ, Velazquez MA, et al. Origins of lifetime health around the time of conception: causes and consequences. *Lancet* 2018; 391: 1842-1852.

3 Guerin A, Nisenbaum R, Ray JG. Use of maternal GHb concentration to estimate the risk of congenital anomalies in the offspring of women with prepregnancy diabetes. *Diabetes Care* 2007; 30: 1920-1925.

4 Schummers L, Hutcheon JA, Bodnar LM, et al. Risk of adverse pregnancy outcomes by prepregnancy body mass index: a population-based study to inform prepregnancy weight loss counseling. *Obstet Gynecol* 2015; 125: 133-143.

5 Dorney E, Boyle JA, Walker R, et al. A systematic review of clinical guidelines for preconception care. *Semin Reprod Med* 2022; 40: 157-169.

6 Centre of Research Excellence Health in Preconception and Pregnancy. Preconception Health Network. 2021. https://hipp.org.au/networks/preconception-health-network (viewed June 2023).

7 Santelli JS, Lindberg LD, Orr MG, et al. Toward a multidimensional measure of pregnancy intentions: evidence from the United States. *Stud Fam Plann* 2009; 40: 87-100.

8 Hall JA, Barrett G, Copas A, Stephenson J. London Measure of Unplanned Pregnancy: guidance for its use as an outcome measure. *Patient Relat Outcome Meas* 2017; 8: 43-56.

9 Lang AY, Hall JA, Boyle JA, et al. Validation of the London Measure of Unplanned Pregnancy among pregnant Australian women. *PLoS One* 2019; 14: e0220774.

10 Stephenson J, Vogel C, Hall J, et al. Preconception Partnership. Preconception health in England: a proposal for annual reporting with core metrics. *Lancet* 2019; 393: 2262-2271.

11 Frayne DJ, Verbiest S, Chelmow D, et al. Health care system measures to advance preconception wellness: consensus recommendations of the clinical workgroup of the National Preconception Health and Health Care Initiative. *Obstet Gynecol* 2016; 127: 863-872.

12 NSW Health. Sydney Local Health District: strategic plan 2018–2023. 2018. https://www.slhd.nsw.gov.au/pdfs/slhd-strategic-plan-2018-2023.pdf (view Aug 2023).

13 Australian Bureau of Statistics. Census of Population and Housing: Socio-Economic Indexes for Areas (SEIFA), Australia, 2016 (2033.0.55.001). 27 Mar 2018. https://www.abs.gov.au/ausstats/abs@.nsf/Lookup/by%20Subject/2033.0.55.001~2016~Main%20Features~IRSD~19 (viewed June 2023).

14 Cheney K, Black K, Pelosi M, Dorney E. Introduction of the London Measure of Unplanned Pregnancy at the booking visit and the midwives' perspective. *BMJ Sex Reprod Health* 2023; 49: 112-117.

15 Rassi A, Wattimena J, Black K. Pregnancy intention in an urban Australian antenatal population. *Aust N Z J Public Health* 2013; 37: 568-573.

16 Goossens J, Verhaeghe S, Van Hecke A, et al. Psychometric properties of the Dutch version of the London Measure of Unplanned Pregnancy in women with pregnancies ending in birth. *PLoS One* 2018; 13: e0194033.

17 De-Regil LM, Peña-Rosas JP, Fernández-Gaxiola AC, Rayco-Solon P. Effects and safety of periconceptional oral folate supplementation for preventing birth defects. *Cochrane Database Syst Rev* 2015; CD007950.

18 McDougall B, Kavanagh K, Stephenson J, et al. Health behaviours in 131 182 UK women planning pregnancy. *BMC Pregnancy Childbirth* 2021; 21: 530.

19 Australian Institute of Health and Welfare. Australia's mothers and babies. Updated 29 June 2023. https://www.aihw.gov.au/reports/mothers-babies/australias-mothers-babies-data-visualisations/contents/antenatal-period/body-mass-index (viewed June 2023).

20 Thrift AP, Callaway LK. The effect of obesity on pregnancy outcomes among Australian Indigenous and non-Indigenous women. *Med J Aust* 2014; 201: 592-595. https://www.mja.com.au/journal/2014/201/10/effect-obesity-pregnancy-outcomes-among-australian-indigenous-and-non-indigenous

21 Bennett WL, Chang HY, Levine DM, et al. Utilization of primary and obstetric care after medically complicated pregnancies: an analysis of medical claims data. *J Gen Intern Med* 2014; 29: 636-645.

22 Brodribb W, Zadoroznyj M, Dane A. The views of mothers and GPs about postpartum care in Australian general practice. *BMC Fam Pract* 2013; 14: 139.

23 Senate Community Affairs References Committee (Australia). Ending the postcode lottery: addressing barriers to sexual, maternity and reproductive healthcare in Australia. May 2023. https://parlinfo.aph.gov.au/parlInfo/download/committees/reportsen/RB000075/toc_pdf/EndingthepostcodelotteryAddressingbarrierstosexualmaternityandreproductivehealthcareinAustralia.pdf (viewed June 2023).

24 Hall J, Chawla M, Watson D, et al. Addressing reproductive health needs across the life course: an integrated, community-based model combining contraception and preconception care. *Lancet Public Health* 2023; 8: e76-e84.

25 Barrett G, Nolan EM, Gürtin ZB, et al. London Measure of Unplanned Pregnancy and newer family forms: an update. *J Epidemiol Community Health* 2020; 74: 765.

26 Schoenaker DAJM, Stephenson J, Connolly A, et al. UK Preconception Partnership. Characterising and monitoring preconception health in England: a review of national population-level indicators and core data sources. *J Dev Orig Health Dis* 2022, 13: 137-150. ■