

ORIGINAL ARTICLE

Health needs, treatment decisions and experience of traditional complementary and integrative medicine use by women with diminished ovarian reserve: A cross-sectional survey

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Background: Women with diminished ovarian reserve (DOR) have fewer eggs than would be expected at their age. It is estimated that 10% of women seeking fertility treatment are diagnosed with DOR. However, the success rate of medically assisted reproduction (MAR) is significantly lower in women with DOR, thus many seek additional approaches.

Aim: To explore the health needs of women with DOR, treatment options and experience of treatment including traditional complementary integrative medicine (TCIM).

Methods: Anyone with a diagnosis of DOR, living in Australia or New Zealand, aged over 18 were invited to complete an online survey distributed via fertility support networks and social media platforms from April to December 2021.

Results: Data from 67 respondents were included. The main aspects of health that were impacted by DOR were fertility (91.0%) and mental health (52.2%). The main treatment recommended was MAR with most women either currently using MAR (38.8%) or having previously used MAR (37.3%). TCIM was widely used with 88.1% of women utilising supplements, 74.6% consulting with TCIM practitioners, and 65.7% adopting self-care practices. The main reasons for using TCIM were to improve fertility or support pregnancy, and to support general health and well-being.

Conclusions: Women with DOR have additional health needs apart from infertility, most notably mental health support. The main form of treatment utilised is MAR, despite DOR being challenging for fertility clinicians. TCIM was widely used, and respondents perceived benefits related to improving fertility, supporting pregnancy, or improving well-being through use of acupuncture, meditation, naturopathy, massage, yoga.

KEYWORDS

diminished ovarian reserve, fertility, mental health, women's experience, traditional complementary integrative medicine

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BACKGROUND

Women with diminished ovarian reserve (DOR) have fewer oocytes remaining in the ovary than would be expected at their age.¹ While a decrease in ovarian reserve is common as women age, some women experience a decrease beyond what is physiologically expected due to normal age-related decline.¹ It is widely accepted that 10% of women seeking fertility treatment are diagnosed with DOR.²

Once a woman is diagnosed with DOR, even in the earliest stages, the chances for successful pregnancy outcomes are lower than in age-matched women with normal ovarian reserve.³ Medically assisted reproduction (MAR) offers options such as ovarian stimulation and intrauterine insemination (IUI) or *in vitro* fertilisation (IVF).⁴⁻⁶ However, the success rate of these methods is significantly lower in women with DOR than those with a normal ovarian reserve.⁷ Additionally, high costs and limited accessibility to MAR are significant barriers,⁸ leading some women to seek other treatment options including traditional complementary integrative medicine (TCIM) while still fertile.

TCIM represents a range of healthcare practices, products, and knowledge systems that place particular emphasis on disease prevention, health promotion and treatment.⁹ The most commonly consulted TCIM practitioners in Australia are bodywork therapists, acupuncturists and naturopaths.⁹ Many women in Australia use TCIM to improve their chances of procreating^{10,11} with women attempting to conceive more likely to consult a naturopath (odds ratio 1.3) compared to women who are not trying to conceive.¹² However, for women with DOR, there are no data from a representative sample as to the prevalence and patterns of using TCIM.

This survey aims to contribute to the understanding of the health needs of women with DOR, treatment options and experience of treatment including TCIM.

MATERIALS AND METHODS

Study design and inclusion criteria

A cross-sectional survey of anyone who self-reported as being diagnosed with DOR, living in Australia or New Zealand, aged 18 or older was conducted between April 2021 and December 2021. With regard to the diagnosis of DOR, respondents were asked which test(s) were used to diagnose their DOR, and who the referring health practitioner was for those tests. Ethics approval was provided by the Western Sydney University Human Research Ethics Committee (H14256, March 2021).

Recruitment was sought through consumer support networks related to fertility such as Jean Hailes for Women's Health and support groups on Facebook such as Polycystic ovary syndrome (PCOS)/Endometriosis natural (15.4 K members), low Anti-Müllerian Hormone (AMH)/Ovarian Reserve (9.4 K members);

electronic newsletters and social media posts of consumer support networks, universities, health practitioners including medical, allied health and TCIM practitioners; as well as paid social media advertising via Facebook and Instagram. Respondents were informed that formal consent was implied upon starting the survey, as stated in the participant information sheet. All responses were anonymous.

Survey instrument

The survey was developed by the authors who have multidisciplinary expertise including general practice, obstetrics/gynaecology, naturopathy and fertility/women's health research and/or TCIM research. Survey questions were revised to include feedback from three consumer representatives. The 55-item survey covered basic demographics, lifestyle habits, DOR diagnosis and its effect on health, treatment provided, use of MAR, use of TCIM (reasons and perceived benefit), if naturopathy was used (services provided, perceived benefit, experiences) (Appendix S1). The questions about the use of TCIM were based on the International Questionnaire to measure use of TCIM across international populations (I-CAM-Q).¹³ The terminology was modified to reflect TCIM practice in Australia. TCIM use is divided into three sections: (i) visits to TCIM practitioners; (ii) types of dietary supplements (a) vitamins/minerals (b) other dietary supplements such as coQ10 and melatonin (c) herbal medicines (d) food supplements such as fish oils and protein powder; and (iii) use of self-help practices including meditation, yoga, relaxation techniques, massage, qi-gong, tai chi, visualisation, reflexology, Bowen therapy, prayer. Respondents were asked to select the main reason for use: (i) fertility/pregnancy; (ii) DOR; (iii) to improve well-being; or (iv) other acute and chronic conditions. The perceived benefits and risks of TCIM were assessed on a three-point Likert scale ranging from very beneficial to not at all beneficial with an additional don't know option.

Statistical analysis

Data were exported from Qualtrics (version 10/21)¹⁴ into Microsoft 365 Excel (version 16.69) for data cleaning and IBM SPSS statistical software (version 29.0)¹⁵ for statistical analysis. Categorical variables were described using proportions and percentages and continuous variables using means and standard deviations. Associations between respondents' use of MAR (users and non-users) and their use of TCIM, and the use of MAR and the types of nutritional supplements and/or herbal medicine used were explored with Pearson's χ^2 test or Fisher's exact test, where there were less than five responses. All *P*-values presented are two-tailed; *P* < 0.05 was considered statistically significant. Complete responses were encouraged by the online survey layout to minimise missing data. Missing data were not replaced.

RESULTS

A total of 67 women completed the survey. The most common methods of DOR diagnosis reported were an AMH test alone (37.3%, $n = 25$) or three endorsed tests that included follicle stimulating hormone, AMH, antral follicle count or low egg collection (32.9%, $n = 22$). The rest reported two or four endorsed tests, while two respondents reported they were unsure which tests had been used. Most women were European/Caucasian (82.1%, $n = 55$), married or living with their partner (85.1%, $n = 57$), held degree qualifications (80.6%, $n = 54$), were employed (82.1%, $n = 55$) and had private health insurance (77.6%, $n = 52$). The average age was 36.8 years (SD = 5.05, range 22–49, $n = 67$). Most rated their diet as good (49.3%, $n = 33$) or very good (17.9%, $n = 12$), with most eating two or more pieces of fruit daily (60.8%, $n = 41$) and five to seven serves of vegetables daily (54.9%, $n = 28$) (Appendix S2).

Table 1 describes the experience of women with DOR regarding health impacts, the diagnosis and treatments offered. The health providers that were consulted in the past year were fertility specialists (80.0%, $n = 52$), general practitioners (76.9%, $n = 50$) and acupuncturists (53.8%, $n = 35$) (Appendix S3). The main form of treatment that was recommended was MAR (65.7%, $n = 44$) with more than half of women being given a referral to a fertility specialist (52.2%, $n = 35$). Most women were either currently using MAR (38.8%, $n = 26$) or had previously used MAR (37.3%, $n = 25$). The main types of MAR used were ovulation induction with gonadotropins and IVF (41.2%), IVF and intracytoplasmic sperm injection (ICSI) (27.5%) and ovulation induction with gonadotropins (23.5%) (Appendix S4).

Most women had been diagnosed with DOR in the past two years (62.7%, $n = 42$) and had no biological children since (67.2%, $n = 45$). Of the women trying to conceive (64.2%, $n = 43$), 72% ($n = 31$) had been diagnosed with DOR in the past two years and 74.5% ($n = 32$) had been trying to conceive for over 12 months.

Most women (88.1%, $n = 59$) had taken supplements in the past year and most commonly prenatal multi-vitamins (59.7%), co-enzyme Q10 (35.8%), fish oils (32.8%), herbal medicine (29.9%), and vitamin D (28.4%) (Appendix S5). Figure 1 describes TCIM use for any health condition and perceived benefit. Almost 75% of women ($n = 50$) had consulted a TCIM practitioner, and 65.7% of women ($n = 44$) had engaged in self-care practices in the past year. The main reasons for using TCIM were to improve fertility or support pregnancy (61.4%, $n = 35$), and to support general health/well-being (50.9%, $n = 29$). The main types of TCIM used for fertility/pregnancy were acupuncture (68.6%, $n = 24$), meditation (48.6%, $n = 17$), naturopathy (45.7%, $n = 16$) and massage (42.9%, $n = 15$), and for general health/well-being were massage (41.4%, $n = 12$), yoga (31.0%, $n = 9$), meditation (24.1%, $n = 7$) and relaxation (24.1%, $n = 7$) (Appendix S6). The main reason that women sought naturopathic care was to try everything while they were still fertile (Appendix S7). The services provided by naturopaths that were perceived the most beneficial were dietary recommendations (78.9%), preconception preparation (68.4%), information

TABLE 1 DOR diagnosis, effect on health, and treatment undertaken ($n = 67$)

Experience of DOR	<i>n</i> (%) or mean [SD]
Age at time of diagnosis	
Years	34.0 [5.07]
Tests used to diagnose DOR	
Low AMH	62 (92.5)
Elevated FSH	32 (47.8)
Low AFC	24 (35.8)
<4 oocytes/eggs retrieved in a previous IVF cycle	16 (23.9)
Unsure	6 (9.0)
Aspects of health affected by the diagnosis of DOR	
Fertility	61 (91.0)
Mental health	35 (52.2)
Self-esteem	24 (35.8)
Menstrual cycle	19 (28.4)
General health and well-being	16 (23.9)
Quality of life	11 (16.4)
Social stigma	9 (13.4)
Elevated liver enzymes	1 (1.5)
Menstrual cycle length	
<26 days	15 (22.4)
26–36 days	46 (68.7)
More than 36 days	3 (4.5)
Not recorded	3 (4.5)
Diagnosed by	
Fertility specialist	48 (71.6)
General practitioner	19 (28.4)
Obstetrician or gynaecologist	5 (7.5)
Naturopath	2 (3.0)
Reason for the practitioner visit	
Trying to conceive	45 (67.2)
Fertility planning	8 (11.9)
Preconception check-up	7 (10.4)
General check-up	2 (3.0)
Irregular menstrual cycles	2 (3.0)
Recurrent miscarriage	2 (3.0)
Endometriosis	1 (1.5)
Knowledge of DOR prior to own diagnosis	
No	50 (74.6)
Yes	14 (20.9)
Unsure	3 (4.5)
Action taken if DOR was diagnosed earlier	
Started trying to conceive at an earlier age	27 (40.3)
Fertility preservation (freeze oocytes or embryos)	23 (34.3)
Started trying to conceive immediately	13 (19.4)
Nothing would have changed	3 (4.5)

(Continues)

TABLE 1 (Continued)

Experience of DOR	n (%) or mean [SD]
Unsure	1 (1.5)
Nature of treatments recommended following the diagnosis	
Medically assisted reproduction	44 (65.7)
Referral to a fertility specialist	35 (52.2)
Dietary advice	7 (10.4)
Lifestyle advice	7 (10.4)
Referral to an obstetrician or gynaecologist	4 (6.0)
Blood tests and/or ultrasound to rule out other causes	2 (3.0)
None	2 (3.0)
Referral to a reproductive immunologist	1 (1.5)
Medically assisted reproduction (MAR)	
Current MAR	26 (38.8)
Previous MAR	25 (37.3)
Considering MAR in the future	9 (13.4)
Not considering MAR	7 (10.4)
Number of biological children conceived after the diagnosis of DOR	
None	45 (67.2)
Conceived with MAR	12 (17.9)
Conceived naturally	10 (14.9)
Current fertility intention	
Trying to conceive	43 (64.2)
Not trying to conceive	14 (20.9)
Pregnant	6 (9.0)
Planning to try in the next 6–12 months	4 (6.0)
Time spent trying to conceive (<i>n</i> = 49)	
<6 months	3 (6.1)
6–11 months	11 (22.4)
12–17 months	9 (18.4)
18 months–2 years	6 (12.2)
More than 2 years	20 (40.8)
Source of information about TCIM for DOR	
Internet websites	25 (37.3)
Social media such as Facebook	19 (28.4)
Medical doctor	12 (17.9)
Family or friends	12 (17.9)
TCIM practitioner	12 (17.9)
Allied health professional	5 (7.5)
Media (television, newspapers, radio)	2 (3.0)
Magazines or books	1 (1.5)
Own research	1 (1.5)

AFC, antral follicle count; AMH, anti-Müllerian hormone; DOR, diminished ovarian reserve; FSH, follicle stimulating hormone; IVF, *in vitro* fertilisation; MAR, medically assisted reproduction; TCIM, traditional complementary integrative medicine.

about the menstrual cycle and ovulation (63.2%), environmental toxins (52.6%) (Appendix S8).

Figure 2 describes the types of TCIM used in the past year compared to MAR treatment. There was no association between the women's use of MAR and the use of TCIM practitioners ($P = 1.000$), the use of MAR and supplements ($P = 0.319$), or the use of MAR and self-care practices ($P = 0.565$). Most individuals used vitamin and mineral supplements, with or without MAR, while herbal medicines were more frequently used by those who were not currently undergoing MAR but might consider it in the future (Fig. 3).

DISCUSSION

Our survey is the first to describe the health needs of women with DOR, treatments offered, and their use and experience of TCIM, including naturopathy. The findings suggest that women with DOR have health needs beyond infertility; the main form of treatment offered by medical practitioners is MAR, and TCIM is widely used and reported to be beneficial by the survey respondents.

The mean age at DOR diagnosis was 34 years among survey respondents, suggesting a non-physiological origin. A decline in ovarian reserve occurs in the transition to menopause and typical onset of natural menopause is around 51 years, with early menopause between 40 and 45 years and premature menopause before age 40.¹⁶ Other risk factors associated with a decrease in ovarian reserve are heterogeneous and may be due to genetic,¹⁷ autoimmune,¹⁸ iatrogenic (such as ovarian surgery, chemotherapy, and radiotherapy)^{19,20} and lifestyle/environmental factors.^{21,22}

The two main aspects of health that respondents reported affected were fertility (91.0%) and mental health (52.2%). Mental health is often negatively impacted alongside infertility, with anxiety and depression scores higher in infertile couples than fertile couples,²³ and greater rates of psychological distress (odds ratio (OR) 1.63; 95% CI 1.24–2.13) and depression (OR 1.40; 95% CI 1.11–1.75) in women with infertility compared to fertile women.²⁴ However, it is currently unclear if providing mental health support would result in better fertility-related outcomes.

Despite more than half of the women in our survey reporting mental health impacts, medical practitioners mainly offered fertility-related treatments such as MAR (65.7%) or referral to a fertility specialist (52.2%). While we did not ask specifically about referrals for mental health interventions, the women were asked if they were referred to a specialist of any kind. None reported being referred to a fertility counsellor, psychologist or psychiatrist. However, 18 (28%) women had consulted psychologists and eight (12%) had sought fertility counselling within the past year. This highlights the importance of medical practitioners addressing the mental health needs of women with DOR, as these women are actively seeking mental health services without formal referrals.

Most women had been diagnosed with DOR within the past two years and had they known the diagnosis earlier almost all (94%)

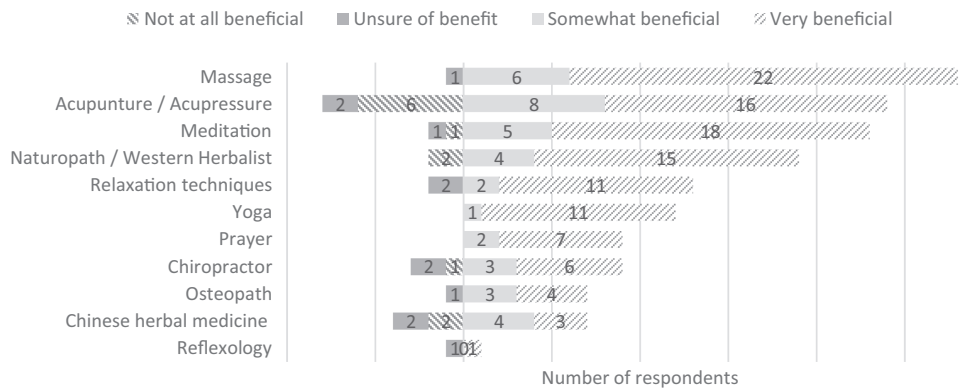


FIGURE 1 Traditional complementary integrative medicine (TCIM) used for any condition in the past 12 months and perceived benefit (n = 62).

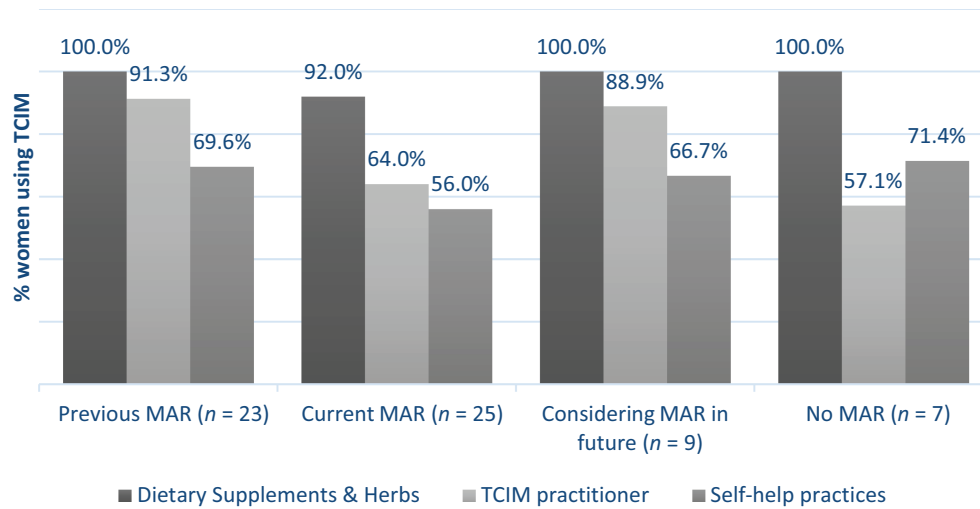


FIGURE 2 Associations between types of TCIM used in the past year and MAR. MAR, medically assisted reproduction; TCIM, traditional complementary integrative medicine.

would have changed their fertility plans by either trying to conceive earlier (59.7%) or undertaken fertility preservation (34.3%). Women knowing their own ovarian reserve status could be a useful tool in reproductive life planning, with 74% of childless individuals responding they would alter their plans if they were identified as having low ovarian reserve on screening (27.5% choosing to start trying to conceive immediately and 39% suggesting they would freeze eggs).²⁵ While the American Society of Reproductive Medicine (ASRM) guidelines advocate for open discussions about reproductive plans, they do not recommend routine screening of ovarian reserve markers²⁶ as they are poor predictors of reproductive potential in women with unproven fertility.^{27,28}

Among MAR users (76.1%), the most common procedure was ovulation induction with gonadotropins and IVF (41.2%). Gonadotropins are used to induce multi-follicular development in the ovaries. This process in combination with IVF is beneficial in the reduction of multiple pregnancy, a widely accepted adverse event in terms of maternal morbidity and neonatal outcome.⁶ Overall the results of MAR were disappointing with only 32% (12/38) of women reporting a live birth after 220 MAR cycles

(average six cycles per woman) excluding fertility preservation. DOR can be a challenging condition for fertility clinicians to manage, and the ideal MAR protocols remain unknown.²⁹⁻³¹

Traditional complementary integrative medicine was widely used by survey respondents, aligning with previous cross-sectional surveys indicating high TCIM usage rates in the general population of Australia and New Zealand.^{32,33} In our survey, respondents reported utilising acupuncture, meditation, naturopathy, massage and yoga for improving fertility, supporting pregnancy, or enhancing well-being. Previous research indicates that many Australian women use TCIM to increase their chances of procreating.^{10,11} An Australian cross-sectional survey showed that women attempting to conceive were more likely to consult acupuncturists (adjusted OR (AOR), 1.46; 95% CI 1.13–1.88) or naturopaths (AOR 1.30; 95% CI 1.03–1.64) compared to those not trying to conceive.¹² Another survey found bodywork therapists (including massage therapists and yoga teachers) to be the most consulted TCIM practitioners, while relaxation techniques and meditation were the most common practices in Australia.³² In our study, over 50% of women found

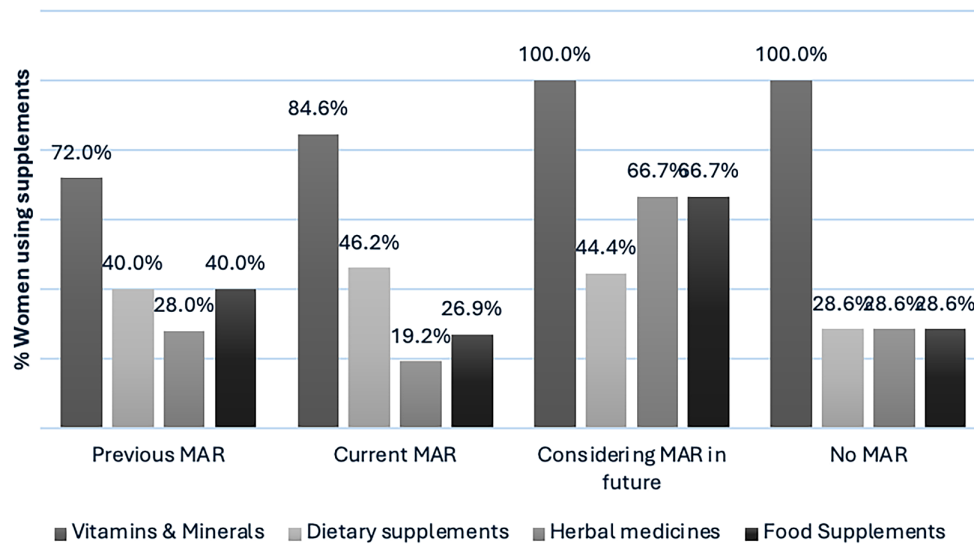


FIGURE 3 Associations between types of supplements/herbal medicines used in the past year and MAR. MAR, medically assisted reproduction.

acupuncture, massage, meditation, and naturopathy to be the most beneficial treatments (for any condition). Future research to explore the benefits of TCIM to support mental health concerns would be warranted.

The majority of women (88.1%) had taken supplements. This is consistent with previous surveys in Australia and New Zealand which reported high usage of vitamin and mineral supplements in the general population.³² It is expected that women attempting to conceive would have high supplement usage since national recommendations, as in many countries, advise folic acid and iodine supplementation when planning a pregnancy. However, supplement usage remained high (79%) when excluding respondents that were only taking a prenatal multivitamin, folic acid, or iodine supplement.

More than 50% of women consulted with a naturopath to try all available treatments while they were still fertile. Naturopathic practice is based on holistic philosophy and emphasises a whole person approach including health promotion, patient education, preventative medicine and wellness as an important and foundational approach to clinical care.³⁴ More than 78% of women liked naturopathy and felt it was a holistic experience. However, about 42% of women found naturopathy expensive and were unsure about its effectiveness. While there is growing evidence suggesting effectiveness for individual dietary supplements, there is a paucity of research for whole-system naturopathic care for health conditions.³⁵ We did not explore the reasons behind naturopathy being perceived as expensive; however, given the already expensive nature of MAR, the cost of naturopathy could add an extra financial burden.

The services provided by naturopaths were perceived as very beneficial by more than 50% of women, who had been provided with the information. The information about preconception care, menstrual cycle and ovulation, dietary approaches,

environmental toxins, physical activity, and stress management was considered 'very beneficial' or 'somewhat beneficial' by 50% of women who undertook naturopathic management. This aligns with the findings of Steel *et al.*³⁶ that suggest women may be consulting with a naturopath for preventative health care rather than to treat infertility.

Limitations

As this is the first survey to explore the health needs and treatment options of women with DOR, results are preliminary. The low respondent numbers may be seen as a limitation whereby the small sample size may prevent the results being generalised to the wider DOR community in Australia. There are no specific consumer advocacy associations for women with DOR in Australia, making it difficult to identify and contact this group. Recruiting through websites and social media may have introduced bias, as the sample might not accurately represent women with DOR. The open access to these platforms could attract women with perceived DOR, potentially skewing results. Future recruitment from gynaecology or women's health clinics would provide a more representative sample. The transferability to other countries may also be limited.

Additional bias may have been introduced by the self-reported nature of the survey data that is subject to responder and recall bias. Users and women with a positive perception of TCIM may have been more inclined to participate in the survey. The validity of the survey data could not be independently confirmed due to anonymous responses. For example, some responses regarding the number of cycles of MAR appear impracticable within the timeframes. Regarding TCIM, respondents were asked to recall usage within a 12-month period, hence, it is not expected to have significantly affected the integrity of the survey data.³⁷

Despite these limitations, this study provides novel insights into the health needs, treatments used and experience of TCIM among women with DOR. We found that women with DOR have additional health needs apart from infertility, most notably mental health support. TCIM is widely used to improve fertility, support pregnancy, or improve well-being, irrespective of MAR treatment. Our findings, while preliminary, are important for understanding what women with DOR need as part of their clinical management. Also highlighted is the need for more evidence regarding the efficacy and safety of TCIM.

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AUTHOR CONTRIBUTIONS

All authors were involved in the conceptualisation and design of the study and contributed to survey development. AM conducted the study, and drafted the manuscript. AM, SA, MA, MC and CE were involved in data analysis, manuscript revisions, and read and approved the final manuscript.

CONFLICT OF INTEREST

Authors AM, CE, SA and MA are academic researchers at NICM Health Research Institute. As a medical research institute, NICM Health Research Institute receives research grants and donations from foundations, universities, government agencies, and industry. Sponsors and donors provide untied and tied funding for work to advance the vision and mission of the Institute. AM declares that she is a naturopathic practitioner at a clinic in Sydney, Australia. She is the recipient of a scholarship from the Jacka Foundation of Natural Therapies for her PhD. The funding body had no role in the design of the trial, in the collection, analyses, or interpretation of data, in the writing of the manuscript, or in the decision to publish the results. CE declares that she is the Jacka Foundation Senior Research Fellow, Chair of the Royal Australian College of General Practitioners (RACGP) Integrative Medicine Specific Interest Network (voluntary role), Program Lead of an academic integrative healthcare centre (no financial interest), past GP Advisory Board member for Blackmores Research Institute, has received industry funding from nutraceutical device companies to conduct clinical trials, and has received honoraria and had travel expenses covered for presenting at complementary medicine events. SA declares that she is a naturopathic practitioner at an obstetrics and gynaecology clinic in Sydney, Australia. She has received payment for providing expert editing of naturopathic and herbal medicine educational programs, and for investigation of naturopathy, herbal medicines and nutraceuticals in

clinical trials and spoken at workshops, seminars and conferences for which registration, travel and/or accommodation has been paid by the organisers. MA declares that he is the chair of the Research Studies committee and the chair of the Clinical Advisory Committee, both for Endometriosis Australia. He works in private clinical practice as a TEAM practitioner at Sydney Endometriosis. He has received funding from Metagenics, Oz Medicann Group, the Medical Research Futures Fund, Canopy Growth and the Victorian Government, all outside the submitted work. MC has no competing interests.

DATA AVAILABILITY STATEMENT

The datasets used and/or analysed during the current study are available from the corresponding author on reasonable request.

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SUPPORTING INFORMATION

Additional supporting information may be found online in the Supporting Information section at the end of the article.

Appendix S1. Questionnaire: A survey of women with diminished ovarian reserve to explore their health needs, treatment decisions and experiences.

Appendix S2. Demographic and lifestyle habits of respondents ($n = 67$).

Appendix S3. Healthcare providers seen in the past 12 months ($n = 65$).

Appendix S4. Types of medically assisted reproduction (MAR) used by women with diminished ovarian reserve (DOR) ($n = 51$).

Appendix S5. Supplements used for any condition in the past 12 months.

Appendix S6. Traditional complementary integrative medicine (TCIM) used in the past 12 months and main reason for use ($n = 62$).

Appendix S7. Naturopathy – reasons for use, supplements provided and advantages/disadvantages perceived by women with diminished ovarian reserve (DOR) ($n = 19$).

Appendix S8. Topics about which information was provided by naturopaths and their perceived benefits ($n = 19$).