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REPRODUCTIVE HEALTH ISSUES AMONG ADOLESCENT AND YOUNG MALE POPULATIONS. PART II

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Abstract

Introduction: The reproductive health of adolescents and young men is a crucial component of overall health and well-being. Despite increasing attention to this issue, there remains a lack of information and awareness in society regarding male reproductive health, which leads to the neglect of important aspects of prevention and treatment. In particular, young men are exposed to numerous risk factors, including behavioral, socioeconomic, and environmental ones, which can negatively affect their future reproductive potential. The timely identification and elimination of these factors are essential for preserving the health of future generations.

Objective: To conduct a comprehensive analysis of the key risk factors affecting the reproductive health of adolescents and young men.

Search Strategy: After systematizing keywords and their synonyms, a comprehensive bibliographic search was carried out. Data was collected from leading international (PubMed, Google Scholar, Embase) and Russian-language (Cyberleninka, eLibrary) scientific databases, focusing on publications from the last ten years. The source selection process included an analysis of abstracts for relevance and an assessment based on citation frequency. Only full-text works were subjected to an in-depth analytical review. The main inclusion criteria were: relevance to the research topic, publication language (English or Russian), full text availability, and a variety of study types. The final selection included original and review articles, systematic reviews, meta-analyses, clinical guidelines, scientific monographs, and collections of abstracts, which ensured a comprehensive coverage of the research problem.

Results and Conclusion: Age is a key factor in the deterioration of reproductive health: men over 45 show a statistically significant decline in sperm quality. Sociocultural aspects, such as distorted family and religious norms, as well as media influence, can contribute to an early onset of sexual activity and neglect of contraception methods, increasing the risk of STIs. Behavioral factors, including smoking, alcohol abuse, and being overweight, have a direct negative impact on spermatogenesis and erectile function. To preserve men's reproductive health, it is necessary to carry out comprehensive preventive measures aimed at increasing awareness of the risks associated with lifestyle and behavior, as well as removing sociocultural barriers to open discussion of sexual health. Special attention should be paid to programs for adolescents and young men to foster a responsible attitude towards their own health. Early diagnosis and timely treatment of congenital and acquired diseases of the reproductive system are also critically important for preventing infertility.

Keywords: *reproductive health, risk factors, adolescents, male fertility.*

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Резюме

ВОПРОСЫ РЕПРОДУКТИВНОГО ЗДОРОВЬЯ СРЕДИ ПОДРОСТКОВ И МОЛОДЫХ МУЖЧИН. ЧАСТЬ II

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Введение: Репродуктивное здоровье подростков и молодых мужчин является важным компонентом общего здоровья и благополучия. Несмотря на растущее внимание к этой проблеме, в обществе сохраняется недостаток информации и осведомленности о репродуктивном здоровье мужчин, что приводит к упущению важных аспектов профилактики и лечения. В особенности, молодые мужчины подвержены влиянию множества факторов риска, включая поведенческие, социально-экономические и экологические, которые могут негативно сказаться на их будущем репродуктивном потенциале. Своевременное выявление и устранение этих факторов имеет решающее значение для сохранения здоровья будущих поколений.

Цель: провести комплексный анализ ключевых факторов риска, влияющих на репродуктивное здоровье подростков и молодых мужчин.

Стратегия поиска: После систематизации ключевых слов и их синонимов был проведён комплексный библиографический поиск. Сбор данных осуществлялся в ведущих международных (PubMed, Google Scholar, Embase) и русскоязычных (Cyberleninka, eLibrary) научных базах, с фокусом на публикации за последние десять лет. Процесс отбора источников включал анализ аннотаций на предмет их релевантности и оценку по частоте цитирования. Лишь полнотекстовые работы были подвергнуты углубленному аналитическому обзору. Основными критериями включения стали: соответствие тематике исследования, язык публикации (английский или русский), полный текст статей и разнообразие типов исследований. В итоговую выборку вошли оригинальные и обзорные статьи, систематические обзоры, метаанализы, клинические рекомендации, научные монографии и сборники тезисов, что обеспечило всесторонний охват исследуемой проблемы.

Результаты и Заключение: Возраст является ключевым фактором ухудшения репродуктивного здоровья: у мужчин старше 45 лет наблюдается статистически значимое ухудшение качества спермы. Социально-культурные аспекты, такие как искаженные семейные и религиозные нормы, а также влияние медиа, могут способствовать раннему началу половой жизни и пренебрежению методами контрацепции, что повышает риск ИППП. Поведенческие факторы, включая курение, злоупотребление алкоголем и избыточный вес, имеют прямое негативное воздействие на сперматогенез и эректильную функцию. Для сохранения репродуктивного здоровья мужчин необходимо проводить комплексные профилактические мероприятия, направленные на повышение осведомлённости о рисках, связанных с образом жизни и поведением, а также на устранение социально-культурных барьеров для открытого обсуждения сексуального здоровья. Особое внимание следует уделять программам, ориентированным на подростков и молодых мужчин, с целью формирования ответственного отношения к собственному здоровью. Ранняя диагностика и своевременное лечение врождённых и приобретённых заболеваний репродуктивной системы также являются критически важными для предотвращения бесплодия.

Ключевые слова: *репродуктивное здоровье, факторы риска, мужская фертильность*

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Түйіндеме

ЖАСӨСПІРІМДЕР МЕН ЖАС ЕРЛЕР АРАСЫНДА РЕПРОДУКТИВТІК ДЕНСАУЛЫҚ МӘСЕЛЕЛЕРІ. II БӨЛІМ

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Кіріспе: Жасөспірімдер мен жас ерлердің репродуктивті денсаулығы — жалпы денсаулық пен әл-ауқаттың маңызды құрамдас бөлігі. Бұл мәселеге деген қызығушылықтың артуына қарамастан, қоғамда ерлердің репродуктивті денсаулығы туралы ақпарат пен хабардарлық жетіспейді, бұл алдын алу мен емдеудің маңызды аспектілерін назардан тыс қалдырады. Әсіресе, жас ерлердің репродуктивті денсаулығына мінез-құлықтық, әлеуметтік-экономикалық және экологиялық сияқты көптеген қауіп факторлары әсер етеді, бұл олардың болашақ репродуктивті әлеуетіне кері әсерін тигізуі мүмкін. Осы факторларды уақтылы анықтау және жою болашақ ұрпақтың денсаулығын сақтау үшін шешуші маңызға ие.

Мақсаты: Жасөспірімдер мен жас ерлердің репродуктивті денсаулығына әсер ететін негізгі қауіп факторларына кешенді талдау жүргізу.

Іздеу стратегиясы: Негізгі сөздер мен олардың синонимдерін жүйелегеннен кейін кешенді библиографиялық іздеу жүргізілді. Деректерді жинау соңғы он жылдағы жарияланымдарға бағытталған жетекші халықаралық (PubMed, Google Scholar, Embase) және орыс тіліндегі (Cyberleninka, eLibrary) ғылыми базаларда жүзеге асырылды.

Дереккөздерді іріктеу процесі олардың өзектілігін анықтау үшін аннотацияларды талдауды және дәйексөз жиілігі бойынша бағалауды қамтыды. Тек толық мәтінді жұмыстар ғана тереңдетілген талдауға алынды. Зерттеу тақырыбына сәйкестік, жарияланым тілі (ағылшын немесе орыс), толық текст және зерттеу түрлерінің әртүрлілігі негізгі іріктеу критерийлері болды. Қорытынды іріктеуге зерттеліп отырған мәселені жан-жақты қамтуды қамтамасыз ететін түпнұсқа және шолу мақалалары, жүйелі шолулар, мета-анализдер, клиникалық нұсқаулар, ғылыми монографиялар және тезистер жинақтары енді.

Нәтижелер мен қорытынды: Жас репродуктивті денсаулықтың нашарлауының негізгі факторы болып табылады: 45 жастан асқан ерлерде сперма сапасының статистикалық тұрғыдан маңызды түрде нашарлауы байқалады. Бұрмаланған отбасылық және діни нормалар сияқты әлеуметтік-мәдени аспектілер, сондай-ақ медианың ықпалы жыныстық өмірді ерте бастауға және контрацепция әдістерін елемеуге ықпал етуі мүмкін, бұл ЖЖБИ қаупін арттырады. Шылым шегу, алкогольді шамадан тыс пайдалану және артық салмақ сияқты мінез-құлықтық факторлар сперматогенез бен эректильді функцияға тікелей теріс әсер етеді. Ерлердің репродуктивті денсаулығын сақтау үшін өмір салты мен мінез-құлыққа байланысты қауіптер туралы хабардарлықты арттыруға, сондай-ақ жыныстық денсаулықты ашық талқылау үшін әлеуметтік-мәдени кедергілерді жоюға бағытталған кешенді профилактикалық іс-шараларды жүргізу қажет. Жасөспірімдер мен жас ерлерге бағытталған бағдарламаларға ерекше назар аудару қажет, бұл олардың өз денсаулығына жауапкершілікпен қарауын қалыптастыруға көмектеседі. Туа біткен және жүре пайда болған репродуктивті жүйе ауруларын ерте диагностикалау және уақтылы емдеу де бедеуліктің алдын алу үшін өте маңызды.

Түйін сөздер: *репродуктивті денсаулық, қауіп факторлары, ерлер фертильдігі.*

Дәйексөз үшін:

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Background

Investigation into the reproductive health of adolescents and young men is a critical and burgeoning field of modern medicine, foundational to both individual well-being and global public health. Male infertility and other reproductive disorders are no longer considered marginal issues but have emerged as a significant and growing concern worldwide, impacting demographic trends and quality of life for millions of people [68, 98]. Data from a vast body of literature consistently indicate a worrying global decline in key male reproductive parameters, including sperm count and semen quality, over the past several decades [61, 74]. This trend has been documented across various populations and geographical regions, prompting an urgent need to identify its underlying causes [51]. The etiology of these disorders is highly complex and multifactorial, involving a dynamic interplay of demographic, genetic, behavioral, medical, and environmental factors [8]. Each of these domains contributes uniquely to the overall risk profile, with their combined effects often leading to more severe outcomes [10].

Objective: To identify key factors influencing the reproductive health of adolescent and young males, with a focus on prevention and early correction of disorders.

Search strategy. The methodological approach began with the systematic identification of primary search terms and their synonymous expressions. A subsequent comprehensive literature search was conducted across major international databases, including PubMed, Google Scholar, and Embase, as well as regional Russian-language academic platforms such as Cyberleninka and e-Library. Selected articles underwent an initial screening of their abstracts to determine thematic relevance. This was followed by a process of bibliographic cross-referencing, which involved analyzing both the cited references and subsequent works that had cited the selected articles. The remaining literature was then categorized according to predefined eligibility criteria, and full-text versions were retrieved for a detailed analytical review. Only methodologically sound and validated studies that met all inclusion criteria were ultimately integrated into the final synthesis. Finally, 101 references were included in this part of the review.

Inclusion and Exclusion Criteria. The inclusion criteria were as follows: (a) thematic relevance to the study's scope; (b) availability in either English or Russian; (c) full text is available. Conversely, publications that did not satisfy these predefined standards were consequently excluded from the review.

The main part

In contemporary scientific literature, the causes and risk factors influencing men's reproductive health are systematically categorized into four key areas: biological and physiological determinants, behavioral and lifestyle factors, environmental exposures, and socio-demographic characteristics [78]. This multifaceted approach provides a more complete understanding of fertility disorders and helps identify the most significant links in the pathogenesis of male infertility (see Figure 1).

Demographic Factors

To date, it has been well established that age, ethnicity, and level of education/living standards represent significant demographic indicators that may exert a substantial impact on male reproductive health [20, 66].

A meta-analysis covering data from 1965 to 2015 identified age as one of the major risk factors for reduced sperm concentration in 13 out of 14 analyzed studies [91]. Research demonstrates that with advancing age, men experience deterioration in key semen parameters — including sperm count, motility, and morphological integrity [49, 54]. For example, *Lee T. et al.* (2023) reported statistically significant alterations in semen quality among

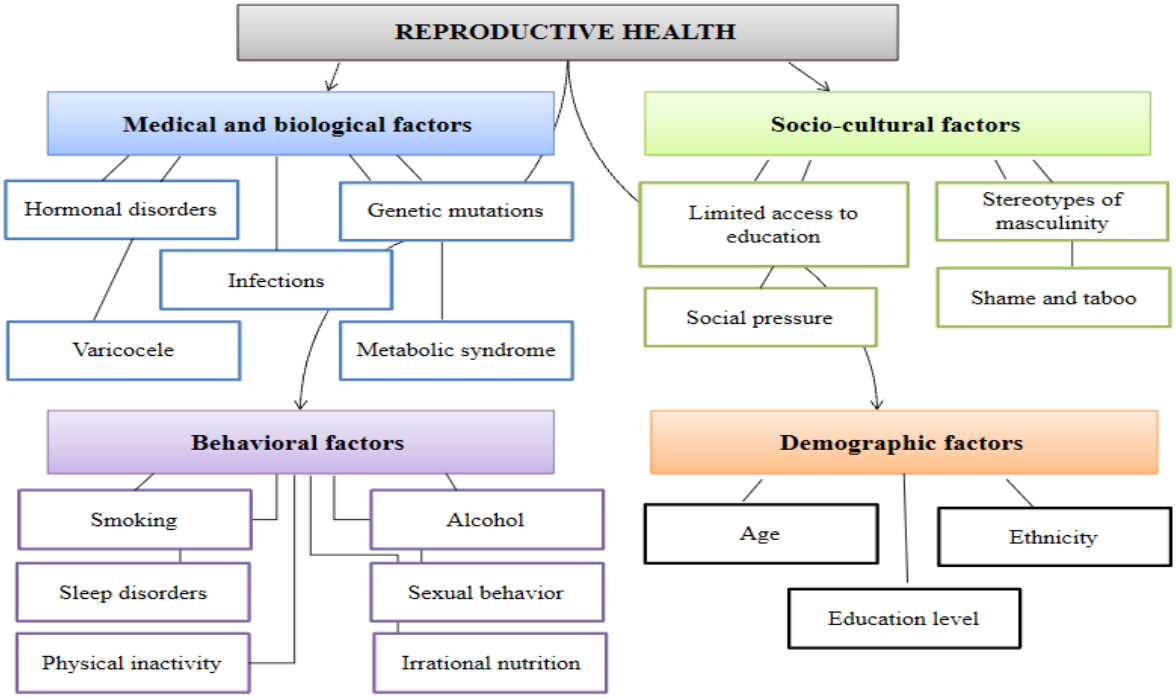

Figure 1. The spectrum of risk factors influencing male reproductive health

men aged 45 years and older compared to those younger than 35. Specifically, reductions were observed in ejaculate volume (2.5 ml vs. 3.2 ml; $p < 0.001$), total sperm motility (31.2% vs. 42.3%; $p < 0.001$), and progressive motility (28.4% vs. 39.2%; $p < 0.001$). The authors associated these changes with age-related dysfunction of Sertoli cells — somatic elements providing structural and metabolic support to spermatogenesis — which in turn may contribute to reduced fertility in middle-aged men [58]. In another study, researchers suggested that ejaculate volume progressively decreases after the age of 45 due to the functional decline of accessory glands in the male reproductive system [37]. Age-related changes also occur in the hormonal profile and functional state of the testes, including reduced Leydig cell numbers and progressive decline in testosterone production [71]. These tendencies are of particular concern given that paternal age is steadily increasing worldwide, largely due to delayed marriage and childbearing for socio-economic reasons [53].

At the same time, a number of studies demonstrate a strong association between early sexual initiation (before the age of 16) and increased risks of adverse outcomes in reproductive and sexual health. Such consequences include a higher likelihood of multiple sexual partners, sexual encounters under the influence of alcohol or drugs, elevated risk of unintended pregnancy, and sexually transmitted infections (STIs) [39]. Data from the Youth Risk Behavior Surveillance System (YRBSS, 2017) revealed that 4.8% of male high school students in the United States had initiated sexual activity before the age of 13 — more than double the prevalence among their female peers (2%) [50].

Furthermore, *Lindberg L. et al.* (2019), in a study among U.S. high school students, documented pronounced ethnocultural differences in the timing of sexual initiation. The highest proportion of very early debut (before 13 years) was observed among African American adolescent males, ranging from 12% to 29% depending on the region. Among Latino adolescents, prevalence varied between 6% and 17%, while among white males it ranged from 2% to 10% [62]. An analysis of demographic data from the Nigerian Department of Health (2003, 2008, 2013) showed that among the 374 ethnic groups in the country, Yoruba males aged 15–19 years exhibited the highest likelihood of early sexual initiation [75]. According to *Burns J. et al.* (2021), young Black men aged 18–24 are at greater risk of STIs, including HIV/AIDS, and demonstrate greater unmet needs in sexual and reproductive health services compared to other ethnic groups [16]. These findings are consistent with earlier evidence (2011) showing that the prevalence of ED among Asian men aged 40–49 years (7–15%) was considerably higher than rates observed in Australia (5–6%) and Europe (3–5%) [59]. Interestingly, within the Asian population, the lowest rates of ED were recorded among certain ethnoreligious minorities, such as Muslims and Zhuangs [106]. In larger ethnic groups, prevalence values of ED were reported as 0.767 among Malays, 0.705 among Chinese, 0.793 among Indians, and 0.667 among other groups [55].

The influence of education level on sexual dysfunction remains a subject of ongoing debate. Several studies, including *Johannes C. et al.* (2000), reported that men with lower educational attainment were at greater risk of developing ED [48]. These findings are supported by other research demonstrating a positive correlation between the severity of erectile and orgasmic dysfunctions and low educational levels [30]. However, contradictory results also exist. For instance, a study involving 1000 men aged 45–70 years in two Finnish cities revealed that higher-educated men more frequently reported ED (OR: 0.52; 95% CI: 0.33–0.83; P = 0.013). Moreover, *Hwang T.* (2010) observed that continuing education up to university level was associated with increased ED prevalence [42]. Finally, several investigations have reported no statistically significant association between educational attainment and the

prevalence of ED, anorgasmia, or disorders related to sexual satisfaction [56, 88].

Some studies highlight an association between men's occupational activity and reproductive health. For example, civil servants more frequently present with abnormal semen parameters, which may be explained by the higher prevalence of risk factors such as smoking and excessive alcohol consumption that negatively affect fertility [99]. An Iranian study revealed that men engaged in manual labor were more prone to infertility compared with office workers. They more frequently exhibited conditions such as varicocele and inguinal hernia (2.4 and 1.6 times higher, respectively), likely due to sustained physical strain and mechanical stress on the reproductive organs, resulting in reduced sperm quality [64].

Social and Cultural Factors

In addition to demographic determinants, social and cultural aspects play an equally important role in shaping male reproductive health. Family attitudes, community norms, religious values, and media influence directly affect sexual behavior, reproductive awareness, and access to medical services. For example, several studies have demonstrated that insufficient communication between parents and adolescents on topics of sexual and reproductive health contributes to higher levels of risk-taking behavior, including early sexual debut and low contraceptive use [82, 89]. Conversely, open dialogue with parents has been associated with delayed initiation of sexual activity and increased adherence to safe sexual practices [96].

Religious beliefs and traditions also exert a considerable influence. In a systematic review by *Kiani Z. et al.* (2021), a strong correlation was found between religious affiliation and sexual activity among adolescents. Boys and young men who were regularly involved in religious practices reported later initiation of sexual activity, fewer partners, and reduced risk of STIs compared with their non-religious peers [84].

Socioeconomic inequality is another critical determinant. In regions with low income and limited access to education, men demonstrate poorer knowledge of reproductive health issues and more often encounter problems in receiving timely medical care. For example, a study in sub-Saharan Africa revealed that young men from lower socioeconomic groups were significantly less likely to use modern contraceptives and more likely to be exposed to sexual risk factors [47]. At the same time, cultural attitudes toward masculinity and sexuality can increase the prevalence of risk-taking behaviors. In many societies, sexual activity at an early age and having multiple partners are perceived as indicators of male "status" and "strength." However, this significantly increases the risks of unprotected sexual activity, infertility, and STIs, including HIV [79, 2].

Finally, mass media and social networks also play a growing role in shaping reproductive attitudes. On the one hand, they serve as a source of information on safe sexual practices; on the other hand, the spread of pornography and sexualized content has been associated with distorted perceptions of sexuality, leading to unrealistic expectations, increased anxiety, and in some cases, erectile dysfunction [65].

Lifestyle Factors

Lifestyle is one of the key determinants of male reproductive health, with particular emphasis on nutrition, physical activity, alcohol consumption, smoking, and psycho-emotional stress. Numerous studies have shown that overweight and obesity are associated with impaired spermatogenesis and an increased risk of erectile dysfunction (ED) [35, 40]. According to a meta-analysis by *Sermondade N. et al.* (2013), men with a body mass index (BMI) above 30 kg/m² had a 21% higher likelihood of oligozoospermia or azoospermia compared with men of normal weight [57]. Excess adipose tissue contributes to increased aromatization of androgens into estrogens, which negatively affects hormonal balance and reduces testosterone levels [1, [63]. Weight reduction may be recommended for infertile patients to enhance their fertility potential [6, 38].

Nutrition plays a crucial role in reproductive health. Diets rich in saturated fats and processed foods are associated with decreased sperm motility and abnormal morphology [3]. In contrast, a Mediterranean-style diet, rich in antioxidants, polyunsaturated fatty acids, and vitamins (C, E, folate), has been shown to improve sperm quality [95, 15]. Micronutrient deficiencies - particularly of zinc, selenium, and folate - are strongly associated with impaired spermatogenesis and reduced fertility [93].

Alcohol consumption negatively affects both spermatogenesis and erectile function. Chronic alcohol intake reduces testosterone synthesis, impairs Leydig cell function, and increases the risk of hypogonadism [100]. Studies have also demonstrated that men who consume more than 20 alcoholic drinks per week have a higher prevalence of ED compared with moderate drinkers [21].

Smoking remains a significant risk factor for reproductive dysfunction. Tobacco smoke contains more than 4000 toxic compounds, including cadmium, lead, and polycyclic aromatic hydrocarbons, which lead to oxidative stress, DNA damage in spermatozoa, and reduced sperm motility [86, 105]. A meta-analysis by *Sharma R. et al.* (2016) confirmed that smokers have significantly lower sperm concentration and motility compared with non-smokers [67].

Psychological stress and chronic fatigue also play a major role. Stress activates the hypothalamic-pituitary-adrenal axis, increases cortisol production, and suppresses the hypothalamic-pituitary-gonadal axis, which leads to reduced testosterone secretion and disruption of spermatogenesis [36]. In addition, stress is considered a significant predictor of ED and decreased sexual satisfaction [18].

Insufficient or excessive physical activity can also negatively influence reproductive health. A sedentary lifestyle leads to obesity, hormonal imbalance, and reduced sperm quality, while excessive endurance exercise (e.g., marathon training) is associated with oxidative stress, hypogonadotropic hypogonadism, and reduced testosterone levels [83, 60].

Environmental Factors

Alongside demographic, social, and lifestyle determinants, environmental conditions play an increasingly important role in male reproductive health [92]. Anthropogenic pollution, exposure to endocrine-disrupting chemicals, radiation, and occupational hazards have been identified as risk factors for infertility and sexual dysfunction. A decline in semen quality has been reported worldwide over the past decades. For instance, *Levine H. et al.* (2017)

demonstrated in a large-scale meta-analysis that sperm concentration in men from North America, Europe, Australia, and New Zealand declined by 52.4% between 1973 and 2011 [103]. The authors attributed this trend to environmental pollution, unhealthy lifestyles, and occupational exposures.

Endocrine-disrupting chemicals (EDCs) - such as bisphenol A (BPA), phthalates, pesticides, and heavy metals - interfere with hormonal regulation of spermatogenesis and reduce testosterone levels [7]. For example, BPA exposure has been linked to decreased sperm count, reduced motility, and increased DNA fragmentation [94]. Air pollution, particularly fine particulate matter (PM2.5), has also been associated with impaired sperm quality. A Chinese cohort study found that long-term exposure to high PM2.5 concentrations was associated with decreased semen volume and abnormal sperm morphology [69]. Similarly, exposure to high concentrations of nitrogen oxides and sulfur dioxide has been correlated with reduced sperm motility [24]. Occupational hazards, especially in industries involving heat exposure, ionizing radiation, solvents, or pesticides, significantly contribute to reproductive disorders [73]. For example, men working in agriculture and pesticide production are at higher risk of infertility due to chronic exposure to organophosphates [26]. Workers exposed to high temperatures (e.g., welders, bakers, drivers) frequently present with impaired spermatogenesis due to scrotal hyperthermia [76].

Finally, climate change and rising global temperatures may also have an indirect negative impact on male reproductive health. Recent studies suggest that prolonged heat exposure may reduce sperm quality and contribute to seasonal fluctuations in semen parameters [12].

Conclusion

A comprehensive understanding of these diverse risk factors is essential for developing effective prevention and intervention strategies [80, 819(105-]. While numerous studies have individually explored the impact of specific factors such as age, smoking, obesity, and exposure to endocrine-disrupting chemicals, the current scientific landscape often lacks a cohesive, synthesized analysis that integrates these disparate findings. The fragmentation of knowledge across multiple specialties and research areas creates a significant gap in the ability of healthcare professionals to provide holistic, evidence-based guidance to young men. Without a clear framework that outlines the relative importance and synergistic effects of these factors, public health initiatives may prove less effective. Furthermore, a deeper understanding of these risks is necessary to distinguish between modifiable and non-modifiable factors, allowing for targeted campaigns that promote healthier lifestyles and responsible reproductive choices.

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