Prenatal alcohol exposure risk perception dimensions and influencing factors: A systematic review and conceptual model

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Abstract

Objective: This paper aims to explore the available literature to understand how risks regarding prenatal alcohol exposure are perceived.

Methods: A systematic review (PROSPERO; CRD 42020212887) was undertaken. PubMed, Embase, PsycINFO, and CINAHL were searched for relevant quantitative and qualitative studies. A thematic analysis of the studies was performed.

Results: Fifteen articles—nine quantitative and six qualitative studies met the inclusion criteria. Three dimensions of risk perceptions were identified—perceived susceptibility, perceived severity, and affective risk perception. Three influencing factors of these dimensions were also identified: information (i.e., consistency, confirmation bias, strength of the evidence, and perceived relevance), sociocultural (i.e., social inclusivity, cultural context, and risk interpretation), and individual (i.e., risks versus benefits, controllability, and experience). These dimensions and influencing factors were brought together to create the proposed novel Pregnancy Alcohol Risk Perception (PARP) conceptual model.

Conclusions: The novel PARP conceptual model developed from the current literature provides a framework to guide understanding of risk perceptions, which includes a wide range of potential influencing factors.

Implications for public health: The novel PARP conceptual model provides the groundwork for further refinement with stakeholders, which could in turn be used to inform the design of interventions and health promotional materials to support harm reduction approaches and prevention of prenatal alcohol exposure.

Key words: perception, risk, pregnancy, model, prenatal alcohol, fetal alcohol spectrum disorder, prevention

Introduction

Prenatal alcohol exposure (PAE) is common.[1] Globally, 9.8% of individuals in the general population reported prenatal alcohol use, with the highest estimated pooled prevalence documented in Ireland (60.4%), Belarus (46.6%), Denmark (45.8%), and United Kingdom (UK) (41.3%).[2] Higher prevalence of PAE was reported when the period between conception and pregnancy awareness was included (i.e., up to 75% of pregnancies in the UK and Ireland).[1] Developing effective approaches to support alcohol reduction and abstinence is imperative[3] as PAE is associated with a range of adverse outcomes for maternal and infant health.[4,5] Adverse outcomes associated with heavy PAE, coupled with the variable research outcomes regarding the effects of low-to-moderate PAE[1,6–8] have led many countries to adopt a precautionary principle of abstinence,[9] which underlies the construction of risk in government and clinical practice guidelines, health policies, and expert opinions in many countries, Australia included.[3,10]

A substantial body of literature has examined potential predictors of PAE,[11,12] women's knowledge,[13] attitudes,[13–15] and beliefs[15] regarding alcohol use in pregnancy. Despite documented improvement in knowledge,[16,17] the effectiveness of PAE preventive interventions is varied.[17,18] More recently, reviews have explored the views and experiences of women regarding alcohol use or abstinence during pregnancy[19] and examined the existing structural barriers and facilitators encountered while navigating reduction or abstinence of alcohol use.[20] Despite being alluded to in a number of studies as possibly contributing to prenatal alcohol use, risk perceptions of PAE have not been extensively studied.[11,21,22] It is widely known that the mere presence of a health risk is insufficient to trigger a change in

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behaviour.[23] The effective uptake of preventive activities is driven to some extent by beliefs about the risks of adverse health consequences and how people come to hold personal beliefs can be influenced by a wide range of external factors.[23] Therefore, understanding risk perceptions is pertinent to facilitate avoidance of health hazards and engagement in health-protective behaviours.[24] For example, this association between risk perceptions and health behaviours has been substantially documented in the initiation, cessation, and switching of different tobacco products[25–28] and alcohol use in the general adult population.[29,30]

In view of the importance of risk perceptions, this systematic review sought to gain a more thorough understanding of how pregnant women perceive the risks of PAE. For this review, risk is defined as the probability of experiencing adverse consequences; risk perceptions of PAE are hence the subjective judgement about the chance of experiencing adverse outcomes. Importantly, risk perceptions are also a complex outcome of structural, social, political, and cultural factors.[29,31,32] Drawing on the definition by Pidgeon, risk perception is "people's beliefs, attitudes, judgements and feelings, as well as the wider social or cultural values and dispositions adopted towards hazards and their benefits."[33] While acknowledging that specification of risk targets (i.e., mother and baby) and that the nature of harms may have an important differential impact on risk perception, this review does not seek to explore the intricacies of this relationship but rather aims to answer two questions: (i) What are the dimensions of PAE-associated risk perception? (ii) What influences these risk perception dimensions?

Methods

The methods for this systematic review were prespecified in a protocol registered with the international prospective register of systematic review (PROSPERO; CRD 42020212887), and reporting of this review conforms to the Preferred Reporting Items for Systematic Reviews and Meta-Analyses statement.[34]

Eligibility criteria

Peer-reviewed articles were eligible for inclusion if (i) the target population consisted of pregnant women or women who had been pregnant; (ii) when women who had never been pregnant were part of the study population, studies will be included if pregnant women and/or those who had been pregnant constituted more than 50% of the study population; (iii) studies utilised observational, experimental, and qualitative designs. Studies were excluded if they were not published in English or non-empirical studies, such as literature reviews, discussion papers, conference abstracts, commentaries, letters, and editorials.

Information sources

The search was undertaken in three stages. The first stage involved a review of relevant papers known to authors to identify keywords and key concepts/phrases to add to the search strategy. The second stage involved database search; PubMed, Embase, PsycINFO, and CINAHL were searched from inception through August 2021. The search aimed to recall as many potential studies as possible (i.e., seeking sensitivity more than specificity) to increase the inclusiveness of our search. See Supporting Information Data File 1 for the search strategies that were applied for each database. The third stage involved hand searching of the reference lists of included studies to identify additional publications.

Selection process

After exporting studies from the databases, duplicates were removed. The first author (MNE) screened the articles for eligibility based on their titles and abstracts; articles not pertaining to perceptions of PAE-associated risks were excluded. Subsequently, the full texts of articles that fulfilled the eligibility criteria were retrieved and reviewed by MNE and MVD independently. Discrepancies were resolved through discussion.

Data collection process

Data extraction was carried out by MNE and MVD independently with disagreements resolved through discussion. For both quantitative and qualitative studies, information about authors, year of publication, sample size, age, ethnicity, pregnancy status, level of PAE, study setting, study design, methodology, risk dimensions, influencing factors, and results were extracted and tabulated.

Quality assessment

Appraisal of quantitative studies was performed using the Critical Appraisal of a Questionnaire Study,[34,35] which focused on methodological quality assessment of questionnaire studies.[35] Nine areas were assessed—research question/study design, validity/reliability, format, piloting, sampling, distribution/administration/response, coding/analysis, results, and conclusion/discussion. The methodological quality was rated as high(++) if the majority of criteria were met, with little or no risk of bias; acceptable quality(+) if most criteria were fulfilled, with some flaws in the study with an associated risk of bias; low quality(-) with either most criteria not fulfilled, or significant flaws relating to key aspects of study design; reject(0) if poor quality study with significant flaws.[35]

Qualitative studies were assessed using the Consolidated Criteria for Reporting Qualitative Research (COREQ) checklist which is a formal checklist covering the reporting of studies using interviews or focus groups.[36] Three domains were assessed—research team/reflexivity, study design, and analysis/findings. Articles were assessed independently by MNE and MVD. All disagreements were resolved through discussion (Table 2).

Synthesis methods

Studies were uploaded to NVivo, and thematic analysis[37] was performed. Thematic analysis consisted of three phases: (i) analysis of content—open line-by-line coding; (ii) development of descriptive themes guided by the codes; (iii) synthesis of descriptive themes—"going beyond" the findings to generate analytical themes.[37] The term "theme" was used for data synthesis. Descriptive themes were grouped into analytical themes of "dimensions" of alcohol risk perceptions, and "influencing factors" of these dimensions. These descriptive and analytical themes were brought together to create the novel Pregnancy Alcohol Risk Perception (PARP) conceptual model, which was initially drafted by MNE and subsequently discussed and refined in an iterative manner with all authors. Analysis of the studies was approached inductively with a broad research question of what does the paper tell us about the

understanding, construction, conceptualisation, and experiences of PAE risks?

Findings

Study selection

The search strategy yielded 2,261 articles, of which 518 were duplicates (Figure 1). The remaining 1,743 records were screened for title and abstracts and 1,722 were removed. Twenty-one full text articles were assessed for eligibility, and seven articles were subsequently excluded. Three articles were excluded for different target population, and four articles did not address risk perceptions. One additional article was identified by hand-searching the reference lists of included articles.[38] A total of nine quantitative and six qualitative articles met the inclusion criteria.

Study characteristics

The included studies were published between 1994 and 2019. The majority of quantitative studies (n=6; Table 1) recruited only pregnant women,[22,39–43] and the remainder (n=3) recruited a mix of pregnant, postpartum, or women with children.[38,44,45] Eight were cross-sectional studies, and one was a prospective cohort study.[40] Five studies recruited participants from the community,[38–40,44,45] two from outpatient clinics,[22,42] one from a combination of community and outpatient clinics,[41] and one from an antenatal program.[43] All except one study included participants with all levels of alcohol use; alcohol use status was not stipulated in Petersen et al.[44] Elicitation of risk perceptions focused on alcohol only in seven of the included studies.[22,39–43,45] Assessment of risk perceptions in two studies[38,44] included a wider range of substances, such as food and medications during pregnancy. In the qualitative studies, a different mix of participants were recruited—only pregnant women,[14,46] pregnant women and their partners,[47] pregnant and recently postpartum women,[48] pregnant, recently postpartum or with young children,[49] and recently postpartum women.[31] Data collection was performed using semi-structured interviews,[14,46,47] focus groups,[48] and a combination of semi-structured interviews and focus groups.[49] In Pati et al.,[31] data were collected using in-depth interviews with pregnant women and their family members, in addition to focus group discussions with frontline workers and community leaders.

Quality assessment

All quantitative studies were scored as "acceptable" quality (Supplementary Data File 2). Research questions and study design, format, coding/analysis, results, and conclusions/discussion criteria were fulfilled by all the quantitative studies. Validity/reliability and piloting of the questionnaires were the least fulfilled criteria; validity and reliability were only reported in Petersen et al.[44] Only two studies piloted their questionnaires.[22,44]

As for qualitative studies, none of the included studies met all the Consolidated Criteria for Reporting Qualitative Research criteria (Supplementary Data File 3). Research team and reflexivity was the least fulfilled domain, with none of the studies adequately describing personal characteristics and the researchers' relationships with the participants. All except one study[14] adequately described the theoretical framework utilised. All studies partially fulfilled the criteria for participant selection and only Pati et al.[31] adequately reported the study setting. All studies described the data analysis adequately. Reporting of findings was adequately fulfilled by all studies except Hammer and Inglin.[46]

Synthesis of findings

Three risk perception dimensions—susceptibility, severity, affective—and three influencing factors—individual, information, sociocultural—were identified and developed into the PARP conceptual model (Figure 2).

Risk perception dimensions

Three identified dimensions of risk perceptions described how pregnant women conceptualised the potential risks associated with PAE.

Perceived susceptibility

Perceived susceptibility described the individual's personal beliefs about themselves or their fetus' vulnerability regarding the potential risks associated with PAE.[14,22,39–41,45–47] Individual differences in susceptibility ["…everybody's different so you don't know whether a little bit will affect you or have no effect whatsoever."][14] and the amount, types, and pattern of alcohol use were identified to impact on risk susceptibility[22,39,41,46] ["If you drink in moderation and you're sensible, then I don't think it affects the fetus.."].[14] One study explored the concept of "unrealistic optimism," which was described as underrating of one's own compared to peers' susceptibility. This study found no evidence that women believed themselves to be less at risk of the adverse consequences of PAE compared to their peers.[43]

Perceived severity

Perceived severity described an individual's appraisal of the seriousness of the potential harms associated with PAE. This dimension was elicited using numeric rating scales[38–40] and specification of the types of risks detailed by the participants.[22] Prematurity,[22] low birth weight,[39] congenital abnormalities,[22,38–40] neurodevelopmental disabilities,[39,40] and the specific diagnosis of fetal alcohol syndrome[40] represented the potential risks for babies. Furthermore, alcohol was perceived to increase the risk of spontaneous abortion.[22] Duration of potential risks additionally characterised this dimension; for example, utilising fixed response categories to elicit beliefs about the duration of adverse effects that have been specified by the participants, 48.1% indicated lifelong harmful effects and 15.5% indicated harmful effects lasting from pregnancy up to the first years of life.[22]

Affective risk perception

Affective risk perception described the emotional dimension involved with the potential risks associated with PAE. Women expressed feelings of enjoyment and stress relief[14] derived from alcohol use ["… if it has a relaxing effect on you, then I don't see there's any harm"][14] while also negotiating fear[49] and guilt[40,47] ["So I was certainly never going to drink…… I think because that [Fetal Alcohol Syndrome] scared the crap out of me."].[49]

Factors influencing risk perception dimensions

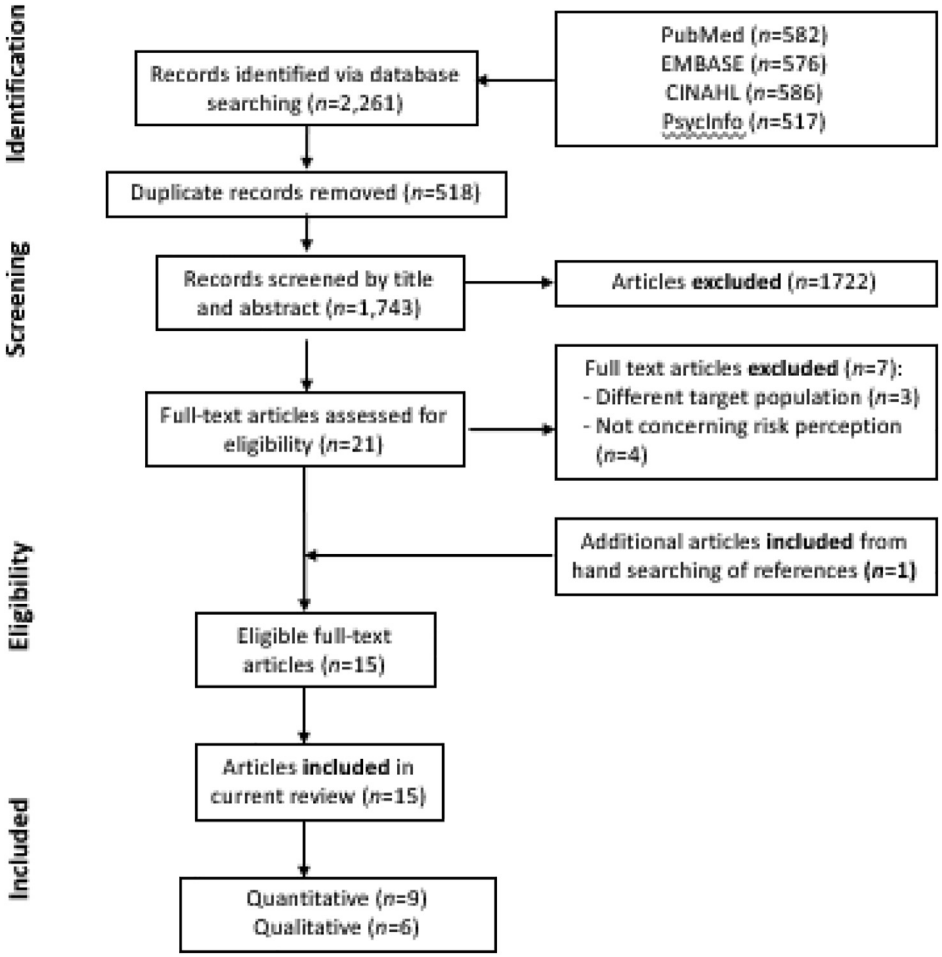
Three influencing factors were identified—information, sociocultural, and individual.

Table 1: Study characteristics.

	Population				Study-related		
	Sample size	Mean age; age range	Ethnicity	Pregnancy status	Description of prenatal alcohol use	Setting	Study design/Methodology
Quantitative studies							
Morris, Swasy and Mazis (1994); *USA*	409	28; 18-44	Caucasian	Pregnant	All	Community	Cross sectional
Testa and Reifman (1996); *USA*	159	27.28; 18 -43	53% white; 43% Black	Pregnant	All	Community	Prospective cohort
Kaskuta (2000); *USA*	321	NA; 18-42	185 A-A, 102 A-I, 34 White	Pregnant	All	Prenatal clinics and community	Cross sectional
Kesmodel and Kesmodel (2002); *Denmark*	439	30.1; NA	Danish	Pregnant	All except Alcohol Use Disorder	Antenatal clinics	Cross sectional
Nordeng, Ystrom and Einarson (2010); *Norway*	1793	30; 17-45	NA	Pregnant and women with children < 5 years old	All	Community	Cross sectional
Petersen et al (2015); *Multinational*	9113	NA; 15-55	Multinational - 18 countries.	Pregnant and postpartum	Not stated	Community	Cross sectional
Dumas et al (2018); *France*	3063	NA; <25 to ≥ 35	French	Pregnant and postpartum	All	Community	Cross sectional
Luow, Tomlinson and Olivier (2018); *South Africa*	128	29; 18-44	South African	Pregnant	All	Participants in antenatal programme	Cross sectional
Corrales-Gutierrez et al (2019); *Spain*	426	31; ≥ 16	Spanish	Pregnant	All	Outpatient clinic at public university hospital	Cross sectional
Qualitative studies							
Branco and Kaskutas (2001); *USA*	11	NA; NA	Native and African American	Pregnant and postpartum	All drank before pregnancy; 2 continued during pregnancy	Health clinic and teaching hospital	Health belief model; Focus group; Thematic analysis
Raymond et al (2009); *United Kingdom*	20	33[a]; 23-40	NA	Pregnant	All drank prior to pregnancy; 6 abstain, 13 reduce use, 1 same consumption	Community organisations	Semi-structured telephone interviews; Thematic analysis
Hammer and Inglin (2014); *Switzerland*	50	NA; 24-41	47 European; 3 Others	Pregnant	NA	Community and health clinics, websites	Sociocultural approach; Semi-structured interviews; Thematic analysis Holland, McCallum and Walton (2016)
Australia	20	NA; NA	NA	Pregnant, postpartum or had young children, planning pregnancy (focus group)	NA	Community, clinics	Social approach; Semi-structured interviews; focus group; Thematic analysis
Pati et al (2018); *India*	19	NA; NA	Indian	Recently postpartum	All drank during pregnancy	Community	Emic and etic approach; In-depth interview
Hammer (2019); *Switzerland*	30	NA; 23-37	19 Swiss	Pregnant and partners	NA	Personal contacts and networks	Sociocultural approach; Semi-structured interviews; Thematic analysis

[a]Median age; A-A – African American; A-I – African-Indian; NA – Not available.

Figure 1: PRISMA diagram.



Information

The influencing factor of information consisted of four components—consistency, confirmation bias, strength of evidence, and perceived relevance.

Consistency

Inconsistency of messages, for example, the shift of the Australian guidelines from the initial focus on the deleterious effects of high-risk drinking to the current guidelines stating that no alcohol should be consumed while pregnant[49] resulted in uncertainty of potential risks interpretation[14,46,49] ["It's very difficult to feel very reassured with any of the advice because everything conflicts so much...."].[14]

Confirmation bias

Confirmation bias described the tendency to gravitate towards information or advice that conformed to an individual's own risk construction ["I drink a little glass from time to time, and she (her midwife) told me 'it's OK' and that's it… so for her, it was acceptable.."][46]

Strength of evidence

Discordance between risk interpretations and framing of risks by authorities led some women to question the strength of scientific evidence justifying the recommendations for complete abstinence[46,49] ["… such changes indicated total abstinence was not based on solid evidence but was a fashion thing."].[46]

Perceived relevance

Individuals may not view information as being relevant to their level of alcohol use, hence justifying the potential risks based on their level of consumption ["…the only information she had received … seemed to be related to Foetal Alcohol Syndrome and her understanding was that this was associated with regular heavy drinking."].[49]

Sociocultural

The influencing factor of sociocultural consisted of three components—social inclusivity, cultural context, and risk interpretation.

Social inclusivity

Alcohol use was identified as a key part of social activities,[31,48] and hence, abstinence from alcohol was found to preclude social inclusivity [I'm a major outcast because I don't drink].[48]

Cultural context

Culture provided the context in which risks were interpreted; for example, women from the Odisha tribe viewed Handia, a traditional

Table 2: Quality assessment for included studies.

Quantitative studies: Critical Appraisal of a Questionnaire Study

	1	2a	2b	3a	3b	4a	4b	5	6a	6b	6c	7	8a	8b	8c	9a	9b	Quality
Morris (1994)	1	0	1	1	1	0	0	1	1	1	1	1	1	1	NR	1	1	++
Testa and Reifman (1996)	1	0	0	1	1	0	0	1	1	1	1	1	1	1	NR	1	1	++
Nordeng (2010)	1	1	1	1	1	0	0	1	1	1	1	1	1	1	1	1	1	++
Kaskutas (2000)	1	0	0	1	1	0	0	1	1	1	1	1	1	1	NR	1	1	++
Kesmodel (2002)	1	0	0	1	1	0	0	1	1	1	1	1	1	1	NR	1	1	++
Petersen (2015)	1	0	0	1	1	1	1	1	1	0	0	1	1	1	NR	1	1	++
Dumas (2018)	1	0	0	1	1	0	0	1	1	1	1	1	1	1	NR	1	1	++
Jacobus (2018)	1	0	0	1	1	0	0	1	1	1	1	1	1	1	NR	1	1	++
Corrales (2019)	1	0	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	++

Qualitative studies: COREQ Qualitative Appraisal Tool

	Domain 1: Research Team and Reflexivity		Domain 2: Study design				Domain 3: Analysis & Findings	
	Personal characteristics	Relationship with participants	Theoretical framework	Participant selection	Setting	Data collection	Data analysis	Reporting
Branco & Kaskutas (2001)	P	P	✓	P	×	×	P	✓
Raymond (2009)	×	×	×	P	P	P	P	✓
Hammer (2014)	P	×	✓	P	P	P	P	P
Holland (2016)	P	×	✓	P	P	P	P	✓
Pati (2018)	P	P	✓	P	✓	P	P	✓
Hammer (2019)	P	×	✓	P	P	P	P	✓

Note: ***Quantitative studies***: 1.*Research question/study design* – questionnaire is the most appropriate method, 2. *Validity and reliability* – 2a. Claims of validity made and justified, 2b. Claims of reliability made and justified, 3. *Format* – 3a. Example questions provided, 3b. Questions understandable, 4. *Piloting* – 4a. Details of piloting undertaken, 4b. Questionnaire adequately piloted, 5. *Sampling* – sufficient and representative, 6. *Distribution, administration, and response* – 6a. Methods reported, 6b. Response rated, 6c. Potential response biases discussed, 7. *Coding and analysis* – appropriate, 8. *Results* – 8a. Relevant data provided, 8b. Quantitative results significant and non-significant results reported, 8c. Qualitative results interpreted, quotes properly justified and contextualised, 9. *Conclusion and discussion* – Appropriate link drawn between data and conclusions, 9b. Findings placed within wider body of knowledge in the field and recommendations justified; 1=Fulfilled; 0=Not fulfilled; NR=Not relevant; ++(High quality). ***Qualitative studies:*** ✓:Criteria fulfilled; P: Criteria partially fulfilled; × : Criteria not fulfilled.

homemade alcohol, as safe compared to commercial alcohol that was viewed as being more intoxicating.[31]

Risk interpretation

Risk interpretation of women's social network influenced their perceptions of risks and hence alcohol use behaviour. For some, social evaluations of drinking differentiated between occasional alcohol use and drunkenness; hence, women did not view alcohol use during social occasions as contradicting social norms or expectations[31,46,49] ["It is norm to have the occasional glass, like four or five over the whole pregnancy and this is certainly not frowned upon."[49]]. On the contrary, some women internalised alcohol abstention as the socially acceptable response to the possibility of PAE risks, citing social pressure as the reason to refrain from alcohol use ["…it seems very all or nothing and I get that the message…."].[49]

Individual

The influencing factor of individual consisted of three components—risks versus benefits, controllability, and experience.

Risks versus benefits

Individuals weighed up the potential risks and benefits of PAE.[14] For some, the immediacy of alcohol benefits and fulfilment of needs dominated their risk discourses ["… it gives me just that total relaxation feeling...outweigh the fact that you're having alcohol……"].[14] On the other hand, for those who were able to cope without the perceived benefits of alcohol, their perceptions of potential harm towards their babies dominated their risk negotiations[46,47] ["…I enjoy drinking a glass of wine but ... for the baby, we'll go without it…"].[46] The comparatively short duration of pregnancy also justified erring towards abstinence ["It is only 9 months ….. not that long really when you've got to think about somebody else's life."].[14]

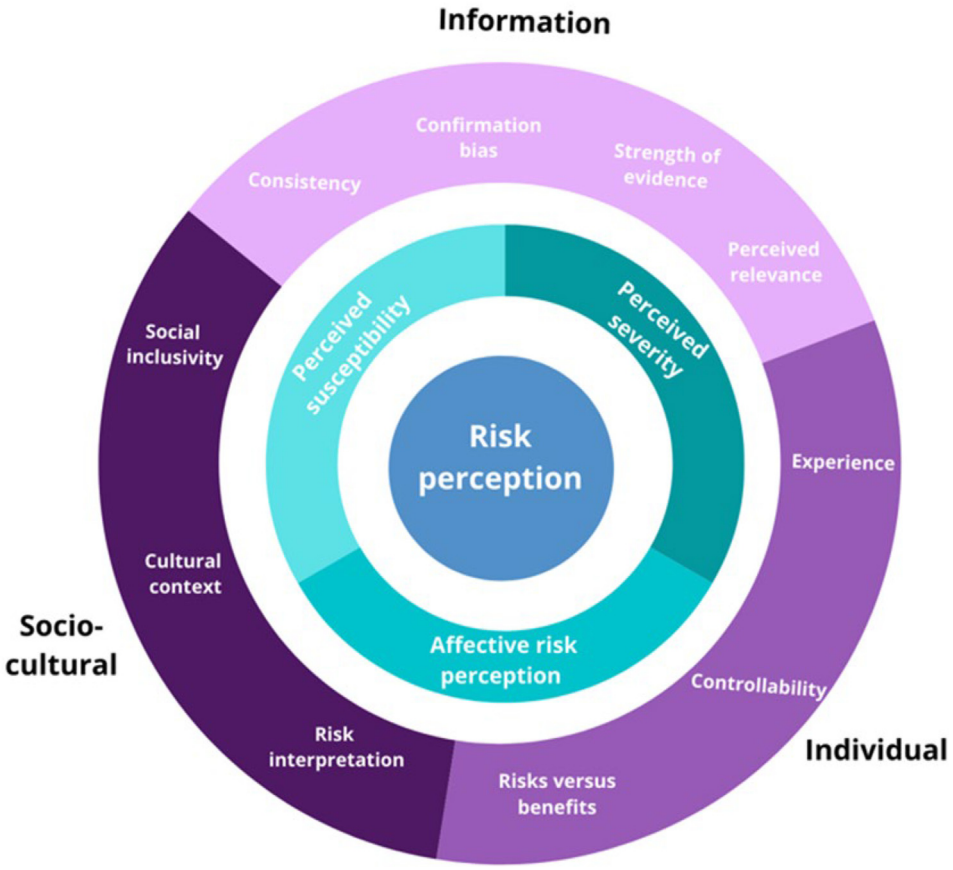
Controllability

As symptoms such as a burning sensation to the throat when consuming alcohol[48] or feelings of drunkenness[46] were thought to represent alcohol riskiness, some individuals reported minimised risks when they did not experience these symptoms. Additionally, symptoms experienced were related to the types of drink consumed ["Hard liquor would be bad …if it burns going down what do you think it's doing when it hits the stomach or is going through your body? …wine would be more like a relaxing thing …."].[48] Hence, individuals perceived that they could control the potential risks of alcohol by consuming moderately, consuming certain types of drinks or having a meal prior to consumption.[46,48] Accordingly, beliefs about strategies that could control or minimise alcohol-associated harm culminated in lower perception of risks ["If I have already eaten well and I drink a little glass of red wine, I do not feel that I put my baby at risk."].[46]

Experience

Perceived risks of PAE were lower among women who had previously given birth to a healthy child.[40] Women shared how doubts are cast

Figure 2: Pregnancy Alcohol Risk Perception (PARP) conceptual model. *Note: Middle circle, risk perception dimensions; outer circle, influencing factors.*



on risk information from pregnancy alcohol guidelines by reassurance from their own unaffected previous pregnancies ["I drank a little bit with my first child and I carried on doing that with my second and third pregnancies. My first child is absolutely fine."][14] or that of close contacts ["Everyone drinks moderately while pregnant without anything happening, so I think (avoiding alcohol entirely while pregnant) is a bit extremist."].[46] Conversely, experiences of negative outcomes such as learning difficulties[14] and Fetal Alcohol Syndrome[49] resulted in increased risk perceptions[14,49] ["I know about Fetal Alcohol Syndrome … a friend of mine works in a prison and he's like, 'Yep, that's about half of them'….. I was certainly never going to drink regularly even once a week…."].[49]

Discussion

This systematic review identified key dimensions and influencing factors regarding how the potential risks of PAE are perceived from the available literature, which has then led to the construction of the novel PARP conceptual model. In addition to advancing our understanding of how PAE-associated risks are construed, the review has situated an individual's risk perceptions in the broader sociocultural, individual, and informational contexts, highlighting the complexity and uniqueness of an individual's risk interpretations.

Perceptions of susceptibility and severity represented the process of an individual's rational and reasoned risk construction. While these two dimensions constituted important determinants of behaviour change in many empirical studies,[32,50,51] extant behavioural research has also increasingly recognised the indispensable role of affect in guiding optimal judgement, decision-making, and preventive behaviours.[52,53] Accordingly, studies in this review reported the various positive and negative emotions experienced while negotiating PAE-associated risks.[40,47,49] Independent from cognitive risk assessment, previous research has identified that affect was a stronger determinant of behaviour compared to cognitive-based risk assessment.[53] Pertinent to the issue of PAE is the uncertainty of the available evidence pertaining to low/moderate levels of PAE, which in part is likely due to the wide range of individual factors that influence an individual's level of risk (i.e., genetic differences, metabolic rates, biochemical and inflammatory responses to alcohol and a wide range of maternal health factors, including maternal size and nutrition),[54–56] which makes it impossible for anyone (i.e., health professionals or individuals themselves) to determine accurately the current level of individual risk associated with PAE. Extrapolating from evidence that suggested effective risk communication influences risk perceptions, attitudes and behaviour,[57] strategies adopted for health education and communication of PAE risks should accurately communicate the uncertainty of the available evidence and the reasons for this current uncertainty.

Sociocultural context offers a lens to support further understanding of an individual's risk perceptions. Women who experienced alcohol as facilitator of social relationships viewed PAE as less risky.[31,46,48,49] Furthermore, the direct experiences of negative consequences resulted in heightened levels of perceived risks. For some women,

these experiences may take precedence over information provided by health professionals. Crucially, in the background of information inconsistency, the relevance of risk information may be discounted; women may gravitate towards advice that aligns with their interpretation of potential risks or that of their social circle.[14,46,49] On the other hand, individuals who derived benefits from alcohol use[14] and those who perceived themselves as having the ability to control the extent of drinking to avert the potential adverse consequences expressed lower perceptions of risks.[46,48]

Implications

The implications of our review and the PARP conceptual model are two-fold; acknowledging the indispensable role of sociocultural, individual, and the informational landscape in shaping the uniqueness of an individual's risk construction and how this conceptualisation of risk perceptions should lead to a more integrated approach regarding PAE prevention.

The multidimensionality of PAE risk perceptions and the shift from the focus on individual towards consideration of the wider socioecological milieu has expanded our understanding of PAE risk perceptions. While risk perceptions may not suffice as the only explanation for pregnancy alcohol use behaviour, the meaning derived from alcohol use within the sociocultural context and the way information and individual characteristics may intertwine offer a different lens to support further understanding of how people make sense of potential risks. Additionally, a constellation of contextual and personal factors influences maternal alcohol use.[58] How risk perceptions of PAE relates to sociodemographic factors, life stressors, coping mechanisms, stigma, mental health status, motives of alcohol use, and hence mediate pregnancy alcohol use behaviour could be explored in future research to further consolidate our understanding of PAE-associated risk construction.

The uniqueness of individual risk construction also challenges the appropriateness of the current "one-size-fits-all" approach to PAE health education and risk communication. The challenge lies in both acknowledging the myriad of factors impacting on an individual's risk perceptions and incorporating this knowledge to address the unique needs of individuals. The public in general and women in particular are not passive, unbiased recipients of health information[59]; self-protective strategies to buffer against unwanted implications posed by risk information, risk denial, avoiding thinking about the potential risks, and minimising the significance of potential risks are common reactions to information received regarding possible risks.[60] Hence, current health education strategies may benefit from a more tailored approach to increase their effectiveness. For example, interventions could include tailoring feedback based on an individual's risk perception characteristics. This could include assessing behaviour in the context of risk dimensions (e.g., perceived controllability of negative consequences or relevance of risk information), measurement of perceived severity and susceptibility as well as the gathering of information regarding affective experiences in relation to alcohol use to inform the specific counselling strategies that would be best suited to each individual's current needs. Additionally, risk information and messages that reflect local cultural values may assist women in relating to the health messages and hence increase the acceptability of and compliance towards preventive strategies and efforts.

Uncertainty not only influences risk perceptions, it affects the interpretation of risk information and ultimately influences motivation to seek additional information.[61] Some health professionals may find it challenging to effectively advocate for abstinence on the background of variable evidence regarding the potential adverse outcomes of low/moderate PAE. While interested in the scientific reasoning, individuals may adopt a more subjective risk interpretation, which is based on intuitive judgements, previous personal experiences, and those of their social networks and inferences derived from available information, which can include media coverage.[62–64] The challenge, henceforth, is for health professionals to appropriately acknowledge the informational uncertainties and hence perceptions of risks, engage clients effectively in shared decision-making, assisting individuals to disentangle, and make sense of these uncertainties in a trusting, nonjudgemental and supportive manner.

Strengths and limitations

This is the first review of risk perception dimensions and influencing factors regarding PAE. A key strength of the review was the detailed thematic analysis of all included studies, which provided rich information to inform the development of the novel PARP conceptual model. However, grey literature was not included and consequently, valuable insights that may have eventuated from this literature would have been overlooked. The focus on pregnant women has highlighted perceptions from one aspect of this complex issue; however, exploring risk perceptions of partners and health professionals could also provide additional perspectives to further understand effective mechanisms of support. The focus on individual risk perception is also incomplete without exploring the social norms dictating the acceptability, compliance, and expectation of alcohol use behaviour. Furthermore, as the majority of included studies are from Western cultures, our model may not capture PAE risk perceptions in all cultures.

Conclusion

This systematic review provides a novel understanding of the conceptualisation of risk discourses related to PAE. The novel PARP conceptual model developed from the current review can inform interventions and materials supporting reductions or abstinence of alcohol use during pregnancy. Acknowledging that the notion of "risk" does not only depict negative connotations could provide a strong impetus towards empowering and more holistically and effectively supporting women to adopt behaviour change for their health and that of their offspring. Risk perception is a multifaceted and dynamic concept; hence, risks can have different meanings at different times and in in different contexts. Further research into the impacts of different risk discourses on health behaviour, and the application of such discourses in education and prevention is required.

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Ethical statement

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Conflicts of interest

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Appendix A Supplementary data

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