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# Preconception health risk factors documented in general practice electronic medical records

Nishadi Nethmini Withanage <sup>1</sup>, Jessica R Botfield <sup>1</sup>,  
Kirsten Black <sup>1,2</sup>, Danielle Mazza <sup>1</sup>

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<sup>1</sup>SPHERE, NHMRC Centre of Research Excellence, Department of General Practice, Monash University, Melbourne, Victoria, Australia

<sup>2</sup>Department of Obstetrics and Gynaecology, University of Sydney, Camperdown, New South Wales, Australia

## Correspondence to

Nishadi Nethmini Withanage, Department of General Practice, Monash University, Melbourne, Victoria, Australia; [nishadi.withanage@monash.edu](mailto:nishadi.withanage@monash.edu)

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## ABSTRACT

**Background** Documenting medical and lifestyle preconception health risk factors in electronic medical records (EMRs) could assist general practitioners (GPs) to identify those reproductive-aged women who could most benefit from preconception care (PCC). However, it is unclear to what extent PCC risk factors are identifiable in general practice records. This study aimed to determine the extent to which medical and lifestyle preconception health risk factors are documented in general practice EMRs.

**Methods** We conducted an audit of the documentation of medical and lifestyle preconception risk factors in 10 general practice EMRs in Melbourne, Australia. We retrospectively analysed the EMRs of 100 consecutive women aged 18–44 years who visited each practice between January and September 2022. Using a template informed by PCC guidelines, we extracted data from structured fields in the EMR and conducted a descriptive analysis.

**Results** Among the data extracted, the more commonly documented medical and lifestyle preconception health risk factors in the EMRs included smoking (79%), blood pressure (74%), alcohol consumption (63%) and body mass index (57%). Among the women audited, 14% were smokers, 24% were obese, 7% had high blood pressure, 5% had diabetes, 28% had a mental health condition, 13% had asthma, 6% had thyroid disease and 17% had been prescribed and could be using a potentially teratogenic medication.

**Conclusions** Better documentation of medical and lifestyle preconception health risk factors in structured fields in EMRs may potentially assist primary care providers including GPs in identifying and providing PCC to women who could most benefit from it.

## BACKGROUND

Preconception care (PCC) refers to interventions that identify and modify

## WHAT IS ALREADY KNOWN ON THIS TOPIC

⇒ General practice electronic medical records (EMRs) are a rich source of patient data and have the potential to contribute to healthcare education, policy and practice and improve service delivery. However, it is unclear to what extent preconception care (PCC) risk factors are identifiable in EMRs.

## WHAT THIS STUDY ADDS

⇒ Our study demonstrates the potential of auditing general practice EMRs for PCC purposes and highlights that a considerable number of women attending general practice have risk factors for a future pregnancy.

## HOW THIS STUDY MIGHT AFFECT RESEARCH, PRACTICE OR POLICY

⇒ Improving the documentation of medical and lifestyle preconception health risk factors in structured fields in EMRs may assist primary care providers in identifying and providing PCC to women who may benefit from it. Initiatives to support and improve the quality of information recorded in EMRs are warranted.

behavioural, biomedical and social risks present in reproductive-aged women.<sup>1–3</sup> PCC aims to enhance health and pregnancy outcomes by managing risk factors such as obesity, smoking, alcohol consumption, diabetes and mental health conditions. It includes the provision of health education, systematic identification of risks (risk assessment) and the initiation of interventions to address those risk factors that may affect future pregnancies.<sup>4</sup> PCC has been effective at reducing

smoking and alcohol consumption, increasing folic acid supplementation and achieving weight loss.<sup>2 5–7</sup> These factors may reduce maternal morbidity and mortality and enhance pregnancy outcomes including reduced risk of miscarriage, neural tube defects, abnormal birth weight and preterm birth.<sup>1 2 8 9</sup>

Primary care settings, including general practice, are ideally placed to deliver PCC as they are often the first point of healthcare service contact for many people.<sup>10</sup> Approximately 85% of the population visits a general practitioner (GP) each year.<sup>11</sup> Primary care providers can identify and address risk factors, support lifestyle changes (eg, relating to smoking, alcohol consumption and obesity) and educate women on the importance of maintaining optimal health during the preconception period.<sup>12 13</sup>

PCC is most commonly provided opportunistically,<sup>14</sup> such as when women initiate discussions on pregnancy planning, fertility or stopping contraception.<sup>14</sup> However, one third of pregnancies in Australia are unintended<sup>15</sup> and not all women are aware of the need for PCC,<sup>16</sup> hence women may miss out on PCC if this is not provided in a systematic way.<sup>17</sup> The provision of more targeted preconception interventions in general practices would first require the identification of women who might most be at risk of adverse maternal health or pregnancy outcomes and may therefore benefit from PCC.<sup>4 18</sup>

General practice electronic medical records (EMRs) are a rich source of patient data and have the potential to contribute to healthcare education, policy and practice and improve service delivery.<sup>19 20</sup> There is evidence that general practice holds the most complete resource of patient information for the Australian population.<sup>20</sup> EMRs comprise information including but not limited to: medical history, immunisations, prescriptions, alcohol consumption and smoking.<sup>19</sup> The Australian Standards for General Practices<sup>21</sup> mentions that lifestyle risk factors including smoking, nutrition, alcohol, physical activity, high blood pressure, height and weight (all of which are important lifestyle preconception risk factors) should be documented at defined intervals. It is unclear, however, whether this is in fact occurring, particularly in reproductive-aged women. We therefore sought to determine the extent to which medical and lifestyle preconception health risk factors are documented in general practice EMRs.

## METHODS

We conducted a retrospective audit of the documentation of medical and lifestyle preconception health risk factors in 10 general practice EMRs in Melbourne, Australia. We retrospectively analysed the EMRs of 100 consecutive women aged 18–44 years who had visited the practices between January and September 2022. We only included ‘active’ patients, that is, those who had visited the same practice at least three times in 2 years.<sup>22</sup> Contact details of prospective

practices were obtained from Health Direct (an open-access government database). General practices were contacted via email/telephone in mid-2022 and were invited to participate in the audit on providing written consent. Using an audit template informed by PCC guidelines<sup>3 4 23 24</sup> (online supplemental table 1) we extracted data from structured fields in EMRs. Our audit template (online supplemental table 1) was informed by guidelines for preventive activities in general practice,<sup>23</sup> a review of preconception health indicators<sup>24</sup> and an article reviewing topics for PCC.<sup>3 4</sup> Seven GPs among our professional networks provided feedback on the draft audit template and data collection process. Our approach to the development of the audit template is described in a separate article (currently under review). Only data in structured fields were extracted. Data in pathology reports and free-text notes were excluded, as data about specific conditions and risk factors may not be easily accessible in free-text notes in EMRs. Data collected included the age of the patient, height, weight, body mass index (BMI; classified into normal weight, overweight and obese), smoking status (current smoker or non/ex-smoker), alcohol consumption status (yes/no/excessive drinker, ie, >10 drinks weekly), blood pressure, blood glucose level, immunisations, past medical history (including past mental and physical/mental health conditions) and current medication (online supplemental table 1). Ethics approval was granted by the Monash University Human Research Ethics Committee (Project ID 31487).

## Patient and public involvement

Patients were not involved in this study.

## Coding and analysis

We coded the data according to a data dictionary (online supplemental table 2) that was developed by the research team, calculated the proportions of patients who had data documented for each preconception health risk factor, and calculated the mean for participants from the 10 practices. For preconception health risk factors including BMI and blood pressure, we only included data if it was reported within the last 2 years (2020–2022), to ensure recency. However, for preconception health risk factors including smoking, alcohol consumption, family history and obstetric history, since including the date of documentation is not an option in EMRs, all data in relevant structured fields were extracted. We determined that a patient had a specific condition if either a related diagnosis was mentioned in the past medical history, current medical conditions or if they were prescribed related medication and/or the reason for the prescription was documented in the EMR. We categorised medication using the Australian categorisation system<sup>25</sup> for prescription medications in pregnancy, noting that drugs classified into Categories C, D or X may have

harmful effects on the human fetus.<sup>26</sup> For immunisations we only extracted data for those relevant to the preconception period and thus included in our audit template: hepatitis B vaccine, rubella vaccine, influenza vaccine, varicella vaccine, measles, mumps and rubella (MMR) vaccine and DTaP (diphtheria, tetanus, acellular pertussis). Other immunisations documented in the EMRs were not extracted.

Data were collated using Microsoft Excel and analysed by calculating the percentage of data documented for each preconception health risk factor and then calculated the mean of the participants among the 10 practices.

## RESULTS

A total of 1000 eligible participants were included in the audit. Participating practices used various commercial EMR software including Zedmed, Australia (n=1), Best Practice, Australia (n=7) and Medical Director, Australia (n=2).

Medical and lifestyle preconception health risk factors more commonly documented included smoking status (79%), blood pressure (74%), alcohol consumption (63%) and BMI (57%). Less commonly documented preconception health risk factors in structured fields written as free-text included diabetes (5%), mental health conditions (28%), history of chronic medical conditions including asthma (13%) and thyroid conditions (6%), iron supplementation (6%), obstetric history (22%) and family history (36%). Medication was recorded as free-text notes in a structured field and according to the classification of drugs in the Australian categorisation system for prescription medications in pregnancy,<sup>25</sup> 13% had been prescribed a Category C and 4% a Category D medication. No women had a Category X drug prescribed. Our findings are summarised in table 1.

Other medical and lifestyle preconception health risk factors, including fertility problems, physical activity, iodine supplementation, history of eating disorders, recreational drug use and genetic diseases, were not documented in a structured field in the EMR. Although some immunisations were documented for most patients, relevant immunisations to the preconception period including hepatitis B vaccine, rubella vaccine, influenza vaccine, varicella vaccine, MMR vaccine and DTaP were only documented in 8% of cases, therefore immunisations were excluded from our analysis.

## DISCUSSION

Our audit study demonstrates the potential for general practice EMRs to identify patients who may most benefit from PCC. We found the majority of reproductive-aged women had their smoking status, blood pressure, alcohol consumption and BMI documented in their general practice EMRs. Less commonly

**Table 1** Key study findings

Preconception health risk factor	Criteria	Mean of participants from the 10 practices (%)
Smoking	Documented (yes)	79
	Smoker	14
Blood pressure	Documented (yes, after 2020)	74
	High blood pressure >140/90	7
Alcohol consumption	Documented (yes)	63
	<10 drinks/week	41
	>10 drinks/week	2
Body mass index (BMI)	Documented (yes)	57
	Overweight (BMI>25–30)	27
	Obese (BMI>30)	24
Blood glucose	Documented (yes, after 2020)	12
	High blood glucose >7.8 mmol/L	6
Diabetes	Diabetes listed as a medical condition	5
Mental health conditions	One or more of schizophrenia, panic disorders, bipolar disease, anxiety/depression listed as a medical condition	28
Asthma	Asthma listed as a medical condition	13
Thyroid disease	Hypo/hyperthyroidism listed as a medical condition	6
Iron supplementation	Prescribed one/more of Ferrograd, Maltofer, iron infusions (Ferinject)	6
Obstetric history	Descriptive text available in structured field for obstetric history	22
Family history	Descriptive text available in structured field for family history	36
Current medication	Category C/D medication (maybe teratogenic)	17

documented preconception health risk factors included blood glucose levels, and obstetric and family history.

Our study demonstrates the current burden of risk of potential adverse pregnancy outcomes. The relatively high prevalence of both preconception lifestyle risk factors in women (14% are smokers, 24% are obese) and medical conditions (7% had high blood pressure, 5% had diabetes, 28% had a mental health condition, 13% had asthma, 6% had thyroid disease and 17% had been prescribed and could be using a potentially teratogenic medication) highlights the potential to use information in the EMR to identify

reproductive-aged women who could most benefit from PCC. When comparing the prevalence of both medical and lifestyle risk factors reported in this study with national datasets, it is evident that general practice EMRs are a rich source of information that may help GPs to understand which of their patients may be at risk of adverse pregnancy outcomes and could most benefit from PCC. The prevalence of obesity, smoking, high blood pressure, mental health conditions, diabetes and asthma reported in this study are comparable to national prevalence rates, for example, for obesity (30% for females >18 years<sup>27</sup>), smoking (12.8% for females >18 years<sup>28</sup>), high blood pressure (4.9% in females aged 18–34 years<sup>29</sup>), mental health conditions (20% in Australians<sup>30</sup>), diabetes (3.8% in all Australian females<sup>31</sup>) and asthma (11% in all Australians<sup>32</sup>), which further emphasises the potential of using general practice EMRs to identify women who could most benefit from PCC.

Similar EMR audit approaches to that utilised in this study have been previously employed in primary care settings to identify patients at risk of medical conditions. A study investigating obesity management in general practice reported that only 22.2%<sup>33</sup> of patients had their BMI recorded in EMRs, compared with 57% of patients having their BMI reported in this study. The difference in reported BMI between the studies could potentially be due to the difference in participant groups between the studies. Our study only included women aged 18–44 years, which is a smaller and comparatively less diverse participant group when compared with all adult patients included in the other study,<sup>33</sup> and there is evidence that men have lower BMI documentation rates when compared with women.<sup>34</sup> Similarly, other studies have used information in EMRs to try and identify patients for total knee replacement,<sup>19 35</sup> predict risk and identify potentially modifiable factors for early and late death in adult-onset epilepsy<sup>36</sup> and to predict mortality in primary care patients with heart disease.<sup>37</sup>

While there is currently limited evidence on approaches to identify women who may most benefit from PCC in primary care settings based on preconception health risk factors, there have been attempts to identify these women in other settings. A study using a survey in community health centres to gather information on women's behaviours related to preconception health risk factors reported 63% of women being overweight or obese and 20% drinking alcohol.<sup>38</sup> The high prevalence of women with preconception health risk factors highlights the importance of developing processes to identify them in primary care settings in order to provide PCC, which may help reduce the risk factors and improve pregnancy outcomes.

Our findings suggest that although some medical and lifestyle preconception health risk factors are more commonly documented in general practice EMRs than others, there are many

factors which are only minimally documented or not documented at all in structured fields. This may occur for a number of reasons. First, patients may not always attend the same general practice or consult the same GP every time they attend a particular practice.<sup>39</sup> This means that data relevant to the assessment of a particular patient's risk may not always be captured comprehensively in one practice. Second, some preconception health risk factors including obstetric history and family history are commonly documented as free-text in clinical notes and hence may not be easily accessible using an audit approach.<sup>19</sup> While free-text can provide valuable information, the analytical process to extract relevant data from free-text in EMRs is complex, time-consuming and requires excessive manual effort, thereby placing an extra burden on the already time-restricted GPs and practice staff.<sup>40 41</sup> Machine-learning methods that can generate clinically relevant synthesised data from free text<sup>42</sup> may be a possible solution, but this is yet to be integrated into EMRs currently in use in Australia. Third, not knowing the currency of data can also make it difficult to verify certain factors. For example, if women were currently taking medication they had been prescribed some time ago and therefore what kind of risk the medication listed in the EMR posed to a future pregnancy. If EMRs are to be utilised to improve PCC it will be important for primary care providers to maximise their use of existing structured fields<sup>42</sup> and ensure data are regularly updated.

Given the time constraints primary care providers experience,<sup>40 41</sup> initiatives to support and improve the quality of information recorded in EMRs are warranted. For example, practice liaison officers have been used to provide regular feedback reports on data quality and population-level health indicators for individual general practices in inner East Melbourne. This has been shown to be effective in improving data quality and completeness.<sup>20 33</sup> Utilising similar initiatives to provide regular feedback reports on the documenting of preconception health risk factors may improve the completeness and accuracy of the EMR.

If preconception health risk factors are documented comprehensively in EMRs, screening tools could be used to assist primary care providers to identify women who may most benefit from PCC. This would enable provision of targeted PCC to reduce the risk of adverse pregnancy outcomes. Screening tools such as the Population Level Analysis & Reporting (POLAR) system play a pivotal role in targeted data extraction from EMR software,<sup>43</sup> and could be beneficial for PCC. For example, by applying filters such as 'patients with a BMI > 30' POLAR can facilitate the extraction of pertinent health data.<sup>44</sup> In previous studies, the POLAR screening tool has been effective in predicting hospital presentations among patients visiting general practices<sup>45</sup> and assessing the prevalence of musculoskeletal complaints in general practice.<sup>46</sup> A similar

strategy could be devised using POLAR to identify reproductive-aged women with preconception health risk factors, thereby allowing PCC to be provided to them if relevant.

Our study has both strengths and limitations. The same researcher was involved in the extraction of data from all the practices to ensure consistency in the extraction of data. The audit template (under review) used to conduct the audit was refined with feedback from GPs with expertise in entering and using data documented in EMRs, who therefore had a good understanding of the currency and accuracy of information on EMRs. As the main providers of PCC,<sup>47</sup> involving GPs in the development of the audit tool was important to understand which preconception health risk factors may be recorded and where that information can be found in the EMR. While our study has many important findings, there are some limitations. The proportions of documented preconception health risk factors reported in this study may be an underestimate for several reasons. Our audit results were subject to the limitations of EMRs, as there was no structured field to document physical activity, substance/recreational drug use, chronic conditions like asthma, thyroid conditions and mental health conditions or the use of over-the-counter supplements such as folate and iodine, these were not able to be audited. Some information pointing to a preconception health risk factor, for example, high blood glucose levels, may be reported in pathology reports, from which we did not extract data. Furthermore, across the 10 practices different EMR software was used and therefore there were differences in some of the data collected, classification and terminologies used. This was an exploratory study with a small sample size which may not be representative of all general practices in Melbourne, Victoria. The data we collected for most preconception health risk factors was documented over an undefined period of time and for a variety of purposes; preconception health risk factors such as alcohol consumption and smoking status may not have been current. Patients may move between practices during their lifetime and may not carry information contained in their previous EMRs such as childhood vaccinations. However, these limitations are in line with other studies in the literature which similarly reported substantial missing data in EMRs.<sup>19 48–50</sup>

Our study demonstrates the potential of auditing general practice EMRs for PCC purposes and highlights that a considerable number of women attending general practice have risk factors for a future pregnancy. More commonly documented preconception health risk factors including smoking status, blood pressure, alcohol consumption and BMI may alert primary care providers to identify and initiate PCC delivery to women who may be considered ‘high risk’ under these categories. These women could potentially be identified and invited<sup>51–53</sup> to the general practice to

receive PCC, although it will be important to understand the perceived acceptability and feasibility of this preventive healthcare approach from both the GP and patient perspective. Future studies could also explore ways to improve the documentation of medical and lifestyle preconception health risk factors in EMRs and to investigate the feasibility of embedding a preconception health risk factor checklist into EMR software, as occurs for other conditions.<sup>54–56</sup>

## CONCLUSIONS

Through examination of general practice EMRs, our findings suggest that although some medical and lifestyle preconception health risk factors including smoking status, blood pressure, alcohol consumption and BMI are more commonly documented in general practice EMRs, there are many risk factors that are only minimally documented or not documented at all in structured fields. Improving the documentation of medical and lifestyle preconception health risk factors in structured fields in EMRs may assist primary care providers in identifying women and providing PCC to women who may benefit from it.

**Correction notice** The article is updated since it got published first, as one of the incorrect affiliation is removed.

X Nishadi Nethmini Withanage @NishadiWith

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**Competing interest** Professor Danielle Mazza is an editorial advisory board member for BMJ SRH.

**Patient and public involvement** Patients and/or the public were not involved in the design, or conduct, or reporting, or dissemination plans of this research.

**Patient consent for publication** Not applicable.

**Ethics approval** This study involved human participants and was approved by Monash University Human Research Ethics Committee (Project ID 31487). Participants gave informed consent to participate in the study before taking part.

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**Data availability statement** All data relevant to the study are included in the article or uploaded as supplementary information.

**Supplemental material** This content has been supplied by the author(s). It has not been vetted by BMJ Publishing Group

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#### ORCID iDs

Nishadi Nethmini Withanage <http://orcid.org/0000-0003-4904-0372>

Jessica R Botfield <http://orcid.org/0000-0001-6157-9739>

Kirsten Black <http://orcid.org/0000-0003-0030-2431>

Danielle Mazza <http://orcid.org/0000-0001-6158-7376>

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**Supplementary table 1: Audit template**

Age	Iron supplementation
Alcohol consumption (per week)	Physical activity
Smoking usage (per day)	Thyroid disease
Recreational drug usage	Mental health illness
History of eating disorder(s)	Asthma
Height (cm) (within last 24 months)	Current medication
Weight (kg) (within last 24 months)	Family history
BMI (within last 24 months)	Obstetric history
Blood sugar (mmol/L) (within last 24 months)	Immunisations - Hepatitis B vaccine, Rubella vaccine, Influenza vaccine, Varicella vaccine, MMR vaccine and dTpa (diphtheria, tetanus, acellular pertussis)
Blood pressure (within last 24 months)	Iodine supplementation
Fertility problems	Genetic diseases
Diabetes	



Supplementary table 2: Data dictionary and results summary

Preconception health risk factor	Description	Practice										Mean of participants from the 10 practices
		A	B	C	D	E	F	G	H	I	J	
Smoking	Documented	68%	93%	70%	99%	88%	75%	63%	93%	77%	63%	79%
	Current smokers (out of documented)	15%	12%	7%	17%	11%	12%	25%	11%	17%	16%	14%
Blood pressure	Documented (after 2020)	54%	30%	83%	75%	90%	74%	84%	90%	64%	95%	74%
	High blood pressure >140/90 (out of documented)	5%	4%	7%	8%	10%	6%	13%	7%	3%	9%	7%
Alcohol consumption	Documented	56%	89%	37%	91%	55%	45%	43%	96%	67%	52%	63%
	Consume <10 drinks /week	34%	26%	54%	29%	53%	49%	28%	57%	40%	44%	41%
	Excessive drinking >10 drinks/week (out of documented)	0%	0%	0%	5%	2%	0%	7%	0%	2%	0%	2%
BMI	Documented	43%	49%	34%	62%	36%	77%	56%	85%	64%	61%	57%
	Overweight BMI > 25 x <29.9 (out of documented)	23%	29%	29%	27%	38%	32%	16%	26%	22%	28%	27%
	Obese BMI >30 (out of documented)	16%	18%	26%	37%	16%	19%	23%	28%	18%	43%	24%
Blood glucose	Documented (after 2020)	4%	0%	3%	5%	13%	5%	4%	43%	29%	11%	12%
	High blood glucose (out of documented) >7.8mmol/l	25%	0%	0%	20%	0%	0%	0%	0%	0%	18%	6%
Diabetes	Documented	0%	1%	2%	8%	3%	2%	3%	91%	26%	5%	14%
	Diabetics (out of documented)	0%	100%	100%	100%	100%	100%	100%	9%	15%	100%	72%

Mental health conditions	Schizophrenia, panic disorders, bipolar disease, anxiety/depression documented in current medical conditions	19%	19%	33%	29%	40%	33%	33%	39%	7%	25%	28%
Asthma	Asthma listed as a medical condition	5%	9%	10%	14%	13%	17%	12%	24%	8%	16%	13%
Thyroid disease	Hypo/hyperthyroidism listed as a medical condition	1%	2%	5%	3%	5%	14%	3%	8%	6%	11%	6%
Iron supplementation	Prescribed with Ferrograd, Maltofer, Iron infusions (ferinject)	8%	6%	12%	7%	3%	10%	2%	1%	3%	4%	6%
Obstetric history	Descriptive text available in a structured field for obstetric history	1%	6%	16%	40%	40%	34%	27%	26%	15%	10%	22%
Family history	Descriptive text available in a structured field for family history	37%	6%	37%	31%	68%	23%	12%	91%	25%	31%	36%
Current medication	Category C/D medication prescribed (may have harmful effects on the fetus)	25%	15%	19%	7%	22%	9%	21%	14%	17%	22%	17%