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The high-priority ethical issues of advanced paternal age: perspectives from a panel of experts in the fields of men reproduction and family building

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Abstract

Background Research shows that the age of fathers at the time of conception is correlated with detrimental effect for the health of the future offspring. This situation raises ethical questions regarding the priority of the principle of reproductive autonomy of men of advanced age over the well-being of their future offspring. This problem leads to other normative implications such as the value of introducing limits to the use of medically assisted reproduction, and the development of public health interventions. For the moment, this ethical reflection is mostly speculative and calls to open up the discussion. The aim of this research was to survey experts, working in related fields to the topic of advanced paternal age (APA), regarding the top priority ethical issues of this emerging subject.

Methods We recruited experts concerned by APA with backgrounds in health sciences, ethics, social work and reproductive medicine. We conducted a modified e-Delphi panel that lasted three rounds to build a consensual list of issues. The last round took the form of structured interviews exploring the results of the previous rounds.

Results The top four issues according to the panel are: (1) Should APA be included as a criterion for prenatal genetic screening? (2) Should we raise awareness on reproductive health in relation to the age of fathers? (3) How can healthcare providers support patients in the context of APA? (4) How can research inform the public without stigmatizing fathers of advanced age?

Conclusions These exploratory results suggest that the issues of how to inform various audiences properly on APA are important concerns for experts.

Clinical trial number Not applicable.

Keywords Advanced paternal age, Late paternity, Modified e-Delphi, Clinical ethics, Public health ethics, Empirical bioethics

Background

There is a trend in most societies toward reproducing later in life [49] also named the “postponement transition” by demographers [51]. Since the 1970s, it is estimated that maternal age at first child has raised by one year each decade [49]. A similar trend has been observed for men in many parts of the globe [33, 56]. Until now, the bioethical issues raised by this postponement

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transition have been mostly studied from the perspective of advanced maternal age [29]. However, the interest on the paternal side is gaining more interest [17].

The interest on advanced paternal age (APA) is fuelled by growing evidence that a greater age at conception is associated with several health risks for the prospective child, the mother, and the father [42]. Research suggests that APA is correlated with a higher risk for the child to develop congenital and neurodevelopmental diseases [42]. APA is also related to a decrease in male fertility parameters [30]. This represents a compelling rationale for employing medically assisted reproduction (MAR), concurrently, it is noteworthy that APA is associated with diminished rate of success in for MAR [22, 40]. In conjunction, APA may engender obstetric complications [3]. Examining from a broader standpoint, authors discuss on whether the paternal age effect could yield transgenerational consequences and merit consideration as matter of public health concern [14, 55]. From a psychosocial perspective, it is conceivable that APA may exert adverse effects on the developmental trajectory of the child. For example, older fathers face an elevated risk of experiencing illness or premature mortality during the child's lifespan [58]. While these risks hold qualitative significance, their assessment should be tempered by the absence of consensus regarding the definition of APA [47], the limited evidential foundation on the subject [37], and the constrained generalizability attributed to the small proportion of children born to fathers of APA and very advanced age [42].

The bioethical literature has adhered to this trend, addressing the normative implications of APA across various domains of inquiry, including clinical ethics [7], population ethics [50] and gender equity [29]. Concurrently, the role of empirical bioethics in this domain has been marginal, with notable exceptions such as the contribution of Klitzman [34]. Employing a qualitative design, Klitzman [34] conducted interviews with health-care providers and patients on how to discern the decision-making processes surrounding age cut-offs for accessing MAR and the criteria defining futile medical interventions with regards to age. Additionally, noteworthy empirical research by Belaisch-Allart et al. [3] and Billari et al. [5] on the attitudes toward age-related deadlines are worth mentioning. These studies focus on the issue of the social perception of gendered reproductive age limits which is central when thinking about APA. Although, it appears that defining a social, medical or biological age limit is just one ethical issue among others.

To instigate a more comprehensive bioethical discourse on APA, this paper presents empirical findings from a modified-e-Delphi panel of experts. The main objective was to identify the most important ethical issues associated with APA, as determined by an interdisciplinary panel of experts working on the topic of fatherhood either from the point of view of reproductive health, clinical practice, social sciences, ethics, law, and community work.

Materials & methods

In pursuit of this objective, we conducted a survey among experts, inspired by a modified-e-Delphi methodology. Delphi surveys are employed to elicit and consolidate expert consensus on a topic of interest [28, 45]. It has previously found applications in bioethics to systematically rank and prioritize bioethical issues [10]. A conventional Delphi method involves the sequential administration of questionnaires to a predetermined group of participants, with each survey (or round) refining the initial proposal in an iterative manner [28]. We enhanced the original design by incorporating a third round comprising online—structured interviews. This modification was inspired by the mixed methods explanatory sequential design [18] and aimed to further elucidate the survey's findings. The research process is illustrated in Fig. 1 [52]. Limesurvey, an online survey platform, hosted on Laval University servers, facilitated data collection (LimeSurvey GmbH).

Recruitment

Participants were recruited via the professional networks of the research team, based in Québec (Canada), adhering to a predefined list of criteria (refer to Table 1). As French-speaking researchers, we developed the survey in French. We contacted the experts through electronic mail, and subsequent reminders were dispatched to ensure timely and comprehensive participation.

Round 1

Round 1 started in July 2021 and ended in October 2021. Following their response to the invitation email, participants were provided with a hyperlink to an electronic survey, which took approximately thirty minutes to complete. The survey contained six sections: (1) the consent form, (2) a description of the research process, (3) sociodemographic questions, (4) general questions on APA, (5) specific questions regarding the initial list of ethical issues and (6) an open-ended question encouraging participants to comment on the list and suggest additional issues (refer to Supplementary material). The initial list encompassed sixteen issues derived from a comprehensive literature review on APA [17].

In Sect. 5, participants were invited to react to the preliminary list of issues (refer to Supplementary material). They were instructed to select one of four options

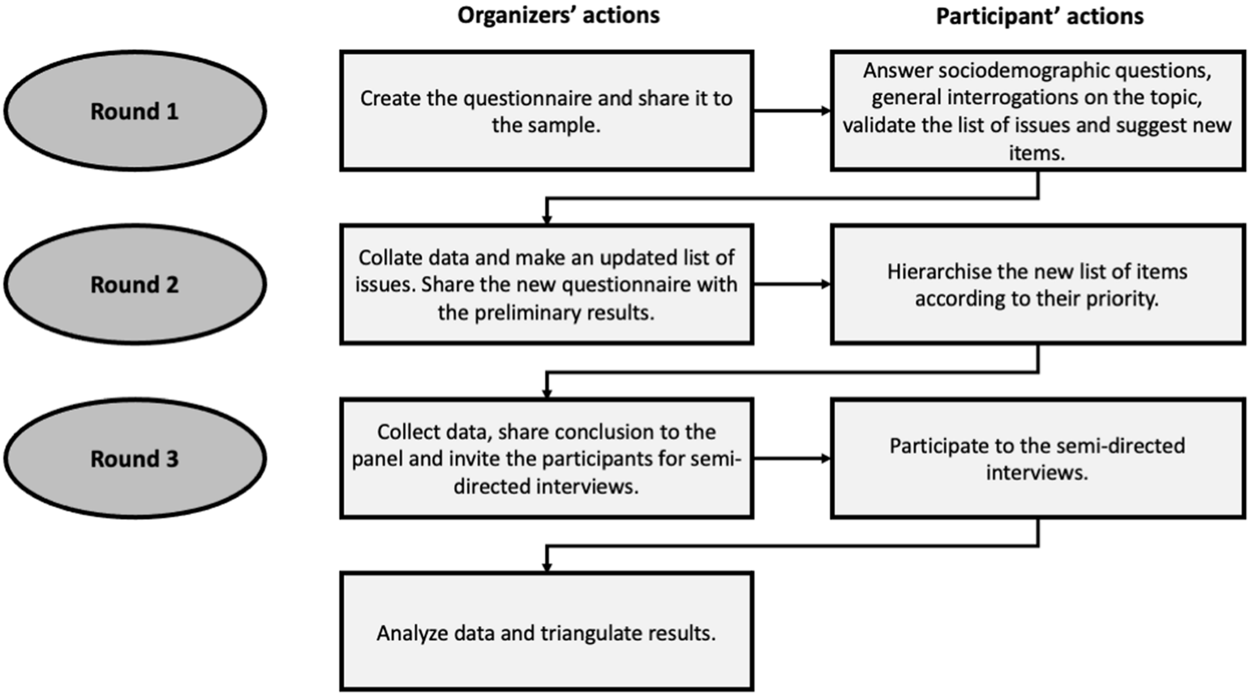

Fig. 1 Research process

Table 1 Selection criteria of participants

- To have one of these expertise related to the study of male reproduction:
  - Reproductive health
  - Clinical practice
  - Social sciences, social work or psychology
  - Ethics and law
  - Advocacy and community work
- To read, write and speak French
- To be available during the three rounds

to assert the perceived importance and formulation adequacy of each specific issue:

1. This issue is important, and is well formulated (two points)
2. This issue is important, but is poorly formulated (one point)
3. This issue is not important, but is well formulated (one point)
4. This issue is not important, and is poorly formulated (zero point)

Each response conferred one point if the issue was deemed important and additional points if it was judged to be well formulated (refer to Supplementary material). The cumulative score for each item on the list was calculated, and the items were subsequently ranked from the highest to the lowest.

Round 2

Drawing upon the findings of Round 1, the research team revised the list of issues removing three issues deemed of low priority by the panel. In response to the comments articulated in the open-ended question of Sect. 6, we refined the phrasing of select items from the original list of issues and incorporated new items as suggested (refer to Supplementary material).

Following the completion of the updated questionnaire, the research team sent an infographic portraying the preliminary results to participants. Simultaneously, participants were provided with a link to the second electronic survey, which remained accessible from March 2022 until April 2022.

In Round 2, the questionnaire was divided into two sections (refer to Supplementary material). In the first section, participants were prompted to assess the "priority" of each issue within the updated list. The construct of "priority" was delineated into three components: (1) the gravity of the issue, (2) the emergency to respond to the issue, (3) the capacity to respond to it. Employing five-point Likert scales, participants indicated their level of agreement for each component, with options ranging from: "Totally agree" (five points), "Agree" (four points), “Neither agree nor disagree” (three points), “Disagree” (two points) to “Totally disagree” (one point). For instance, participants were asked to express their agreement level with statements such as “Do you consider that [issue 1] is an issue of gravity?” In the second section, participants were tasked with ranking the nineteen issues by manually reordering each item into a list according to their perceived significance.

For the analysis of the data from the first section of questions, one point was assigned for each instance in which a participant placed an issue within their top five rankings. For the analysis of the data from the second section, we translated the ranking bestowed by each participant into a scoring system: each first place received nineteen points, each second place received eighteen points, each third place received seventeen points, and so forth until the nineteenth place was allocated one point. Subsequently, the cumulative scores for each issue were calculated and ranked accordingly. For the conclusive analysis, the rankings from the first and second sections were aggregated to generate a comprehensive and refined ranking.

Round 3

The last round took place between June 2022 and ended in August 2022. Subsequent to the completion of the survey in the preceding round, participants were provided with the opportunity to express their interest to contribute to the concluding round. Those who affirmed their interest were contacted for an interview aimed to explore the top four issues identified. A structured interview guide was crafted based on the results of the preceding survey and aligned with the research objective (refer to Supplementary material). Through the deployment of open-ended questions, participants were encouraged to provide comments on the survey results. The average duration of the interviews was fifty-six minutes. Transcriptions of the interviews were conducted verbatim and analysed using the general inductive approach for analyzing qualitative data [53].

Research ethics board certificate

The project received approval from the Laval University Research Ethics Board under study number 2021–158/14–06–2021. The study was considered as posing minimal risk. Prior to participating in the study, individuals signed an online information and consent form. During the subsequent data analysis, all personal information was removed. The project data has been securely stored on Laval University servers with a restricted access limited to the research team.

Table 2 Study sample, demographics and participants’ definitions of advanced paternal age

	Round 1 N (%)	**Round 2 N (%)**	**Round 3 N (%)**
Total of participants	23 (100)	17 (74)	3 (13)
Gender			
• Women	15 (65)	12 (71)	2 (67)
• Men	8 (35)	5 (29)	1 (33)
Median age group	50—59 y/o	50—59 y/o	40—49 y/o
Fields of expertise			
• Psychosocial research	9 (39)	6 (35)	2 (67)
• Biomedical research	8 (35)	6 (35)	0 (0)
• Others	6 (26)	5 (30)	1 (33)
Chronological definition of APA			
Beginning age of APA		Number of participants suggesting that definition N (%)	
35 years old		2 (10)	
36 years old		1 (5)	
40 years old		9 (45)	
45 years old		5 (25)	
50 years old		3 (15)	

APA Advanced paternal age

Results

Study sample and demographics

We enlisted twenty-three participants for the initial round (refer to Table 2). Following subsequent contact attempts and issuance of reminders, we successfully retained 74 per cent of participants ($N = 17$) for the second round. The ultimate round entailed qualitative interviews, to which only three experts consented to participate. In the initial round, nearly two thirds of participants were women, a proportion that increased to three quarters in the second round. Furthermore, during the initial round, we achieved a balanced representation across various fields of expertise. However, for the final round, we did not recruit any participants possessing expertise in biomedical research.

Additional sociodemographic questions revealed that a significant majority of the sample is employed within academic institutions such as universities, holds a doctoral degree (PhD), identifies as white, resides in the province of Quebec (Canada), and does not report any visible or invisible disabilities. The overwhelming majority of participants have one or two children. The oldest age at birth of the youngest child is forty years old, with a mean age of approximately thirty-two years old. Merely two participants with expertise in biomedical research disclosed prior involvement in a research project pertaining to

APA. Approximately half of the sample demonstrates a thorough or profound understanding of the topic of APA.

Round 1: defining APA

The initial round was structured into two sets of questions. The initial set focused on delineating the definition of APA. Participants were prompted with the question: "According to you, what is the definition of APA?" Three types of definition summarized the experts' responses to this open question: chronological, social, and biological. Often, these dimensions were intertwined in the same response and the expertise of the participant did not correlate with one specific type of definition.

Most of the participants defined APA in chronological terms. Little less than the majority of experts considers APA commences after the age of forty (refer to Table 2). However, within the group, three experts abstained from explicitly specifying a discrete age threshold. One expert referred to an upper percentile within the distribution of reproductive age at conception, while another cited social norms dictating what qualifies as APA. Those who conceptualized APA as a social construct emphasized its normative aspect, viewing it as a marker delineating specific societal roles. For instance, one participant defined APA as "an age that social norms associate to another role, namely the one of being a grandfather." Moreover, other participants considered the significance of determining APA in relation to the age of one's partner, highlighting the relational aspect of the concept. Additionally, for two participants, APA signified assuming the responsibilities of fatherhood at a particular time in life.

Conversely, five participants defined APA in biological terms, emphasizing its association with increased risks, such as the elevated likelihood of transmitting genetic diseases to offspring, heightened health risks during pregnancy and child development, and diminished fertility.

Notably, three participants answered with a negative definition of APA, stating that the criteria for delineating APA need not exclusively rely on biological considerations. They argued that aging represents a continuous physiological process rather than adhering to clear-cut age thresholds. Furthermore, one participant stated the absence of consensus regarding the criteria for a definition of APA at the present time.

Round 1: building a preliminary list of issues

In the initial round of the survey, participants determined the significance and formulation adequacy of each of the issues outlined preliminary (refer to Supplementary material). One issue emerged as the top priority, while three others secured second place rankings (refer to Supplementary material). Conversely, three issues garnered the lowest scores, highlighting areas of notable divergence (refer to Supplementary material). In anticipation of the second round, the bottom three issues were omitted from the list, and new issues proposed by participants were incorporated.

Round 2: ranking a list of issues according to their priority

Four distinct groups of issues categorized according to their priority levels: those classified as high, intermediary-high, intermediary-low, and low priority (refer to Table 3). Notably, both the high-priority and the low-priority groups exhibited consistency across the two ranking strategies employed. In contrast, issues positioned between these two extremes demonstrated discrepancies in their two rankings. Some issues attained high in the first ranking set, but received low rankings in the second set, or vice versa. The lack of consistency in rankings could be attributed to the various methodological limitations encountered during the study, which will be explained later.

Upon observing the upper part of the list, the first two issues secured the top positions in both ranking strategies, followed by two other issues occupying the third position. Examination of the nature of these issues reveals a commonality in their ethical necessity to share pertinent information regarding APA to various stakeholders. The foremost issue pertains to prenatal genetic screening (issue 13). The second one focuses on disseminating general information on reproductive health (issue 21). The third one highlights the importance of facilitating informed discussions during individual encounters between clinicians and patients (issue 5). The fourth one emphasizes the dissemination of scientific research to inform the public without instigating stigmatization (issue 16). Collectively, these four issues encompass testing, awareness-raising, supporting and informing. In contrast, the remaining issues are centred around more conventional normative considerations involving the balancing of principles, policy development, and social justice. Indeed, the low-priority group exhibits a common theme that pertains to fairness in the treatment of specific groups within the context of APA: individuals with varying abilities (issue 9), cultural minorities (issue 18), and partners of different genders and ages (issue 22).

We examined the variations in rankings based on the type of expertise. Within the high-priority group, psychosocial experts exhibited results relatively akin to those of the biomedical experts. However, discrepancies emerged with the expert categorized under "Other" expertise, who assigned lower scores to issues 13 and 5 compared to the remainder of the panel (refer to Supplementary material). This category of experts encompassed three clinicians, a

Table 3 Ranking of each issue

Levels of priority	Issues	Ranking in the first set of questions	Ranking in the second set of questions	Combined ranking
High	**13.** Should APA be included as a criterion for prenatal genetic screening?	1	1	2
	21. Should we raise awareness on reproductive health in relation to the age of fathers?	2	2	4
	5. How can health-care providers support patients in the context of APA?	5	3	8
	16. How can research inform the public without stigmatizing fathers of advanced age?	3	5	8
Intermediary high	**3.** How to balance the risks and benefits of APA?	7	2	9
	2. What balance should be struck between the parents' reproductive autonomy and the future well-being of the unborn child in terms of APA?	6	3	9
	19. Are there unconscious biases in the funding of research on male reproduction?	4	5	9
	6. How can we reduce the moral uncertainty associated with treating patients with a family project at an APA?	6	6	12
	20. Is it acceptable to medically intervene on women's bodies to compensate for men's difficulties?	9	3	12
	7. Should we maintain a double standard between advanced maternal age and APA?	8	4	12
Intermediary low	**1.** Should we agree on a consensual definition of APA?	11	3	13
	15. Which equitable policies could be developed to reduce the population's reproductive age?	7	6	13
	12. Should there be an age limit to access to medically assisted reproduction?	10	4	14
	11. Is this an intergenerational justice issue?	9	6	15
	17. Does APA "pathologize" a parental project and the resulting child?	11	5	16
	10. Do we have a collective responsibility (or not) to solve the problems posed by APA?	12	5	17
Low priority	**9.** Does regulating APA be conceived as a form of capacitism?	13	7	20
	18. Does regulating APA can be perceived as cultural discrimination?	14	8	22
	22. Can PAA be associated with undue pressure from younger partners?	15	8	23

APA Advanced paternal age

specialist in gerontology/aging, and a specialist in service organization.

Round 3: commenting on the list

For the last round, we conducted interviews to delve into the top four issues identified by the panel previously. Three experts accepted to participate to this final step.

Regarding the panel's highest priority issue related to genetic screening, participants mentioned health professionals' lack of knowledge on APA and its implications for genetic testing. APA remains a topic largely omitted from professional discourse (Participant 1). Thus, there is a pressing need to enhance training opportunities for professionals to dispel misconceptions surrounding the reproductive capabilities of older men. "We should better inform health professionals about the effects of APA to counter the impression that men can conceive in the same way, no matter how old they are." (Participant 3). The three participants also noted disparities in care based on the gender of patients, with women receiving more comprehensive follow-up compared to their older male partners (Participant 1). This highlights the importance of acknowledging the unique challenges associated with paternity, akin to those associated with maternity. Genetic testing, participants noted, serves as a mechanism to facilitate informed decision-making (Participant 1) and potentially alleviate some of the burdens typically borne by women in the context of APA (Participant 2). For Participant 1, testing "allows parents to have a better-informed decision-making process while deciding what they want to do with the pregnancy's continuity." However, despite its advantages, genetic testing also implies inherent risks, including potential for genetic discrimination, the medicalization of reproductive practices, and the risk that individuals may face discrimination if testing reveals genetic anomalies of lesser significance (Participant 2).

Participants also provided feedback on what the panel considered the second issue of highest priority: the public awareness and education on fathers' reproductive health. For one participant, the absence of comprehensive information undermines parents' capacity for making informed decisions. Highlighting the importance of early intervention, a participant stressed the necessity to inform parents swiftly (Participant 2) to prevent regretting their decisions due to the absence of essential information (Participant 3). "[C]ampaigns to promote prevention [...] [have] to be done upstream so that men and women can make an informed decision about it, maybe informing them before they get their two feet in." (Participant 2) The current lack of information on APA perpetuates a disproportionate burden on women's shoulders in reproductive matters. "Reproductive work is women's work, as is contraception and the prevention of sexually transmitted diseases, often in a heteronormative context," according to Participant 1. This unequal attribution of responsibility underlies the imperative of educating both men and women on parenthood issues (Participant 3), particularly in discussion surrounding APA. Participants suggested various avenues for addressing this socially discussed issue of APA, such as documentaries, television programmes, or radio shows (Participant 3). Furthermore, a participant suggested the relevance of initiating discussions on relevant family creation dynamics as early as secondary school (Participant 1). However, akin to genetic testing, public education poses its challenges. Participants emphasized the need for a multidimensional approach to public awareness and education (Participant 2), inclusive of fathers who become parents without resorting to assisted reproduction (Participant 2), and culturally adapted initiatives (Participant 3).

Regarding the panel's third highest issue concerning the support and counselling patients in the context of APA, the three participants emphasized the necessity of clarifying the prerequisites for accessing such support. Participant 1 raised several questions, "Who can have access to it? Which health professional oversees the follow-up care? Should a psychological follow-up be mandatory, similar to what we see in the case of gamete donation?" To address these concerns, participants advocated for staff training initiatives including the development of practice guides and ethical guidelines for clinics (Participant 1) to mitigate the risk of stigmatizing men by health professionals (Participant 3). Enhancing patient support through improved transmission of information regarding the risks of APA was suggested as a viable approach and the "most ethical way to accompany these couples" (Participant 1). A participant also noted challenges in patient support stemming from health professionals' tendency to merely include fathers in the care process without actively involving them, thereby marginalizing their role in discussions surrounding parenthood, including during childbirth (Participant 2).

Regarding the last panel's top priority issue concerning how to educate the public and raise awareness on APA while mitigating the stigmatization of fathers, participants highlighted various societal dynamics contributing to stigmatization. One participant noted that "it is not research that stigmatized, stigmatization is a social process." (Participant 1). Ageism could be one of its causes (Participant 1) or prevailing tendencies in social discourses to associate men with more negative aspects of parenthood (Participant 2). To address this, participants emphasized the importance of research presenting risks associated with APA while also highlighting positive aspects to prevent a form of "tunnel vision" (Participant 3). Moreover, they mentioned that research should also address APA as a subject in its own right, rather than as a mere, subcategory of women's issues (Participant 2). Some participants also posited that stigmatization may not be the core issue, suggesting instead that it could be attributed to a lack of comprehensive information on the topic (Participant 3).

Discussion

This study contributed to the emerging field of empirical bioethics pertaining to APA. It provides different insights on this biopsychosocial phenomenon from the perspective of experts across related disciplines. We see a continuity with prior empirical studies on the subject [3, 5, 34]. Notably, there is a sustained emphasis on the clinical issue of enhancing the support provided by health professional to individuals navigating situations of APA. However, the findings of the present study highlight additional dimensions of the phenomenon, such as the public health implications of APA, exemplified by the prioritization of offering genetic screening to this population and the necessity expressed to develop awareness and education campaigns. Furthermore, this study underscores the recognition of potential ethical consequences associated with research on APA, a discernment that is unsurprising given the composition of the panel, predominantly comprising individuals working within academic settings.

Panel definition of APA

Our analysis of experts' perspectives on the definition of APA resonates with the literature on APA regular concern that the absence of consensus is a limitation to the advancement of the field [38]. In our study, fairly less than the majority of experts indicated that APA could be characterized by conceiving at forty years of age and older. This inclination aligns with findings observed in existing literature [17, 47] and in professional guidelines [6, 54]. However, in the present study, participants had the opportunity to provide additional insights into their understanding of APA. Their responses revealed a nuanced comprehension of APA which cannot be solely considered as a discrete numerical threshold (e.g. ≥ forty). Instead, participants depicted APA as blend of chronological, biological, and social dimensions. This finding follows the deconstruction of APA conducted by Martani et al. [38]. According to these authors, each type of age (chronological, biological, and sociocultural) individually lacks the ability to serve as a normative criterion (e.g. for restricting access to MAR), although they may collectively inform decisions. From our survey, it remains unclear whether such combination is advisable and whether we should consider chronological age, individual health status, and social paternity status as independent entities.

The importance of informing all publics

The central focus of this project was to identify priority ethical issues raised by APA that require collective responses according to a panel of experts. Upon examining the top issues, a clear emphasis emerges on the importance of informing all segments of the public: prospective parents, health professionals, and the general population. The means of dissemination, as suggested by the panel, encompass actions such as screening, counselling, raising awareness and mobilizing knowledge from research. From an ethical standpoint, this imperative to inform serves as a prerequisite for obtaining consent for any health intervention and, particularly in the context of family planning and life-altering decisions. While this may seem to apply to the clinical encounters of individuals in a situation of APA, the results highlight the necessity to extend beyond the dissemination of information and engage with the broader population. We can extrapolate from these findings that the level of intervention recommended by the panel is more about providing information on APA than doing nothing or restricting reproductive choices [41]. Examining each top issue reveals that this imperative to inform the public about APA has been highlighted by numerous authors albeit accompanied by several ethical dilemmas.

Genetic screening for APA

The primary issue identified by the panel as a priority is the inclusion of APA as a criterion for prenatal genetic screening. Examining the broader ethical literature on APA, this finding is noteworthy, particularly considering that it appears as less covered in comparison to other considerations, such as establishing an age limit for MAR [44] and deliberating on the question of "how old is too old" [14].

A related issue raised during the interviews conducted in Round 3 pertains to the adequacy of sufficient available information on APA to facilitate such screening endeavours. In the literature, different biomarkers have been associated with the negative effects of paternal age, including DNA fragmentation, aneuploidy, autosomal dominant mutations, and de novo mutations [46]. Additionally, several screening strategies have been proposed by authors: anatomic screening, sperm analysis, amniocentesis, preimplantation genetic diagnosis, prenatal genetic screening [30], karyotyping [6], testing sperm genome decay [31], whole genome sequencing [50], non-invasive prenatal testing with or without cell-free DNA [6, 46]. It is also foreseeable that growing research on the epigenetics of APA will contribute to the identification of new biomarkers of interest.

Part of the discussion entails examining the advantages and disadvantages of the existing techniques for detecting different pathological risks associated with APA. To some extent, there is scepticism regarding the utility of the available techniques, although others hold a contrary view [6]. In an empirical study involving genetic counsellors, the limited options for screening have been cited as one of the main reasons why genetics counsellors may not discuss the topic of APA [46]. However, at the same time, Quirin et al. [46] noted that screening tests for some conditions associated with advanced paternal age are now available. In North America, one plausible explanation for this contradictory scenario may lie in outdated guidelines for APA genetic screening [54], suggesting that new guidelines could provide guidance for counsellors and patients alike [46].

From a bioethical perspective, prenatal screening is grounded in the principles of procreative autonomy [29], implying that greater knowledge enables informed reproductive decisions. As one participant noted (Round 3), this information may also prove useful years after pregnancy, enabling parents to promptly address the emergence of certain health characteristics in their child. This aligns with Hens' [29] second rationale for prenatal screening, grounded in procreative beneficence, wherein screening facilitates appropriate actions in support of the future well-being of the child. Furthermore, screening holds the potential to benefit future generations, and, by extension, the broader population, because of the heritable nature of most genetic anomalies mentioned earlier [50]. However, given the current state of understanding of APA, there remains considerable uncertainty. With the low risk of developing conditions associated with APA [42] and the possibility that genetic variations induced by APA may not be qualitatively negative, the beneficent nature of screening does not find a strong justification. For these reasons, screening may be more grounded in the principle of precaution rather than the one of beneficence.

Raising awareness on APA

The subsequent priority issue identified by the panel highlights the need for disseminating information about APA into the public domain. Numerous authors have advocated for health promotion and educational campaigns aimed to develop public awareness on APA and preconception health [1, 4, 8, 49]. Agricola et al. [1] emphasized that such information campaigns should target both men and women. Different objectives for such campaigns have been suggested, including prevention [15] or addressing men's lack of knowledge regarding reproduction in general [21]. These initiatives aim to enable individuals to make more informed decisions about family building and elucidate about the trade-offs associated with postponing parenthood [4].

To explore deeper into the implications of these campaigns, Kroløkke [35] gives an insight into the potential outcomes of such strategies. The seminal article provides a description of a Danish fertility campaign ("Can your spunk do the funk?") targeting the fertility risks associated with APA. One of her conclusions is that this type of campaign contributes to the construction of a male biological clock, also referred to as "male repro-temporality." This concept of clock promotes "individualized forms of self-enhancement and moral responsibility" [35], as well as a heteronormative conception of reproduction and family. By extension, it plays a role in shaping the image of the "new modern man" who is proactive in addressing family-related concerns. Through this lens, it becomes evident that health promotion campaigns are not neutral and often promote specific values.

From a bioethical point of view, it prompts an inquiry into the ethical considerations surrounding this specific form of communication [27]. While assessing the utility of such campaigns is undoubtedly important, it is equally imperative to explore other dimensions as well, such as the manner in which the message is crafted, its content, and its potential adverse effects [27].

Counselling patients

The issue of "how can health-care providers support patients in the context of APA?" connects with the primary issue of genetic counselling for APA. Most frequently, in the literature, this engagement with health-care practitioners can take place either during preconception care [11] or fertility care [14]. Existing literature highlights practical challenges in counselling, namely that the effects of paternal age are rarely discussed with patients [47] and the ambiguity surrounding the delivery of adequate counselling for APA [9]. Although discussions on the impact of the male partner's age [13], Ethics Committee of the American Society for Reproductive Medicine 2016 [19]; [26, 54] and older parenting [25] are strongly advocated, there remains a gap in how to effectively provide counselling for APA. Many experts' voices argue that all adults of advanced reproductive age should receive counselling on the risks associated with APA to enable informed reproductive decision-making [23, 39, 43, 48].

Some uncertainties might remain regarding how to counsel patients about APA, existing literature offers valuable insights into the best practices. Effective counselling should take the form of a comprehensive discussion that encourages individuals to consider the implications of their reproductive choices on the well-being of their future child [7, 36, 39]. APA should be considered as a preconception health issue and integrated into individuals' reproductive life plans [11]. Education and counselling for APA patients should include topics such as parental loss, parenting at an advanced age, increased genetic risks and infertility [7, 32, 48]. This counselling is viewed as crucial for addressing the widespread misconception regarding the ability to reproduce at any age [34, 48].

The issue of counselling for APA may be rooted in deeper systemic challenges. Firstly, men are often excluded from discussions on preconception care [23]. This could be the result of several barriers embedded within health-care systems [11] or cultural paradigms regarding men's role in reproduction [20]. Secondly, the absence of clear criteria defining APA, and when it begins, exacerbates the challenge [47]. Finally, from a philosophical perspective, there is a question of "ought means can" [24], that is to say whether we ought to intervene given the limited capacity to alter the trajectory of global demographic trends toward family building later in life.

Transferring research results without stigmatizing

The panel's last high-priority issue concerns how research can inform the public without stigmatizing fathers of advanced age. There is a strong connection with the previous three top priority issues, all of which focus on ethically disseminating knowledge the various audiences. For this fourth issue, the core issue is the risk of stigmatization. Stigmatization can be defined as "an activity that: (1) involves identifying and marking a characteristic as undesirable in accordance with community norms of desirability; (2) has a distinctive set of consequences, most commonly, social isolation" [16], 75).

When applied to APA, there is apprehension that older fathers may face negative labels, such as being deemed irresponsible parents, which could potentially impact children's development, possibly leading to lower self-esteem. However, for the moment, such concerns remain mostly speculative. Media studies on APA generally indicated a positive public perception of older fathers [12, 57]. It is important to note that stigma varies in its intensity across different groups and tends to be more pervasive among underprivileged groups [2]. In the context of APA, men may not face stigma for being fathers of advanced age, but for other attributes such as socioeconomic status (e.g. coming from a lower social class), ethnicity, or, as noted by one participant in Round 3, simply for being elderly.

Another dimension of stigma, as stressed in public health literature is that stigmatization is not *inherently* unethical [16]. While we recognize the overall negative impacts of stigmatizing populations, it is noteworthy that some health campaign resulted in significant health benefits, partly due to stigmatization [2]. In this regard, stigmatization can serve as a mechanism to promote positive health behaviours. However, the implications of stigmatization may vary regarding its potential consequences. Will fathers face individual discrimination, structural discrimination, or merely be labelled as less trustworthy? At this stage, it is challenging to draw conclusions. In our context, the focus is not on policing APA, but rather the (more modest) task of disseminating research findings to the population.

Limitations

This exploratory research sought to identify the most important ethical issues surrounding APA, drawing insights from an interdisciplinary panel of experts engaged in fields pertinent to male reproductive health. While this study offers novel directions for future inquiry, it faces several limitations that affect the transferability of its findings. Foremost among these limitations is the relatively small cohort of participants, and the attrition observed across successive rounds. Due to resources constraints, the study could not accommodate additional rounds of quantitative inquiry to bolster a stronger consensus and statistical significance. For the last qualitative round, there was not enough participant to obtain thematic saturation, hindering the depth of insights gathered. Another limitation stems from the location of the sample. All participants reported living in the adjacent provinces of Quebec (Canada) and Ontario (Canada). In addition, for practical reasons, we recruited French-speaking participants related to our research network. For these two reasons, our conclusions may reflect a cultural bias that must be taken into account for further interpretations. One key feature of the study involves the reliance on expert perspectives. Although, there is a growing scientific interest on APA, only half of the initial sample of participants mentioned a comprehensive understanding of the topic of APA. This suggests the ongoing imperative to disseminate knowledge on APA within expert circles and cultivate specialized expertise in this domain.

Conclusions

Our findings indicate that we are now in the "information phase" regarding APA. The surveyed experts expressed their concerns regarding the optimal means and the duty to inform diverse audiences, be it through genetic screening, public education, patient counselling, or the transfer of research findings. These results diverge from conventional bioethical considerations that typically weigh various principles, including reproductive autonomy, the best interest of the future child and gender equity. Bioethicists will discover, within the four top-priority issues we have identified, subjects of inquiry that will help to develop a more comprehensive discourse on the ethics of APA.

Supplementary Information

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Supplementary Material 1.

Supplementary Material 2

Authors' contributions

All authors have contributed to significative part of the research project and the writing of the manuscript.

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Data availability

Data and materials are available under the request to the corresponding author.

Declarations

Ethics approval and consent to participate

The project adhered to the Declaration of Helsinki and received approval from the Université Laval Research Ethics Board under study number 2021–158/14–06-2021. The study was considered as posing minimal risk. Prior to participating in the study, all participant signed an online informed consent form. During the subsequent data analysis, personal information was removed. The project data has been securely stored on Université Laval servers with a restricted access limited to the research team.

Consent for publication

Not Applicable.

Competing interests

The authors declare no competing interests.

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