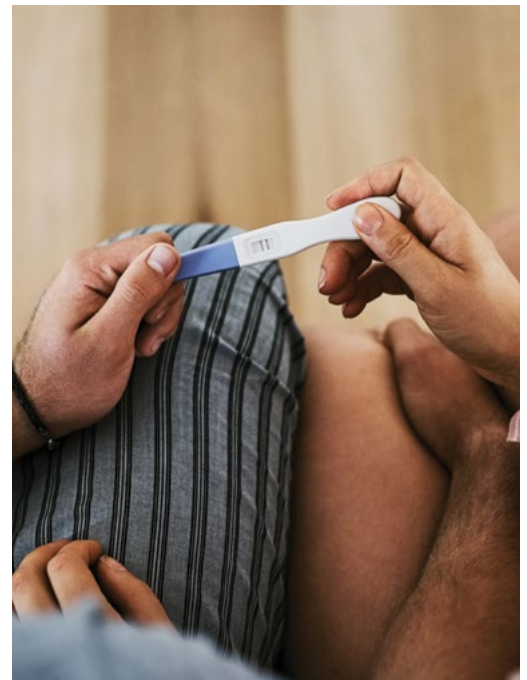


Preconception care



Edwina Dorney, Kirsten Black

Background

Preconception care (PCC) entails a comprehensive suite of interventions to improve the health of potential parents, their babies and future generations. PCC is not limited to a first pregnancy, and addressing health and wellbeing is equally important in the interconception period.

Objective

The aims of this paper are to discuss the evidence for and components of PCC, as well as the role of the general practitioner in the delivery of PCC.

Discussion

It is estimated that 90% of women and over 50% of men have preconception health issues to address. Although all people stand to benefit from PCC, certain population groups experience increased risk of adverse outcomes and require more targeted attention. Although most do not present for a dedicated PCC consultation, asking about pregnancy intention can start the conversation. Evidence shows that interventions delivered in primary care can improve preconception health knowledge and reduce preconception risk factors.

PRECONCEPTION HEALTH, the health of a person before pregnancy, impacts pregnancy outcomes, childhood health and the health of future generations.^{1,2} Preconception care (PCC) is the assessment, identification and intervention targeting risk factors to improve a person's health across behavioural, biomedical and social domains.^{1,3}

PCC is not limited to a first pregnancy, and addressing health and wellbeing is equally important in the interconception period.⁴

Evidence shows increased rates of unintended pregnancies, lower rates of preconception health behaviours and increased prevalence of risk factors with increasing parity.^{5,6} In this update, the term 'PCC' relates to care before both a first and subsequent pregnancies.

Each year approximately one in 10 Australian women become pregnant.^{7,8} Ninety per cent of women⁹ and over half of all men have at least one preconception health issue to address to improve reproductive outcomes.¹⁰

Recommendations and supporting evidence for PCC

Over 80 clinical content areas have been identified as part of comprehensive PCC.¹¹ A checklist for PCC is provided in Table 1.

Patient-centred care and reproductive life plan

PCC is underpinned by the principles of patient-centred care and shared decision making, and discussion should focus on the individual's or couple's reproductive life plan. Tools to discuss pregnancy intention are outlined in Table 2. A detailed mental health history and review for family and intimate partner violence should also be performed.¹²

Folate supplementation

A daily folate supplement of at least 400 mcg has been demonstrated to lower neural tube defects (NTDs) by 72% compared with no supplementation.¹³ Women with additional risk factors (refer to Table 1) require increased supplementation.¹⁴ Data show that women in Australia have suboptimal rates of preconception folate supplementation, particularly younger women and women having their third or more baby.⁶

There is ongoing research to explore the most effective dose and formulation of folate for women with recurrent miscarriage and gene polymorphisms. Best practice is to ensure those without risk factors do not exceed the maximum daily intake of 1000 mcg, because this can result in elevated levels of unmetabolised folic acid.¹⁵

Table 1. Preconception care checklist**Reproductive health**

- Family planning and reproductive life plan
 - Discussion on desired number of children (if any) and timing of pregnancies
 - Discussion about contraception options, including safety, efficacy and timing for intended pregnancies
 - Discussion about options for unintended pregnancies

Healthy eating and active living**Physical activity**

- 150 min exercise per week or 30 min/day
- Pelvic floor training

Weight assessment

- Respectful and supportive assessment of weight including BMI measurement
- Advise of healthy weight range and assist with goals to achieve this
- Refer to Institute of Medicine recommendations for weight gain in pregnancy (www.health.gov.au/resources/pregnancy-care-guidelines/part-d-clinical-assessments/weight-and-body-mass-index)

Nutrient intake

- Supplementation
 - Folate 400 mcg daily or 5 mg if increased risk^A
 - Iodine 150 mcg daily
- Adequate intake of iron, calcium, vitamin D
- Restricted intake^B
 - Vitamin A (retinol) 800 mcg/day
 - Restricted caffeine intake (200 mg/day from all sources)
 - Mercury-containing fish^C

Immunisation

- Review vaccination history and update for human papillomavirus, hepatitis B, varicella zoster, measles mumps rubella, pertussis, influenza and COVID-19

Infectious diseases and conditions

- Recommended screening investigations for all potential parents
 - Blood-borne viruses: HIV, hepatitis B, hepatitis C
 - STIs: syphilis
 - Infectious diseases: rubella, varicella zoster
- Recommended screening investigations determined by individual situation
 - STIs^D: chlamydia, gonorrhoea
 - Infectious diseases^E: cytomegalovirus
- Education
- Infectious diseases: cytomegalovirus, toxoplasmosis, parvovirus, herpes simplex virus
 - Food borne: listeriosis
 - Travel: malaria, Zika virus

Medical conditions

- Review and optimisation of pre-existing conditions; referral to specialist as required
- Diabetes: optimise glycaemic control

Psychosocial assessment

- Mental health
- Domestic and intimate partner violence
- Assessment of financial support and access to care

Parental exposure

- Alcohol
 - Ask about alcohol use with AUDIT-C tool and advise there is no safe level in pregnancy
 - Provide support for reducing alcohol intake
- Smoking and e-cigarettes
 - Ask about smoking and e-cigarette use and advise on benefits of quitting
 - Consider cessation support, including referral to Quitline or nicotine replacement therapy
- Illicit substances
 - Ask about recreational drug use and advise on benefits of quitting
 - Consider cessation support, including assistance from drug and alcohol services

Family and genetic history

- Detailed genetic history and referral to genetics counsellor for positive family history, known genetic conditions or previous affected pregnancy
- Carrier screening to be discussed

Environmental exposure

- Assess for endocrine disrupting chemicals and reproductive toxin exposures
 - Workplace: chemical, metal, gas, radiation and animal exposures
 - Household: personal care products and plastics

Medication

- Review prescription and over-the-counter medications for safety in pregnancy
 - Cease and prescribe alternative medications as required

Preventive health

- Cervical screening and breast self-examination
- Dental review

Obstetric history

- Review previous pregnancy outcomes: miscarriages, stillbirth, disorders of placentation

^AFamily history or previous pregnancy affected, body mass index (BMI) ≥ 30 kg/m², diabetes, on anticonvulsant medication, malabsorptive condition.

^BFor patient information resources, refer to Food Standards Australia and New Zealand for patient fact sheets (www.foodstandards.gov.au/consumer).

^CFish containing high levels of mercury: shark (flake), orange roughy (deep sea perch), marlin, swordfish, catfish, broadbill.

^DFor those who request a sexually transmissible infection (STI) screen, have a new sexual partner, previous STI or exposure in the past 12 months, partner from a high-risk population, those who live or travel to areas with high STI prevalence.

^EThose with increased risk of exposure, childcare workers, those with a child in nappies attending childcare.

AUDIT-C, alcohol use disorders identification test consumption; HIV, human immunodeficiency virus.

Table 2. Tools to discuss pregnancy intention**Preconception (future pregnancies)**

One Key Question*: assesses pregnancy preferences in next 12 months

Single question: Would you like to become pregnant in the next year?

Four possible answers:

Yes

I don't mind

I'm not sure

No

Desire to avoid pregnancy scale: assesses preference to avoid pregnancy in the next 3 months (higher score = higher desire to avoid pregnancy)

14 questions

Answer options

I wouldn't mind it if I became pregnant in the next 3 months

It would be a good thing for me if I became pregnant in the next 3 months

Thinking about becoming pregnant in the next 3 months makes me feel unhappy

Thinking about becoming pregnant in the next 3 months makes me feel excited

Becoming pregnant in the next 3 months would bring me closer to my main partner

I want to have a baby within the next year

If I had a baby in the next year, it would be bad for my life

It would be a positive addition to my life to have a baby in the next year

It would be the end of the world for me to have a baby in the next year

Thinking about having a baby within the next year makes me smile

Thinking about having a baby within the next year makes me feel stressed out

I would feel a loss of freedom if I had a baby in the next year

If I had a baby in the next year, it would be hard for me to manage raising the child

I would worry that having a baby in the next year would make it harder for me to achieve other things in my life

Five possible answers to each question (scored 0–4): strongly agree; agree; neither agree/disagree; disagree; strongly disagree

For negatively worded questions, 4 = strongly agree

For positively worded questions, 4 = strongly agree

Table continued on the next page

Non-communicable disease

The evidence supporting PCC interventions for non-communicable disease stems from the concept of fetal programming, where periconceptual health impacts health over the life course, also known as the Developmental Origins of Health and Disease (DOHaD).¹⁶ In 2021, almost 50% of women in Australia were above a healthy weight as they entered pregnancy.⁸ Increased weight leads to a greater risk of gestational diabetes, hypertensive disorders and pre-eclampsia.¹⁷ For women who gain weight between pregnancies, these risks further increase in a dose-dependent

manner, with women whose body mass index increased by ≥ 3 kg/m² having the higher risk.¹⁸

Empowering women with type 1 and type 2 diabetes, by providing support and tailored education about the benefits of glycaemic control (target HbA1c <6.5%), can reduce the risk of congenital malformations.^{19,20} Contraception should be considered until blood sugar levels are stabilised.²¹ Review for micro- and macrovascular comorbidities should be performed. For women with gestational diabetes in a previous pregnancy, testing to ensure normalisation of blood sugars at 6–12 weeks postpartum is required.

Women with elevated blood sugar levels require ongoing surveillance and assessment for type 2 diabetes, with management depending on future pregnancy plans.

Smoking, alcohol and other drugs

Smoking remains an important preventable risk factor for preterm birth, low birthweight and perinatal death. Up to 22% of women smoke in the preconception and early pregnancy period, with higher rates among First Nations people, younger people and people living in rural and remote areas.²² The use of e-cigarettes is increasing, with the largest increase in those aged 18–24 years.

Table 2. Tools to discuss pregnancy intention (cont'd)

Pregnancy and postpartum (current or recent pregnancy)

Single question of pregnancy intention: Is/was this pregnancy planned?	Two possible answers: Yes No
London measure of unplanned pregnancy	
Six questions:	Answer options (scored 0–2)
In the month that I became pregnant 0 – Always used contraception 1 – Sometimes used contraception 2 – Did not use contraception	Three possible answers to each question Scores 0–9 unintended Scores 10–12 intended
In terms of becoming a mother 0 – Wrong time 1 – Okay, but not quite the right 2 – Right time	
Just before I became pregnant 0 – Did not intend to get pregnant 1 – My intentions kept changing 2 – I intended to get pregnant	
Just before I became pregnant 0 – Did not want a baby 1 – Mixed feelings about a baby 2 – Wanted a baby	
Before pregnancy, had you and your partner 0 – Never discussed pregnancy 1 – Discussed, but no firm agreement 2 – Agreed to get pregnant	
Preparation for pregnancy 0 – No actions 1 – One action 2 – Two or more actions	

The effects of vaping in pregnancy remain unknown, but many e-cigarettes contain harmful substances and their use during pregnancy and preconception is not recommended.^{23,24}

Approximately 77% of adults in Australia drink alcohol.²⁵ There is no safe level of alcohol consumption in the preconception period or during pregnancy, and it is recommended that any person planning a pregnancy abstains from alcohol.²⁶ Research shows that almost all women expect their healthcare provider to talk about alcohol when planning a pregnancy.²⁷ The alcohol use disorders identification test consumption (AUDIT-C) tool is a validated tool to assess alcohol intake in the preconception and

pregnancy period, and resources are available from the Foundation for Alcohol Research and Education (FARE) to assist clinicians and consumers with this topic.²⁸ Recreational and other illicit drug use also needs to be assessed, because many of these drugs can cross the placenta and impact fetal brain development.²⁹ Education should be provided on the benefits of quitting and strategies to achieve this.

Genetic carrier screening

Inherited conditions affect up to one in 400 people in Australia. A detailed family history must be taken to assess the likelihood of an inherited genetic condition and appropriate testing arranged. If there is a family history,

or if a person is from Eastern European (Ashkenazi) Jewish background, referral to a genetic counsellor is recommended. Carrier screening is relevant to all people considering pregnancy and is outlined in Table 3.³⁰ Medicare rebates for cystic fibrosis, spinal muscular atrophy and fragile X screening are available since November 2023. The Royal Australian College of General Practitioners (RACGP) education module *Beware the rare* provides general practitioners (GPs) with additional education in this area.³¹

Medical history and medications

A thorough medical history should be taken, and any medical conditions optimised prior to pregnancy. Contraception should be offered

where appropriate while stabilising chronic conditions. All medications, both prescription and complementary, should be reviewed, considering the drug indication, dosing, route of administration and alternatives to ensure there is no or least risk to a developing fetus. Teratology information resources are available to assist in decision making, with examples including Reprotox (<https://reprotox.org>) and the Teratogen Information Service (<https://uktis.org>). Mothersafe (www.royalwomen.org.au/mothersafe) is an example of a local teratogen information service for consumers and health professionals in New South Wales.

Previous pregnancy outcomes

Previous pregnancy outcomes can inform risk factor modification and interventions

in the interconception period. Disorders of placental insufficiency, such as intra-uterine growth restriction, pre-eclampsia or gestational diabetes, might require targeted interpregnancy diet and exercise goals, and education for early antenatal intervention in subsequent pregnancies.

Preventive health and screening, including sexually transmissible infections and infectious diseases

All potential parents should be educated about infectious diseases and have a review of their vaccination history for measles, mumps, rubella, varicella zoster, diphtheria, tetanus and pertussis and hepatitis B undertaken. Serological testing is recommended to confirm immunity to varicella, rubella

and hepatitis B. Required vaccinations should be provided, including information to wait 28 days after rubella and varicella vaccinations before conceiving.^{32,33} Syphilis, human immunodeficiency virus (HIV) and hepatitis C testing should be routinely performed, with other sexually transmissible infection testing determined on individual risk (Table 1).

Although routine screening for cytomegalovirus (CMV) is not currently listed in preconception care guidelines, CMV education and prevention are priority areas of pregnancy planning.³⁴ CMV can cross the placenta and is the most common congenital infection, affecting up to 2000 babies annually.³⁵ Fewer than one in five women of reproductive age know about CMV, and this

Table 3. Genetic carrier screening

Preconception and pregnancy

All people planning a pregnancy, and pregnant, should be provided with information on genetic carrier screening

Three-gene panel

Genetic conditions screened: spinal muscular atrophy, cystic fibrosis, fragile X

Considerations

- 5% of individuals will carry a gene
- 1 in 240 couples affected
- Medicare rebate available

Expanded panel

Genetic conditions screened: >400, >500, >1000 gene options

Considerations

- 75% of individuals will carry a gene
- 1 in 20 couples affected
- Medicare rebate only for spinal muscular atrophy, cystic fibrosis and fragile X testing

Offering the test

Sequential: one person offered screening; screen partner as indicated

Couple screening: both people screened

Potential pathways for individual or couple with confirmed genes

Preconception

- Spontaneous conception
- IVF, own sperm and egg, with pre-implantation genetic diagnosis
- IVF, donor sperm or egg from non-carriers
- Decision to not have a pregnancy

Pregnant (antenatal testing)

- No antenatal testing
- CVS from 11 weeks
- Amniocentesis from 15 weeks

Postpartum

- Postnatal testing on baby (newborn screening)

CVS, chorionic villus sampling; IVF, in vitro fertilisation.

improves with provision of CMV education resources.³⁶ Individual risk assessment and screening should be performed for women with a risk of exposure, such as childcare workers and those with young children in childcare. All women should be educated about hygiene measures to reduce their risk of infection.

Preventive health measures such as breast self-examination, the importance of good oral health and cervical screening should be discussed. Recent changes to the National Cervical Screening Program now enable all people to access self-collection as a means for cervical screening.

Role of the GP in PCC

The prepregnancy period can range from a minimum of three months to years to improve behaviours and health.^{37,38} Given this, the International Federation of Obstetricians and Gynaecologists (FIGO) has called for all healthcare professionals who see people of reproductive age to deliver PCC.³⁹ Australian studies show that both clinicians and consumers believe that GPs are well placed to deliver PCC.^{40,41}

Barriers to delivering PCC include low levels of community awareness, a lack of presentations for a dedicated PCC appointment and high rates of unintended pregnancies.^{42,43} For clinicians, barriers include a lack of time, other competing preventive health priorities and a lack of available resources to help facilitate the delivery of PCC.^{40,44}

Asking about pregnancy intention can start the conversation about PCC, including contraception options for those who do not intend to become pregnant. A pilot study in Australian GPs found that using the One Key Question® to ask about pregnancy intention was acceptable to women attending for non-preconception consultations.⁴¹ GPs found the tool easy to use, with a median consultation extension time of two minutes.⁴¹ Other enablers to the delivery of PCC include checklists and high-quality clinical practice guidelines. A recent systematic review of clinical practice guidelines for PCC identified only 11 guidelines internationally, with two from Australia, from the RACGP and The Royal Australian and New Zealand College

of Obstetricians and Gynaecologists.⁴⁵ Evidence exploring the effectiveness of PCC interventions delivered in primary care showed impact for brief interventions in improving a person’s preconception health knowledge and reducing their preconception risk factors.⁴⁶

PCC is a shared responsibility from the population level down to the individual. The Preconception Health Network Australia is a multidisciplinary collaboration established to promote best practice in preconception healthcare and research and to drive policy change. Priorities and enablers identified by the Network are outlined in Table 4. The Network works with GPs to enhance the delivery of PCC for all Australians.

Key points

- PCC benefits parents, their children and future generations.
- Challenges to delivering PCC include low levels of community awareness of the importance of preconception health and low numbers of presentations for PCC.
- GPs are ideally placed to deliver PCC, and this can begin with a discussion on pregnancy intention.
- PCC is not only for first pregnancies, and previous pregnancy outcomes need to be reviewed.

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References

1. World Health Organization (WHO). Preconception care: Maximizing the gains for maternal and child health. A policy brief. WHO, 2013. Available at www.who.int/publications/i/item/WHO-FWC-MCA-13.02 [Accessed 14 December 2023].
2. Fleming TP, Watkins AJ, Velazquez MA, et al. Origins of lifetime health around the time of conception: Causes and consequences. *Lancet* 2018;391(10132):1842–52. doi: 10.1016/S0140-6736(18)30312-X.
3. Posner SF, Johnson K, Parker C, Atrash H, Biermann J. The national summit on preconception care: A summary of concepts and recommendations. *Matern Child Health J* 2006; 10 Suppl 5:S197–205. doi: 10.1007/s10995-006-0107-x.
4. Dorney E, Mazza D, Black KI. Interconception care. *Aust J Gen Pract* 2020;49(6):317–22. doi: 10.31128/AJGP-02-20-5242.

Table 4. Priorities and enablers for preconception care in primary care

For consumers
• Health promotion activities to increase awareness among consumers
• Improved equity of access to care for preconception and contraception consultations
For clinicians
• Health promotion activities to increase awareness among clinicians
• Available clinical guidelines to support delivery of high-quality, evidence-based care
• Available resources of appropriate health literacy to support delivery of preconception care
• Financial support and health service reform including Medicare rebates for primary care, and practice nurses to enable the timely delivery of preconception care
For policy makers
• Data collection on preconception health and care indicators to allow deidentification and monitoring of policy for preconception health and care
• Socioecological enablers for positive healthy eating and active living behaviour change, such as sugar taxes and increased access to green spaces

5. Australian Institute of Health and Welfare (AIHW). Australia's mothers and babies data visualisations. AIHW, 2017. Available at www.aihw.gov.au/reports/mothers-babies/australias-mothers-babies/contents/about [Accessed 5 January 2024].
6. Tang HEJ, Blumenthal C, Pasupathy D, Melov SJ. PSANZ 2023 – Oral presentations: Identification of at-risk groups for low use of folic acid in early pregnancy among a high migrant population. *J Paediatr Child Health* 2023;59 Suppl 1:4–54.
7. Guttmacher Institute. Country profile: Australia unintended pregnancy and abortion. Guttmacher Institute, 2023. Available at www.guttmacher.org/regions/oceania/australia [Accessed 14 December 2023].
8. Australian Institute of Health and Welfare (AIHW). Australia's mothers and babies. AIHW, 2023. Available at www.aihw.gov.au/reports/mothers-babies/australias-mothers-babies [Accessed 14 December 2023].
9. Stephenson J, Schoenaker DA, Hinton W, et al. A wake-up call for preconception health: A clinical review. *Br J Gen Pract* 2021;71(706):233–36. doi: 10.3399/bjgp21X715733.
10. Agricola E, Gesualdo F, Carloni E, et al. Investigating paternal preconception risk factors for adverse pregnancy outcomes in a population of internet users. *Reprod Health* 2016;13(1):37. doi: 10.1186/s12978-016-0156-6.
11. Jack BW, Atrash H, Coonrod DV, Moos MK, O'Donnell J, Johnson K. The clinical content of preconception care: An overview and preparation of this supplement. *Am J Obstet Gynecol* 2008;199 6 Suppl 2:S266–79. doi: 10.1016/j.ajog.2008.07.067.
12. Arluck JC, Mayhew AC. Preconception care for the general Ob/Gyn. *Clin Obstet Gynecol* 2018;61(1):62–71. doi: 10.1097/GRF.0000000000000338.
13. 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;2015(12):CD007950. doi: 10.1002/14651858.CD007950.pub3.
14. Royal Australian and New Zealand College of Obstetricians and Gynaecologists (RANZCOG). Vitamin and mineral supplementation and pregnancy. RANZCOG, 2019. Available at <https://ranzco.org.au/wp-content/uploads/2022/05/Vitamin-and-Mineral-Supplementation-and-Pregnancy.pdf> [Accessed 14 December 2023].
15. Institute of Medicine (US) Standing Committee on the Scientific Evaluation of Dietary Reference Intakes and its Panel on Folate, Other B Vitamins, and Choline. Dietary reference intakes for thiamin, riboflavin, niacin, vitamin B6, folate, vitamin B12, pantothenic acid, biotin, and choline. National Academies Press, 2000. Available at www.ncbi.nlm.nih.gov/books/NBK114310/ [Accessed 14 December 2023].
16. Wrottesley SV, Lamper C, Pisa PT. Review of the importance of nutrition during the first 1000 days: Maternal nutritional status and its associations with fetal growth and birth, neonatal and infant outcomes among African women. *J Dev Orig Health Dis* 2016;7(2):144–62. doi: 10.1017/S2040174415001439.
17. Akseleson A, Rossen J, Storck-Lindholm E, Rådestad I. Prolonged pregnancy and stillbirth among women with overweight or obesity – A population-based study in Sweden including 64,632 women. *BMC Pregnancy Childbirth* 2023;23(1):21. doi: 10.1186/s12884-022-05340-4.
18. Teulings NEWD, Masconi KL, Ozanne SE, Aiken CE, Wood AM. Effect of interpregnancy weight change on perinatal outcomes: Systematic review and meta-analysis. *BMC Pregnancy Childbirth* 2019;19(1):386. doi: 10.1186/s12884-019-2566-2.
19. Inkster ME, Fahey TP, Donnan PT, Leese GP, Mires GJ, Murphy DJ. Poor glycated haemoglobin control and adverse pregnancy outcomes in type 1 and type 2 diabetes mellitus: Systematic review of observational studies. *BMC Pregnancy Childbirth* 2006;6(1):30. doi: 10.1186/1471-2393-6-30.
20. 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(7):1920–25. doi: 10.2337/dc07-0278.
21. Rudland VL, Price SAL, Hughes R, et al. ADIPS 2020 guideline for pre-existing diabetes and pregnancy. *Aust N Z J Obstet Gynaecol* 2020;60(6):E18–52. doi: 10.1111/ajo.13265.
22. Australian Institute of Health and Welfare (AIHW). Smoking during pregnancy. AIHW, 2023. Available at www.aihw.gov.au/reports/mothers-babies/australias-mothers-babies/contents/antenatal-period/smoking-during-pregnancy [Accessed 14 December 2023].
23. Larcombe A, Allard S, Pringle P, Mead-Hunter R, Anderson N, Mullins B. Chemical analysis of fresh and aged Australian e-cigarette liquids. *Med J Aust* 2022;216(1):27–32. doi: 10.5694/mja2.51280.
24. The Royal Australian and New Zealand College of Obstetricians and Gynaecologists (RANZCOG). Smoking and pregnancy. RANZCOG, 2020. Available at <https://ranzco.org.au/wp-content/uploads/2022/05/Smoking-and-pregnancy.pdf> [Accessed 14 December 2023].
25. Government of Western Australia Mental Health Commission. Alcohol and our community: Use and harm statistics. Government of Western Australia, 2023. Available at <https://alcoholthinkagain.com.au/alcohol-and-our-community/use-and-harm-statistics> [Accessed 14 December 2023].
26. Department of Health. Clinical practice guidelines: Pregnancy care. Australian Government Department of Health, 2020. Available at www.health.gov.au/resources/pregnancy-care-guidelines [Accessed 5 January 2024].
27. Peadon E, Payne J, Henley N, et al. Attitudes and behaviour predict women's intention to drink alcohol during pregnancy: The challenge for health professionals. *BMC Public Health* 2011;11(1):584. doi: 10.1186/1471-2458-11-584.
28. Foundation for Alcohol Research and Education (FARE). Supporting health professionals to have conversations about alcohol and pregnancy. FARE, 2022. Available at <https://fare.org.au/supporting-health-professionals-to-have-conversations-about-alcohol-and-pregnancy/> [Accessed 14 December 2023].
29. Ross EJ, Graham DL, Money KM, Stanwood GD. Developmental consequences of fetal exposure to drugs: What we know and what we still must learn. *Neuropsychopharmacology* 2015;40(1):61–87. doi: 10.1038/npp.2014.147.
30. The Royal Australian and New Zealand College of Obstetricians and Gynaecologists (RANZCOG). Genetic carrier screening. RANZCOG, 2019. Available at https://ranzco.org.au/wp-content/uploads/2022/05/Genetic-carrier-screeningC-Obs-63New-March-2019_1.pdf [Accessed 14 December 2023].
31. The Royal Australian College of General Practitioners (RACGP). Beware the rare: A guide to the early referral and diagnosis of spinal muscular atrophy (SMA) and other paediatric neuromuscular disorders. RACGP, 2020.
32. Australian Technical Advisory Group on Immunisation (ATAGI). Australian immunisation handbook. Australian Government, 2022. Available at <https://immunisationhandbook.health.gov.au> [Accessed 14 December 2023].
33. The Royal Australian and New Zealand College of Obstetricians and Gynaecologists (RANZCOG). Clinical Guidance Statement: Pre-pregnancy and pregnancy related vaccinations (C-Obs 44). RANZCOG, 2023. Available at <https://ranzco.org.au/wp-content/uploads/2022/05/Pre-Pregnancy-and-Pregnancy-Related-Vaccinations.pdf> [Accessed 4 September 2024].
34. The Royal Australian and New Zealand College of Obstetricians and Gynaecologists (RANZCOG). Statement: Prevention of congenital cytomegalovirus (CMV) infection. Interim update. RANZCOG, 2023. Available at <https://ranzco.org.au/wp-content/uploads/2022/05/Prevention-of-congenital-cytomegalovirus-CMV-infection-C-Obs-64.pdf> [Accessed 4 September 2024].
35. van Zuylen WJ. Clinical and epidemiological features of congenital cytomegalovirus infection globally. *Microbiol Aust* 2015;36(4):153–36.
36. Lazzaro A, Vo ML, Zeltzer J, et al. Knowledge of congenital cytomegalovirus (CMV) in pregnant women in Australia is low, and improved with education. *Aust N Z J Obstet Gynaecol* 2019;59(6):843–49. doi: 10.1111/ajo.12978.
37. 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(10132):1830–41. doi: 10.1016/S0140-6736(18)30311-8.
38. Dean SV, Lassi ZS, Imam AM, Bhutta ZA. Preconception care: Closing the gap in the continuum of care to accelerate improvements in maternal, newborn and child health. *Reprod Health* 2014;11 Suppl 3:S1. doi: 10.1186/1742-4755-11-S3-S1.
39. Jacob CM, Killeen SL, McAuliffe FM, et al. Prevention of noncommunicable diseases by interventions in the preconception period: A FIGO position paper for action by healthcare practitioners. *Int J Gynaecol Obstet*. 2020;151 Suppl 1:6–15. doi: 10.1002/ijgo.13331.
40. Kizirian NV, Black KI, Musgrave L, Hespe C, Gordon A. Understanding and provision of preconception care by general practitioners. *Aust N Z J Obstet Gynaecol* 2019;59(6):799–804. doi: 10.1111/ajo.12962.
41. Fitch J, Dorney E, Tracy M, Black KI. Acceptability and usability of 'One Key Question'® in Australian primary health care. *Aust J Prim Health* 2023;29(3):268–75. doi: 10.1071/PY22112.
42. Bortolus R, Oprandi NC, Rech Morassutti F, et al. Why women do not ask for information on preconception health? A qualitative study. *BMC Pregnancy Childbirth* 2017;17(1):5. doi: 10.1186/s12884-016-1198-z.
43. Khan NN, Boyle JA, Lang AY, Harrison CL. Preconception health attitudes and behaviours of women: A qualitative investigation. *Nutrients* 2019;11(7):1490. doi: 10.3390/nu11071490.

44. Mazza D, Chapman A, Michie S. Barriers to the implementation of preconception care guidelines as perceived by general practitioners: A qualitative study. *BMC Health Serv Res* 2013;13(1):36. doi: 10.1186/1472-6963-13-36.
45. Dorney E, Boyle JA, Walker R, et al. A systematic review of clinical guidelines for preconception care. *Semin Reprod Med*. 2022;40(3-04):157-69. doi: 10.1055/s-0042-1748190.
46. Withanage NN, Botfield JR, Srinivasan S, Black KI, Mazza D. Effectiveness of preconception interventions in primary care: A systematic review. *Br J Gen Pract* 2022;72(725):e865-72. doi: 10.3399/BJGP.2022.0040.

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