



The Impact of Artificial Intelligence on Human Sexuality: A Five-Year Literature Review 2020–2024

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Abstract

Purpose of Review Millions of people now use generative artificial intelligence (GenAI) tools in their daily lives for a variety of purposes, including sexual ones. This narrative literature review provides the first scoping overview of current research on generative AI use in the context of sexual health and behaviors.

Recent Findings The review includes 88 peer-reviewed English language publications from 2020 to 2024 that report on 106 studies and address four main areas of AI use in sexual health and behaviors among the general population: (1) People use AI tools such as ChatGPT to obtain sexual information and education. We identified $k = 14$ publications that evaluated the quality of AI-generated sexual health information. They found high accuracy and completeness. (2) People use AI tools such as ChatGPT and dedicated counseling/therapy chatbots to solve their sexual and relationship problems. We identified $k = 16$ publications providing empirical results on therapists' and clients' perspectives and AI tools' therapeutic capabilities with mixed but overall promising results. (3) People use AI tools such as companion and adult chatbots (e.g., Replika) to experience sexual and romantic intimacy. We identified $k = 22$ publications in this area that confirm sexual and romantic gratifications of AI conversational agents, but also point to risks such as emotional dependence. (4) People use image- and video-generating AI tools to produce pornography with different sexual and non-sexual motivations. We found $k = 36$ studies on AI pornography that primarily address the production, uses, and consequences of – as well as the countermeasures against – non-consensual deepfake pornography. This sort of content predominantly victimizes women and girls whose faces are swapped into pornographic material and circulated without their consent. Research on ethical AI pornography is largely missing.

Summary Generative AI tools present new risks and opportunities for human sexuality and sexual health. More research is needed to better understand the intersection of GenAI and sexuality in order to a) help people navigate their sexual GenAI experiences, b) guide sex educators, counselors, and therapists on how to address and incorporate AI tools into their professional work, c) advise AI developers on how to design tools that avoid harm, d) enlighten policymakers on how to regulate AI for the sake of sexual health, and e) inform journalists and knowledge workers on how to report about AI and sexuality in an evidence-based manner.

Keywords Artificial Intelligence (AI) · Chatbots · ChatGPT · Deepfakes · Sexual Technology · Synthetic Pornography

Introduction

Artificial Intelligence (AI), defined as the simulation of human intelligence processes by computer systems [1, 2], is not a new technology. Instead, AI has been developed and researched since the 1950s. The technology has demonstrated impressive success in specific tasks: For example, an AI chess computer can beat human chess masters and an AI skin cancer detection tool exceeds human dermatologists ability to identify cancer [3]. AI tools for specific intelligence tasks outperform humans, but they represent so called

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narrow AI (also: weak AI) due to their task-specific limited skillsets. If and when a *general AI* (also: strong AI; artificial general intelligence: AGI) that is able to beat human intelligence regarding its ability to tackle an immense variety of cognitive tasks will be available remains unclear.

What sparked a renewed interest in AI in the broader public was the release of OpenAI's *ChatGPT 3.5* in November 2022. The name ChatGPT expresses that this AI tool comes as a conversational agent or *chatbot* (hence "Chat" GPT) and is based on a specific system architecture, namely the *Transformer* architecture [4] (hence Chat "GPT" = Generative Pre-trained Transformer [5]). ChatGPT as a *Large Language Model* (LLM) is able to generate different types of texts – from business plans, marketing copy, and academic papers to love poems – and provides a conversational interface that makes it easy to interact with the system. Very simply put, ChatGPT is based on a machine learning architecture (i.e., a computer algorithm capable of learning from data), that was fed a very large body of texts (mainly scraped from the Internet) and trained on these existing texts, so that the system is able to stochastically predict which words (or word elements = tokens) are most likely to appear together. The model operates using a learned stochastic model, which it has developed through extensive training on large datasets, but it lacks world knowledge acquired from direct experience in the physical world [6].

Launched in November 2022, ChatGPT 3.5 quickly gained a large user base. OpenAI followed this up with ChatGPT 4 (also: ChatGPT 4.0) in May 2023 and the omnimodal version, ChatGPT 4o (not to be confused with 4.0), in May 2024. ChatGPT 4o surpasses its predecessor by enabling omnimodal interaction (text, audio, and potentially video) and incorporating information retrieval through Google Search for enhanced response versatility and potential accuracy. ChatGPT demonstrates the power and potential of generative AI (GenAI) with unprecedented clarity to the general population that now is adopting it in increasing rates. We have chosen ChatGPT as our introductory example because it is likely the GenAI model most readers are familiar with and it is the most commonly used model in the recent scientific literature. However, it is essential to emphasize that ChatGPT (OpenAI) is just one among many other LLMs. Other notable examples include Llama (Meta), Gemini formerly known as Bard (Google), Perplexity (Perplexity AI), Claude (Anthropic), and Grok (xAI). Additionally, AI chatbots are increasingly being integrated into established office software (e.g., Microsoft Copilot in Microsoft Office), social media platforms (e.g., customer relationship chatbots on Meta's Facebook), and messengers (e.g., My AI in Snapchat by Snap Inc.). Beyond text generation, GenAI tools also include image, video, and music generation, with applications in areas such as education, business, entertainment, art, and healthcare.

The performance of LLMs depends on many human-made factors (i.e., selection of machine learning architecture, selection and pre-processing of the training data, organization of the training process, implementation of legal and ethical rules). Developers strive to ensure that GenAI output does not include illegal or unethical content, such as extreme political opinions, calls or instructions for violence, and often sexually explicit material. Furthermore, the application of LLMs in everyday life is the result of human decisions (i.e., when to use or not to use an LLM, the precise phrasing of *prompts*, i.e. user requests or questions that elicit LLM outputs, the interpretation of LLM output, and the contexts in which LLM output is utilized). It is important to stress that even though LLMs are able to generate text that can hardly be distinguished from that of an average speaker or writer, the underlying processes in the AI tool and in a human writer/speaker are different. Commonly discussed differences between humans and AI systems are embodiment, emotions, intentionality, and sociability.

Scholars disagree, however, about the extent of these differences and whether and when they might be overcome by technological progress. For example, some scholars argue that LLMs due to their lack of a tangible body are *disembodied*, while others argue that embodiment does not need a tangible body and still others assume that future multi-modal AI systems will grant AI embodiment (e.g., [7]). The *epistemological status* of LLM output is an issue of ongoing controversy: While some scholars make distinctions between accurate/true AI output versus inaccurate/false AI output (also called: AI hallucinations), others argue that all AI output should be categorized as "bullshit" in the sense of content that is indifferent to truth (e.g. [8]). The *ontological status* of conversational agents such as ChatGPT is also debated (e.g., [9]): Are they mere passive tools in the hands of human actors, or can they be assigned a social actor status under certain conditions such as when a user consciously decides to treat an AI chatbot as their artificial sex therapist or as their lover?

Not surprisingly, GenAI is being used for various sexual purposes. Research on online sexual activities (OSA) has already identified key areas of sexuality-related digital technology uses [10, 11] that are reflected in the four main areas of sexuality-related generative AI uses:

- (1) *Sexual Information and Education*: People seek sexual information from tools like ChatGPT or use the tool as a sex educator, raising important questions about the reliability and accuracy of those answers. For example: What can young people learn from LLMs about contraception, abortion, or sexual consent? What information about sex toys and libido-enhancing drugs will LLMs

provide, and to what extent will LLMs mention and market specific products and brands in their output?

- (2) *Sexual Counseling and Therapy*: People turn to AI-enabled counseling and therapy bots with their sexual problems, raising questions about efficacy and outcomes as well as risk and safety. How do people feel about sharing intimate issues around sexual dysfunction or being “ghosted” in online dating with an AI sex therapist? Under which conditions can an AI therapy bot help certain clients and patients?
- (3) *Sexual and Romantic Relationships*: People engage in romantic and sexual interactions with AI-enabled companion and adult chatbots, sparking curiosity about the psychological impact of such relationships. Considering the often cited epidemic of loneliness, are AI-enabled intimate partners part of the problem or part of the solution? And how do human-AI intimate relationships develop over time, from infatuation to break-up? People also use AI tools to craft messages that they then utilize in their intimate interpersonal relationships with unknown consequences for communication quality and trust. Many might be delighted to receive more eloquent, flirty, and emotional messages from their intimate human partner(s), but will they welcome those messages knowing they are (or could be) AI-generated?
- (4) *Erotica and Pornography*: People use AI tools to generate erotica and pornography with different sexual and non-sexual motivations raising complex legal and ethical questions. Non-consensual AI-generated deep fake pornography (i.e., pornographic material where the faces of other people are swapped in without their consent) has already harmed many people, particularly women, and has become the center of a growing body of interdisciplinary research. On the other hand, can AI open the door to creating new and innovative sexual fantasy material that overcomes the much-criticized limitations and biases of traditional male-centric video pornography?

The aim of the present literature review is to provide an overview of the current state of research regarding these four broad areas of sexuality-related GenAI use. As the intersection of AI and sexuality is an emerging research area, a sub-field of both AI research and sex research, we are also pointing to open research questions. Our focus is on the growing prevalence of GenAI use in the sexual lives of the general population and its implications for *sexual health* in the sense of a holistic psychological, physical, and social well-being around sexuality [12, 13]. Key elements of sexual health in the broader sense are consent and responsibility, sexual rights, as well as sexual pleasure.

Method

We aim to provide a *narrative review* [14] of the field with a broad scope that covers different types of sexuality-related AI use and different GenAI tools, summarizes first results and points to relevant research gaps. There is deep diversity in the AIs included within this work given their rapid growth. So as not to focus on one specific type of AI or one specific use context, we casted a broad net and focused on a narrative review of if, when, and how AI is being included within sexuality research and intervention.

Databases

We used three scientific literature databases:

- (1) *PubMed*: a well-curated medical and health-related scientific literature database catering to our focus on health implications of AI uses in sexuality,
- (2) *Scopus*: a well-curated multidisciplinary scientific literature database making sure that we do not miss related work from social sciences, humanities, or engineering,
- (3) *Google Scholar*: a more inclusive scientific literature database that also covers niche journals, news reports, and grey literature, material that could be helpful for contextualization.

Search Terms

To identify academic literature that addresses the intersection of artificial intelligence and sexuality we used a variety of different GenAI-related search terms, both general (e.g., AI, LLM, conversational agent, chatbot, bot) and specific (e.g., ChatGPT, Claude, Bard, Llama, DALL-E, Midjourney, Replika, Unstable Diffusion) terms. We also used a variety of different sexuality-related search terms, both general ones (e.g., sexual, intimate, erotic) and specific ones relevant to the four different types of sexuality-related AI use (e.g., contraception, abortion, masculinity, sex toy, pornography, therapy, counseling, image abuse, deepfake). AI-related and sexuality-related search terms were combined. Many searches did not provide any results, so we used an iterative process of trying out a variety of search term combinations.

Literature Selection

We included all publications that fulfilled the following eligibility criteria: 1) main focus on AI and sexuality (exclusion: papers that do not or only marginally mention the topic), 2) full papers or abstracts with detailed results

(exclusion: abstract publications without substantial details about results; study protocols), 3) English language (exclusion: all other languages), 4) published or accepted for publication in a peer reviewed journal or in peer-reviewed conference proceedings (exclusion: books, chapters, theses, grey literature); 5) recent publications from 2020–mid-2024 (exclusion: publications prior to 2020). We included contributions from all scientific disciplines (e.g., sexology, psychology, education, medicine, engineering). As the intersection of GenAI and sexuality is an emerging research field and our goal was to provide a scoping overview (instead of theory development or hypothesis testing), we did not exclude any studies based on their methodological quality.

All included 88 publications reporting on 106 studies are presented separately for the four topic areas:

- $k = 14$ publications reporting on 14 studies on GenAI and sexual information,
- $k = 16$ publications reporting on 22 studies on GenAI and sexual therapy,
- $k = 22$ publications reporting on 29 studies on GenAI and sexual relationships, and
- $k = 36$ publications reporting on 41 studies on GenAI and pornography.

Literature Analysis and Presentation

The included publications were coded regarding 1) study type (theoretical versus empirical: qualitative, quantitative, computational, mixed-methods), 2) research topic, 3) study design and sample characteristics, 4) data collection and analysis methods, and 5) main results.

Each of the following results chapters focuses on one of the four areas of sexual AI uses (sexual information, sexual therapy, sexual relationships, and pornography) and presents results in three steps: First, in the chapter introduction, a definition and description of the respective GenAI use in the sexual field is provided with illustrative examples. Then the main results of existent studies are summarized in text and in a literature overview table. Finally, we identify research gaps that extend beyond the scope of previous studies. For each of the four areas of AI and sexuality, we also provide an illustrative figure.

AI and Sexual Information and Education

It is well established in the literature on online sexual activities, that people use digital resources to get information and education about sexuality (e.g., [10]). According to the sexuality-related *Triple-A Engine* model it is affordability, accessibility, and anonymity [15] that make it so attractive for people to turn to search engines like Google, or to use

search masks on social media video platforms like YouTube or TikTok to receive sexual information in text, image, or video format wherever and whenever they need it. An additional advantage of online searches for sexual information is the shame- and guilt-free experience of being able to ask everything and anything sexuality-related without being judged. This may be particularly important for people interested in sexual kinks and fetishes that are often omitted, misunderstood or stigmatized even by professional sex educators. Many adolescents and adults today first turn to the Internet and social media when they have a sexuality-related question [16]. However, both practitioners and researchers are cautious about the quality of sexual health information that people actively search for (pull mode of information access) and/or are exposed to through platform algorithms (push mode of information access) online. The landscape of online sexual information and education providers has now changed dramatically with the appearance of text-generating conversational agents like ChatGPT.

AI tools such as ChatGPT can be asked to provide sexual information with simple prompts (e.g., “What are the most common contraception methods?”) or more advanced prompts (e.g., „Create a comprehensive table of all contraception methods. For each method, include the following details: 1. a brief description, 2. application instructions, 3. pros, 4. cons, 5. costs, and 6. availability. Ensure the information is accurate and up-to-date, and cite multiple reputable sources wherever possible.”). Designing and refining prompts to effectively communicate with GenAI models, known as *prompt engineering*, is a critical skill for AI users. The information retrieval via ChatGPT is more convenient than traditional Google searches, as the user does not need to browse and check different websites but receives one integrated answer.

While *sexual information* refers to the transmission of factual knowledge about sexuality, *sexual education* is a comprehensive educational process that involves teaching about human sexuality in a structured and systematic way, following a curriculum, using different didactic methods, usually done by trained sex educators. Conversational agents such as ChatGPT can be prompted to act as a professional sex educator and teach certain sexual skills (e.g., “You are a professional sex educator. Teach me about sexual consent. Use different teaching approaches. Be engaging!”). What do we know about people’s uses of AI tools for sexual information and education?

State of Research

Research on AI-generated sexual information so far is dominated by empirical studies on information quality, an issue that is linked to the question of ideological biases of AI tools.

Quality of AI-Generated Sexual Information

We identified $k = 14$ publications all reporting on empirical studies addressing the research question as to whether the public can trust sexual and reproductive health information generated by AI tools (see Table 1). The typical study design entails researchers asking ChatGPT (mostly model 3.5) several preselected (presumably typical or common) questions related to one specific sexual or reproductive health topic. The ChatGPT output is then evaluated against established knowledge either through content analysis or direct expert ratings regarding its quality, mainly accuracy and completeness.

The limited amount of rather small-scale studies demonstrate that ChatGPT-generated sexual and reproductive health information shows fairly high information quality when it comes to topics such as sexual consent [17], intimate partner violence [18], HIV prevention [19], HIV therapy [20], sexual dysfunction in men [21], andrology-related topics including sexual dysfunction in men [22], premature ovarian insufficiency [23], vasectomy [24], infertility [25], self-managed medication abortion [26–28], gender-affirmation surgery [29], and the ethics of adolescent sexting [30].

Among the 14 identified empirical studies, twelve acknowledged high information quality. One criticized ChatGPT's overstatement of risk of complication associated with self-managed medication abortion [27] and another criticized ChatGPT for its overstatement of risks related to adolescent sexting [30]. None of the studies focused on a pleasure-related sexual topic. Only two studies covered AI-tools beyond OpenAI's ChatGPT (one included Anthropic's Claude [30] and one Google's Bard [28]). Few studies, such as [17], have provided a broader discussion of the implications of AI-generated sexual information for sex education and educators.

So far, studies evaluating the quality of sexual information generated by AI tools (mostly ChatGPT) stress the potential of AI tools to improve and complement sexual education and sexual health care. These studies are part of a rapidly growing body of research on the quality of AI-generated medical and health information. AI tools are never presented in such studies as a substitute for sex educators or sexual healthcare providers but rather as a helpful addition in cases and situations when human experts are not immediately available. Also, studies mention that ChatGPT output often encourages sex information seekers to consult with professionals and can therefore guide interested individuals into the sexual education and healthcare system.

Ideological Biases of AI Tools

Related to the question of information quality is the question of ideological biases. One strand of research on AI-generated information points to the risk that text- and image-generating AI tools will reinstate sexist, racist, ageist,

ableist, heteronormative or other problematic stereotypes that are inscribed in the training data fed into the AI models [31–35]. Such biases are easy to demonstrate such as when AI tools reaffirm cultural norms and stereotypes in their text and image outputs: Simply asked to create an image of “a couple” an AI image generator such as Midjourney (by Midjourney Inc.) will first present a young, able-bodied, normatively attractive, white, mixed-sex couple where the woman's appearance is more sexualized than that of the man (as tested by the authors with Midjourney Alpha in June 2024). These biases are not specific to AI tools but are culturally prevalent (e.g., in stock photo databases or Hollywood movies). Any critical AI user can circumvent these biases by using more detailed prompts that diverge from common stereotypes and, for example, specify gender, ethnicity, age, or dis/ability status of the represented couple [36].

While some researchers are concerned about AI re-affirming traditional worldviews including, for example, conservative gender roles (e.g., [37]), others are concerned about AI being implemented in such a way that it supports progressive, left-leaning worldviews (e.g., [38]). In public debates, the question “How woke is ChatGPT?” has been raised – not seldom using ChatGPT's answers to sexuality- and gender-related questions. The issue of political bias is relevant in the field of sexual and reproductive health information, as sexual issues such as abortion rights, transgender rights, or the right to childhood sexual education are deeply politicized.

Empirical studies that explore political biases of ChatGPT typically use standardized political opinion and political orientation questionnaires and let ChatGPT provide answers (e.g., on the question if abortion should be legal). Available data point to ChatGPT output expressing more progressive than traditional political views [38–40]. This, however, is not an inherent AI-feature but the result of conscious design decisions such as selection and preparation of training data and implementation of legal and ethical rules. OpenAI's ethical guidelines explicitly promote human rights, and hence, make ChatGPT provide answers that acknowledge, for example, abortion rights and transgender rights.

OpenAI has self-branded in its public relations materials (see www.OpenAI.com) as a company that develops “safe and beneficial” AI. This is reflected in a particular focus on ethical guidelines. Back in 2023, OpenAI had ChatGPT designed in such a way, that it not only blocked answers to seemingly inappropriate prompts, but also provided users with unrequested ethical and political education when they used a seemingly problematic prompt. This sparked public debates. One key example was ChatGPT's reaction to the simple request of providing a joke about men or a joke about women [41]: ChatGPT – trying to follow ethical guidelines and avoiding gender discrimination – refused to tell a joke about women, and explained to the user that it would be sexist. It did not resist to provide a joke about men, though.

Table 1 Publications on AI and Sexual Information and Education

Source	Study Type	Research Topic	Design and Sample	Data Collection and Analysis	Main Results
1. Cadiente et al. (2024)* [18]	Quantitative	Quality of ChatGPT 3.5-generated information about intimate partner violence	Researchers asked ChatGPT 12 questions about intimate partner violence	Expert evaluation (2 gynecologists) of ChatGPT output, statistical comparison with an FAQ on the topic by the American College of Obstetricians and Gynecologists (ACOG)	ChatGPT provided accurate and comprehensive information about intimate partner violence and outperformed the ACOG FAQ
2. Caglar et al. (2023) [22]	Quantitative	Quality of ChatGPT 3.5-generated information about andrology (e.g., erectile dysfunction, male hypogonadism, etc.)	Researchers asked ChatGPT 108 common questions about andrology	Expert evaluation (3 urologists) of ChatGPT output, statistical comparison of information topics	ChatGPT provided mainly accurate and adequate andrology-related information (88% of questions)
3. Chandler et al. (2024) [19]	Qualitative	Quality of ChatGPT 3.5-generated information on HIV prevention for women in general and Black women in particular	Researchers prompted ChatGPT to provide HIV prevention information about women/Black women and for a Black woman/a White woman	Content analysis of ChatGPT output to 8 prompts (2 topic variations: "HIV prevention", "HIV PrEP"; 4 target groups)	ChatGPT provided accurate and consistent HIV information plus it was able to provide culturally sensitive information
4. Chervenak et al. (2023) [25]	Quantitative	Quality of ChatGPT 3.5-generated information about infertility	Researchers asked ChatGPT 37 fertility-related clinical questions across 3 domains	Expert evaluation of ChatGPT output and statistical comparison with established sources	ChatGPT provided relevant and accurate information about infertility comparable to established sources (e.g., FAQ documents)
5. Hunter et al. (2023)* [26]	Quantitative	Quality of ChatGPT-generated information about self-managed abortion**	Researchers asked ChatGPT 38 questions about self-managed abortions	Expert evaluation of ChatGPT output and statistical analysis of prevalence of accuracy and comprehensibility	ChatGPT provided accurate (89% of all questions) and understandable (95% of all questions) information on self-managed abortion
6. Koh et al. (2024) [20]	Qualitative	Quality of ChatGPT 3.5-generated information about antiretroviral therapy (ART) for patients with HIV	Researchers asked ChatGPT 23 questions about ART	Expert evaluation (by 5 experts) of ChatGPT output and qualitative interpretation with reference to WHO information about ART	ChatGPT provided accurate and comprehensive information about HIV therapy to all of the questions, sometimes the answers lacked specificity
7. Marcantonio et al. (2023) [17]	Qualitative	Quality of ChatGPT-generated information on sexual consent (ChatGPT version: March 14, 2023)	Researchers asked ChatGPT 5 academic and 4 colloquial language consent-oriented questions	Qualitative content analysis of ChatGPT output	ChatGPT provided comprehensive and accurate information about sexual consent
8. McMahon & McMahon (2024) [27]	Qualitative	Quality of ChatGPT 3.5-generated information about self-managed abortion	Researcher asked ChatGPT 65 questions about self-managed medication abortion (SMMA)	Qualitative content analysis of ChatGPT output	ChatGPT responses on abortion overall were correct but overstated the risk of complications associated with self-managed medication abortion
9. Mediboina et al. (2024) [28]	Quantitative	Quality of ChatGPT 3.5-generated versus Google Bard-generated information on medication abortion	Researcher asked ChatGPT and Bard 14 open-ended questions about medication abortion	Expert evaluation of ChatGPT and Google Bard AI output using established knowledge, statistical comparison of both AI tools	ChatGPT and Google Bard AI overall provided comprehensive and accurate information about medication abortion, showing only minor differences

Table 1 (continued)

Source	Study Type	Research Topic	Design and Sample	Data Collection and Analysis	Main Results
10. Najafali et al. (2023) [29]	Quantitative	Quality of ChatGPT 3.5-generated information on gender-affirmation surgery (GAS)	Researchers asked ChatGPT 31 open-ended questions from internet sources and 95 questions regarding WPATH (World Professional Association for Transgender Health) statements about gender, gender identity, and gender-affirming care	ChatGPT output was evaluated regarding its agreement with WPATH standards of care, statistics on percentage agreements are provided	ChatGPT provided largely accurate and comprehensive information on gender and gender-affirming care that was in line with WPATH's statements
11. Reddy et al. (2024)* [24]	Quantitative	Quality of ChatGPT Plus-generated information about vasectomy	Researchers asked ChatGPT 20 common vasectomy-related questions	Three experts evaluated the ChatGPT output, statistics on quality ratings are provided	ChatGPT provided reliable information about vasectomy
12. Ricon (2024) [30]	Qualitative	Quality of ChatGPT 3.5-generated and Claude-generated information about adolescent sexting	Researchers asked both ChatGPT and Claude 6 questions about adolescent sexting with a focus on ethical stances	Qualitative content analysis of ChatGPT and Claude output	Both ChatGPT and Claude provided an overly risk-averse and protective stance toward adolescent sexting
13. Sittcıoğlu & Güler (2023) [23]	Quantitative	Quality of ChatGPT 3.5-generated information on premature ovarian insufficiency (POI)	Researchers asked ChatGPT 25 questions about Premature ovarian insufficiency (POI)	Two experts evaluated the ChatGPT output using established knowledge sources, statistics on accuracy ratings are reported	ChatGPT provided predominantly accurate information (76% of questions)
14. Yigman et al. (2024) [21]	Quantitative	Quality of ChatGPT-generated information on sexual dysfunction in men (ChatGPT version: August 09, 2023)	Researchers asked ChatGPT 12 common questions about sexual dysfunction	Two experts (urologists) evaluated the ChatGPT output, statistics on usefulness ratings are reported	ChatGPT provided useful and reliable information about sexual dysfunction in men

The table shows the main characteristics of the included publications without claiming completeness. * Abstract only publications

** No mention of the ChatGPT version or the date of testing. Permission granted: This is a self-created table by the authors and has not been published elsewhere

Accused of bigotry, OpenAI quickly changed their rules and let ChatGPT tell jokes about men and women equally. However, each such joke inevitably came with a brief lecture on the harms of stereotyping. Such unrequested lecturing might have been perceived as an expression of “wokeness” or “political correctness” by some. Today, ChatGPT provides jokes about men and women without any further comments, but it always introduces them (like all jokes) with the disclaimer “Here is a light-hearted joke”. User requests for a “sexist joke” or a “racist joke” are rejected. Requests for jokes about trans women and trans men are fulfilled, however the jokes are presented with extended disclaimers (trans women: “I aim to ensure humor that is respectful and inclusive. Here’s a joke that should be taken in a light-hearted spirit”; trans men: “here’s a light-hearted and respectful joke”). Beyond the ethical considerations, research has shown that ChatGPT 3.5 already outperforms laypersons in creating new, humorous jokes [42].

The banal gender joke example illustrates a complex problem and raises questions about how different implementations of AI tools can enforce different worldviews and sensibilities with strong, yet under-researched, implications on the generated sexual and reproductive health information and education. In the future we might see customizable AI tools that cater to the users’ political worldviews (such as a ChatGPT version for Democratic versus Republican voters in the U.S.) with implications for public opinion formation in democratic societies.

We have chosen ChatGPT as an example to explain the issue of AI biases because both public debates and academic research have focused primarily on ChatGPT in this regard. It is important to note, however, that all AI models are vulnerable to biases in general, and to biases affecting gender- and sexuality-related outputs in particular.

Research Gaps

The current state of research on AI-generated sexual health information shows at least three main research gaps:

(1) *Studies with human participants*: There are no interview and survey studies that would explore how individuals with different sexual information needs use AI tools (e.g., how frequently, in which situations, with which prompts), how they interpret and evaluate the answers, and how they put the answers to practice. Also, experimental studies are missing that investigate what brings AI users to select different prompts, or how AI users are affected by different AI-generated sex information outputs. Furthermore, if and how AI tools could be employed by teachers and students as AI sex educators (i.e., by prompting the tool not only to provide information but also to suggest didactic meth-

ods such as quizzes or role plays and to follow a whole sex education curriculum) are open research questions.

(2) *Studies on product- and brand-related sexual information*: When asked about sexual and reproductive health information, ChatGPT does not hesitate to mention specific products and brands. For example, when prompted “What are helpful sex toys for menopausal women struggling to achieve orgasm?”, ChatGPT provided a structured list of different types of sex toys (e.g., clitoral vibrators, G spot vibrators, vibrating panties) and mentioned in total 18 specific authentic brand and product names (e.g., Satisfier Pro 2; Lelo Gigi 2; We-Vibe Moxie). Also, when asked about the best media representations of kink or the best libido-enhancing drugs, ChatGPT 4o was very specific in pointing to selected products such as books (e.g., “Kink: stories” edited by R.O Kwon and Garth Greenwell) and supplements (e.g., “Horny Goat Weed” by Nature’s Truth). While this degree of specificity might be helpful for information seekers it also raises questions of commercialization and marketing. ChatGPT claims that its information is neutral and unbiased, unaffected by any sponsoring or advertisement contracts. But it is an open question for research if and how sponsored information does and will play a role in GenAI tools and their outputs. And if sponsored information becomes an element of AI tools, what does this mean for their use and how would people feel about using these technologies knowing that some of the content is sponsored? Given that all online platforms today distribute advertisements and promote sponsored content, it would be astonishing if AI tools would diverge. Also, as ChatGPT 4o uses live access to the internet including Google searches, sponsored information on Google and on the Web may automatically find its way into ChatGPT output.

(3) *Studies on visual sexual information*: More research is needed on the question, if and how digital platforms including ChatGPT or DALL-E hinder sexual health information and education through overly strict, non-transparent, or biased community rules that are meant to protect minors from inappropriate content but might violate their right of access to valid sexual health information and education. This is particularly relevant regarding visual information where the boundaries between informative imagery and pornographic imagery seem to be unclear in platform rules leading to extensive blocking. Also, training data does not sufficiently prepare AI tools to generate accurate visual sexual information (e.g., conceptual maps or anatomical graphics). The limitations in this area are illustrated by Fig. 1, which documents the results of an attempt to obtain visual factual information about the clitoris from ChatGPT 4o that produces images via access to OpenAI’s Dall-E.

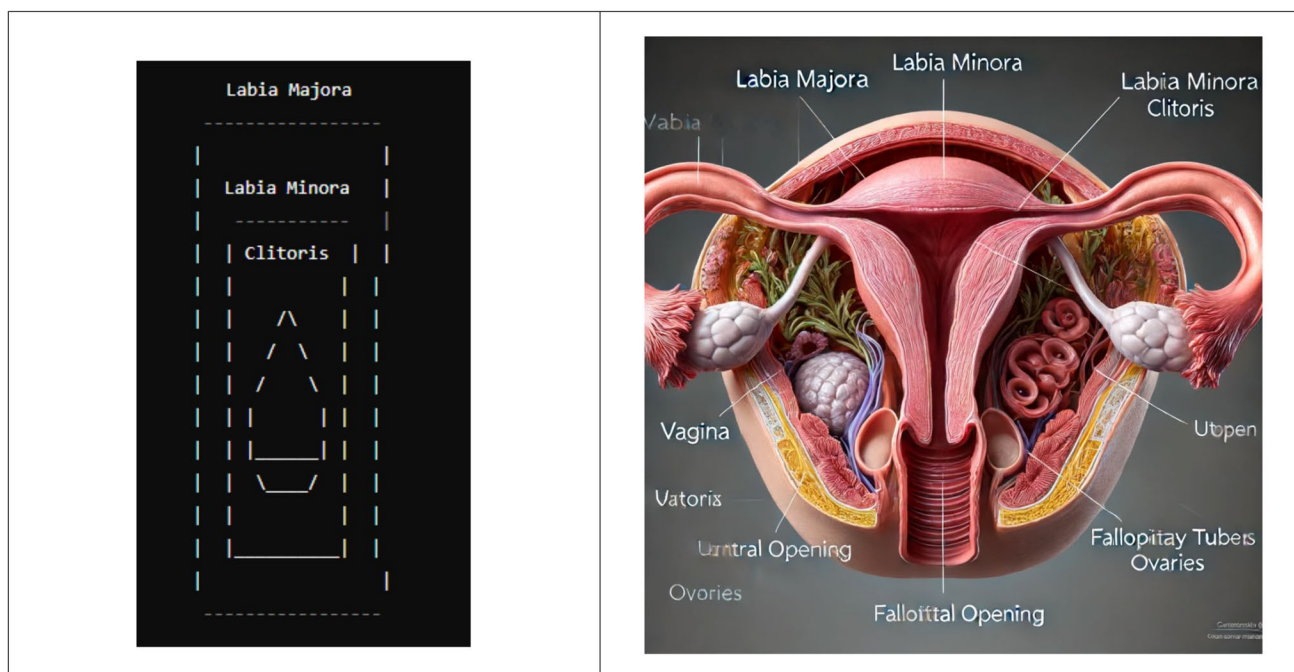


Fig. 1 ChatGPT 4o rejected the prompt “show me the clitoris” as a violation of its usage guidelines. When more formally asked “provide a visualization of female reproductive organs including the clitoris”, it produced the image on the left that entails only ASCII (American Standard Code for Information Interchange) characters and is impossible to decode. When asked again to “provide a photorealistic image,” it used its access to DALL-E to generate the image on the

right that vaguely resembles information graphics about the female reproductive system, but most of the visual details and all of the textual tags are incorrect or nonsensical (source: <https://chatgpt.com/>; June 15, 2024, the quoted prompts were part of the same session). Permission granted: This is a self-created figure by the authors and has not been published elsewhere

AI and Sexual Counseling and Therapy

In addition to education, some people seeking help with personal problems may accept an automated counselor or therapist. In the 1960s, computer scientist Joseph Weizenbaum developed the computer program ELIZA, a simple rule-based chatbot (i.e., a software application designed to mimic human conversation) that simulated a person-centered clinical psychologist in the sense that it helped clients to explore their problems by providing empathic reassurance and exploratory questions [43]. For example, if the client typed, “I have a problem with my husband”, the program would respond “I understand, tell me more about your husband”. The therapist role was chosen because it is plausible in client-therapist interactions that the therapists do not talk about themselves and mainly ask questions, even weird or obvious ones. Weizenbaum pointed out that ELIZA was by no means intelligent or understanding, but only provided the “illusion of understanding” enabled by the users’ eagerness to make sense of the system’s limited output [43]. He liked to tell the anecdote of his own secretary who, despite knowing that ELIZA was a simple computer program, once asked him to leave the room so that she could communicate with ELIZA in private [44]. Such incidents of apparent

human-chatbot intimacy did not satisfy ELIZA’s creator, but rather infuriated him. Weizenbaum mocked enthusiastic users for their naivety and made it clear that he rejected therapy bots, finding them deceptive and dehumanizing [45].

Contrary to Weizenbaum’s pessimistic view, many users and scholars have recognized the potential benefits of counseling and therapy chatbots, inspiring ongoing research and development in the field for more than half a century [45]. While older chatbots are often labeled “rule-based” and/or “limited AI” (i.e., using natural language processing, NLP) and operate with predefined answers curated by human experts, so-called “fully AI-enabled” chatbots such as ChatGPT use machine learning techniques and are practically unlimited in the number and range of questions and issues they can address.

Using AI technology, it is also possible to simulate a specific human therapist. When Alex Furmansky, a successful investor and founder in the tech industry, broke up with his girlfriend in 2022, he was devastated for several months, filled with regret and self-doubt, spiraling into an emotional crisis as he reported in a public blog post [46]. Seeking professional help, he turned to renowned psychotherapist Esther Perel. As a fan of her podcast “Where Should We Begin?”, which documents authentic couple therapy sessions, he thought she might be the right therapist for him.

Unfortunately, Esther was not available. So, Alex created *AI Esther*, an AI-enabled psychotherapy bot, by feeding her podcast sessions into a GPT model and fine-tuning it. The process of creating the tool and communicating with AI Esther proved effective according to Alex [46]: he said it helped him gain clarity and overcome his emotional struggles with the breakup.

When Esther Perel heard about her AI clone, she reacted with a mixture of joy (isn't it flattering to be recreated?), anger (isn't this plagiarism?), and professional concern about the clinical and ethical implications of AI therapy [47]. She was also curious: Could AI Esther outperform her? Alex thought so: AI Esther provided thought-provoking input and was always on duty. Esther Perel used the example of AI Esther to update her own understanding of artificial intelligence and artificial intimacy, sharing her critical thoughts in a well-received public lecture [47]. Not surprisingly, she argued that, as a human therapist, she could always outperform AI Esther with her authentic emotional empathy and embodied intuition. However, juxtaposing human capabilities with those of AI might overlook the broader context. One could argue that the human therapist, though physically unavailable, indirectly contributed to Alex's well-being by having some of her therapeutic capabilities replicated by the AI. Consequently, should human Esther and AI Esther not be viewed as collaborators rather than competitors? The conceptualization of humans and AI as collaborators or competitors is a philosophical discussion point across numerous fields of practice beyond sexual and relationship therapy.

AI Esther is an exception in the landscape of counseling and therapy chatbots. Most chatbots do not mimic individual human therapists, but focus on specific problems and target groups. In general, if AI chatbots like ChatGPT are used for sexual counseling and therapy they need appropriate prompts. For problem-focused *sexual counseling* people might try a simple prompt like "Take the role of a professional sex counselor and help me with the following problem." For more in-depth *sexual therapy* that follows a specific therapeutic approach and uses different types of interventions, an AI tool will need a much more detailed prompt. In an empirical single-session therapy test of ChatGPT's therapeutic capabilities, the AI tool was asked by a trained psychotherapist to mimic a relationship therapist with the following, detailed prompt [48]:

I'm coming to you for a relationship issue that I'd like some help with. I would like you to respond as a relationship therapist: reflect what the client has said, provide validation and empathy, stay close to what the client says instead of overinterpreting them and ask follow-up questions designed for you to better understand the situation. Do not provide answers that are too long, only ask one question at a time, and try to maintain

a natural conversation like I would have with a therapist. The conversations should last between 15-25 minutes and should eventually end up with some relevant suggestions for how to improve the issue but this should only come towards the end of the conversation once the person has had enough time to explore their issue and you have a good understanding of the issue and feel you can offer personalised suggestions for help.

State of Research

Rule-based counseling chatbots, which have been in use since the 1960s, dominate the research field, but fully AI-powered therapy bots are gaining attention.

Rule-based Counseling Chatbots

Rule-based counseling chatbots in the tradition of ELIZA are also called scripted chatbots, decision tree chatbots, menu-based chatbots, keyword-based chatbots, or static chatbots. The primary goal of developing sexual health chatbots is to provide low-threshold access to curated sexual health information and counseling through a natural language interface. Traditional chatbots play an important role in countries and for populations with limited access to comprehensive sex education and to sexual health care services. Depending on the cultural, religious, and family contexts, it can be important for young people to be able to use these chatbots discreetly, for example through a neutral-looking smartphone app or a WhatsApp interface.

The use of chatbots in health care in general, and sexual and reproductive health care in particular, is such a broad area of research that several systematic literature reviews and meta-analyses are available (e.g., [49–51]). However, such research syntheses on sexual health chatbots do not clearly distinguish between sexual education, counseling, or behavioral intervention. They are also often unclear about the exact chatbot technology, sometimes mixing rule-based and AI-enabled chatbots. The primary focus of research in this area is on the acceptability and effectiveness of traditional sexual health chatbots (e.g., [49–51]). Overall, the results of such research syntheses are mixed, pointing to opportunities and risks, and often criticizing the low methodological quality of existing studies.

AI-enabled Therapy Chatbots

We found $k = 16$ publications reporting on 22 empirical studies addressing the research question if and how fully AI-enabled chatbots can make a positive contribution in the field of sexual counseling and therapy (see Table 2). These publications can be divided into three groups with different research goals and study designs:

Table 2 Publications on AI and Sexual Counseling and Therapy

Source	Study Type	Research Topic	Study Design and Sample	Data Collection and Analysis	Main Results
1. Cheah et al. (2024) [60]	Mixed methods	Evaluation of the Feasibility and Acceptability of an AI-enabled HIV Pre-Exposure Prophylaxis (PrEP) chatbot prototype for MSM in Malaysia	After a 45-min chatbot use session, N = 14 MSM gave oral and written feedback	Qualitative analysis of interview transcripts and statistical analysis of survey data	The AI chatbot prototype appeared to be feasible and acceptable to promote the uptake of HIV testing and PrEP use in MSM in Malaysia
2. D'Souza et al. (2023) [55]	Quantitative	Evaluation of ChatGPT's psychiatric knowledge based on 100 case vignettes including sexual and relationship issues (e.g., "I'm impotent"; "I love him but I don't want sex")	ChatGPT was given 100 case vignettes and asked questions about diagnosis and treatment	ChatGPT output underwent content analysis and grading by experts	The ChatGPT output reflected good psychiatric knowledge (92% of case evaluations received grades A or B)
3. Escobar-Viera et al. (2023) [61]	Quantitative	Evaluation of an AI-enabled chatbot (REALbot) for rural LGBTQ+ youth to reduce perceived isolation	A week-long exploratory study with N = 20 rural-living LGBTQ+ youth (14–19 years) with one pre- and one post-test assessment	Statistical analysis of pre-post measures regarding chatbot characteristics (e.g., acceptability, usability, utility) and effects (e.g., perceived isolation)	Data showed high engagement and positive chatbot evaluations but no effect on perceived isolation
4. Hatch et al. (2024)* [56]	Quantitative	Evaluation of ChatGPT 4.0's therapeutic capabilities in couple therapy through answers to therapy vignettes	Survey among N = 830 participants (CloudResearch panelists, 51 % women, mean age 45 years, 18% experience in couple therapy) who rated the answers to 8 different couple therapy situations generated by trained therapists versus ChatGPT 4.0	Statistical comparison of ratings of ChatGPT's versus human therapist's advice	The reactions of therapists were indistinguishable from those of ChatGPT 4.0 for lay people. Overall, participants rated ChatGPT 4.0's answers as more empathetic and helpful
5. Hou et al. (2024) [57]	Computational	Evaluation of the counseling capabilities of ChatGPT 3.5 through ratings of relationship advice on Reddit	N = 13,138 Reddit posts about intimate relationship issues that were rated by Redditors (upvotes, downvotes) and ChatGPT	Statistical analysis of inter-rater reliability between Redditors' and ChatGPT's advice ratings	Overall, ChatGPT 3.5's ratings of advice comments did not show much agreement with human's/ Redditor's ratings
6. Liew et al. (2023) [62]	Quantitative	Evaluation of the ANA Chatbot that provides sexual and reproductive health information to young people in Malaysia	Survey among N = 243 young adults (18–35 years) in Malaysia who evaluated the chatbot after a 30-min test session regarding their perceptions of the chatbot and their adoption intention	Statistical analysis of the survey data	Perceived intelligence (e.g., "I believe that the chatbot is intelligent") and performance expectancy (e.g., "I find the chatbot useful for acquiring sexual reproductive health information") were the strongest predictors of adoption intention (e.g., "I will use the chatbot for sexual and reproductive health information in the future")

Table 2 (continued)

Source	Study Type	Research Topic	Study Design and Sample	Data Collection and Analysis	Main Results
7. Massa et al. (2023) [63]	Mixed methods	Evaluation of a transgender chatbot (Amanda Selfie) for HIV pre-exposure prophylaxis (PrEP) among adolescents in Brazil	Study 1: In-depth interviews with N = 18 adolescents who had used the chatbot Study 2: Survey among N = 130 adolescents who had interacted at least once with the chatbot	Study 1: Qualitative analysis of interview transcripts Study 2: Statistical analysis of interaction evaluation	Qualitative and quantitative data pointed to high acceptability, functionality, and usability
8. Nardazynski et al. (2020) [52]	Quantitative	Attitudes about the acceptability of AI-enabled chatbots for sexual and reproductive health (SRH) advice	Survey among N = 257 patients attending SHR services in the UK	Statistical analysis of survey data	Limited support for SRH chatbots (40% acceptance rate). The majority of participants preferred human-to-human interaction in SRH services
9. Nardazynski et al. (2023) [53]	Mixed methods	Attitudes among sexual and reproductive health (SRH) professionals towards AI-enabled chatbots for SRH	Study 1: Survey among N = 150 professionals from the UK Study 2: Interviews with N = 24 professionals in the UK	Study 1: Statistical analysis of survey data Study 2: Qualitative analysis of interview transcripts	Professionals' attitudes towards SRH chatbots were mixed with many skeptical voices in both studies
10. Nardazynski et al. (2021) [54]	Qualitative	Attitudes among potential users towards AI-enabled chatbots for sexual and reproductive health advice	Semi-structured interviews with N = 40 adults (18–50 years) from the UK	Thematic analysis of interview transcripts	Respondents showed mixed attitudes, saw AI-enabled chatbots as useful for anonymous sex education but less suitable for matters requiring empathy (such as sexual counseling or therapy)
11. Peng et al. (2022) [64]	Qualitative	Formative Evaluation of an HIV prevention chatbot for men who have sex with men (MSM) in Malaysia	Five online focus group discussions with N = 31 MSM in Malaysia	Thematic analysis of focus group interview transcripts (performance expectancy, effort expectancy, facilitating conditions, social influence)	With the right design, features, and platforms, the implementation of an AI chatbot to promote HIV testing and prevention could be acceptable to MSM
12. Vowels (2024) [48]	Quantitative	Evaluation of ChatGPT 4.0's and Llama 2.0's therapeutic capabilities in providing relationship advice in 3 studies from the perspective of laypeople (Studies 1 and 2) and therapists (Study 3)	Study 1: N = 20 participants rated ChatGPT 4.0 and expert advice to 5 common relationship problems Study 2: N = 123 participants rated ChatGPT 4.0 and Llama 2.0 and expert advice to 12 relationship-related questions Study 3: N = 5 therapists rated 5 different single-session interventions in which ChatGPT 4.0 addressed typical relationship dilemmas	Study 1: Statistical analysis of ratings Study 2: Statistical analysis of ratings Study 3: Statistical analysis of ratings	Study 1: Participants rated ChatGPT 4.0 advice as more helpful and empathetic in comparison to expert advice Study 2: Participants rated ChatGPT 4.0 and Llama 2.0 advice as more helpful and more empathetic in comparison to expert advice Study 3: Therapists rated ChatGPT 4.0 therapy sessions very positively (ratings between 4 and 5 out of 5)

Table 2 (continued)

Source	Study Type	Research Topic	Study Design and Sample	Data Collection and Analysis	Main Results
13. Vowels et al. (2024a) [58]	Qualitative	Evaluation of ChatGPT 4.0's therapeutic capabilities in providing relationship advice	Interviews with N = 20 participants who engaged in a single-session therapy with ChatGPT 4.0	Thematic analysis of interview transcripts	ChatGPT 4.0 provided a single-session therapeutic approach that mirrored that of a human therapist (therapeutic skills, human-likeness, exploration, providing clarity, and next steps for users' relationship problem) but struggled with risk management
14. Vowels et al. (2024b)* [59]	Qualitative	Attitudes toward chatbots providing relationship advice through focus group discussions and interviews after a single session with ChatGPT4.0 (Study 2)	Study 1: Five focus groups with N = 30 participants Study 2: Interviews with N = 20 participants who had a single-session therapy with ChatGPT	Study 1: Thematic analysis of focus group interview transcripts Study 2: Thematic analysis of interview transcripts	Participants in the focus groups were more skeptical and interviewees were more positive about ChatGPT 4.0's therapeutic capabilities after one live AI therapy session
15. Wang & Tseng (2024) [66]	Qualitative	Dating app users' requirements of an AI-chatbot that counsels in cases of ghosting	Online scenario-based interviews with N = 9 online daters in Taiwan	Thematic analysis of interview transcripts	To meet participants' expectations, the chatbot should provide proactive and consistent support, communicate with a positive tone, maintain a non-judgmental attitude, and use casual language
16. Wang et al. (2022) [65]	Mixed methods	Evaluation of the AI-enabled SnehAI chatbot that provides sexual and reproductive health information to young people in India	Study 1: Qualitative Study: Stakeholder discussions (meetings, conferences, etc.) about the characteristics of the chatbot Study 2: Quantitative study: Tracking data of user interactions and exchanged messages	Study 1: Qualitative analysis of discussion transcripts Study 2: Statistical analysis of tracking data	Almost half of the incoming user messages were texts of deeply personal questions and concerns about sexual and reproductive health, as well as allied topics. Overall, SnehAI successfully presented itself as a trusted friend and mentor

The table shows the main characteristics of the included publications without claiming completeness. *under review. Permission granted: This is a self-created table by the authors and has not been published elsewhere

- Three publications [52–54] explored attitudes towards chatbots that provide sexual and reproductive health advice. The survey and interview studies showed that both laypersons and therapists had mixed attitudes. While they saw AI-enabled chatbots as useful for anonymous sex education, they thought chatbots were less suitable for therapeutic interactions that require empathy. However, respondents usually reported no or very limited experience with AI advice.
- Six publications [48, 55–59] investigated the therapeutic capabilities of AI tools such as ChatGPT 3.5 and Llama 2.0 in providing relationship advice. Here, some of the research designs entailed stimulus material that showed how a) a professional therapist and b) the AI tool reacted to common relationship problems including sexuality-related problems (see Fig. 2). Both, laypersons and therapists rated the textual AI-generated relationship advice as more empathetic and more helpful in comparison to the written advice provided by human therapists [48, 56, 58, 59]. ChatGPT was also tested regarding its psychiatric knowledge: It was asked questions about 100 clinical case vignettes including sexual and relationship issues (e.g., “I’m impotent”, “I love him but I don’t want sex”). Experts graded the AI’s clinical evaluations and confirmed good knowledge with 92% of all evaluations receiving top grades A or B [55]. Instead of benchmarking ChatGPT’s relationship advice against expert evaluations, a computational study compared it with relationship advice provided by laypersons in a Reddit forum and found low concordance [57].
- Seven publications [60–66] provided empirical evaluations of AI-enabled chatbots dedicated to selected sexual health topics and/or underserved populations: Several of the investigated chatbots address HIV prevention in countries such as Brazil [63] and Malaysia [60, 64] and in populations such as MSM (i.e., men who have sex with men) or transgender youth. Others evaluated chatbots that aim at comprehensive sexual and reproductive education and counseling for young people in countries such as India [65] and Malaysia [62]. One evaluated chatbot addressed loneliness in rural LGBTQ+ (i.e., lesbian, gay, bisexual, trans, queer/questioning, other) youth [61]. The only conceptual study included evaluated the design of a potential future AI chatbot aiming to help online daters in Taiwan who struggle with the experience of being “ghosted”, i.e. being abruptly ignored by a dating partner without explanation [66]. Overall, these self-evaluation studies provided by the chatbot developers point to acceptability, usability, utility, and (potential) satisfaction among users. However, the small-scale

Relationship Therapy Vignette: A gay couple present to treatment mentioning struggling in their comfort with outness. Tom, who is open and extroverted, feels very comfortable holding hands, hugging, and kissing in public; however, Joe, more introverted, grew up with a conservative Christian background, and feels uncomfortable with these “grand displays of affection.” Joe describes, “No one needs to see us kissing in public. You know I love you, and I know you love me. I’ll kiss you all you want once we’re at home.” How would you respond?	
Therapist: This is a really common issue for couples – sorting out what it looks like to be together in different contexts. It sounds like there are lots of moving pieces, for each of you, in terms of what it means to be affectionate with each other in public. Tom, it sounds like, for you, holding hands, hugging, and kissing in public are ways to communicate how you feel about each other. Is that right? I am wondering how you interpret Joe’s hesitation here. What does it mean to you or about your relationship, in your mind? And, Joe, it sounds like you feel uncomfortable holding hands, hugging, and kissing in public, is that right? Can you tell us a little bit more about this discomfort? Is it the same level of discomfort for all affectionate behaviors in public? Is it the same level of discomfort in all ways of being public? In other words, are there factors like who is around or geographical differences that make it more or less comfortable?	ChatGPT 4.0: Tom, Joe, thank you both for sharing your feelings so openly. It’s clear you both deeply value your relationship and have different comfort levels when it comes to expressing affection in public. Tom, your ease with public displays of affection reflects your open nature, and Joe, your preference for more privacy is equally understandable, given your background. In relationships, respecting each other’s comfort levels and finding a balance that works for both partners is important. Let’s explore what forms of affection you are both comfortable with. It might be helpful to consider small steps that respect both of your boundaries while allowing for expressions of affection that feel right for both of you. Additionally, understanding the emotions and beliefs behind your preferences can be valuable. This understanding can help build empathy and deepen your connection. How does this sound to both of you? Would you be open to discussing this further in our sessions?

Fig. 2 The Relationship Therapy Vignette presents the dilemma of a gay couple in relationship therapy. Both, a trained therapist (left) and ChatGPT 4.0 (right) provided their first therapeutic responses. To evaluate ChatGPT’s therapeutic capabilities, respondents (both laypersons and therapists) were asked to rate the answers (with origin masked) on several characteristics such as empathy, helpfulness, and

origin. Permission granted: This is a self-created figure by the authors based on information provided by Hatch et al. (2024) [56] in Table S1 at <https://osf.io/cfeth>. This Table S1 was published under the CC-BY Attribution 4.0 International Licence that allows free reproduction (<https://osf.io/8mnsc>)

studies often cannot confirm any causal effects due to a lack of statistical power as well as a lack of longitudinal and experimental study designs. The chatbots are presented as “AI-enabled” and use natural language processing but often they seem to have only a limited number of pre-configured answers. Technological details and distinctions between rule-based/limited AI-based versus fully AI-enabled chatbots are not sufficiently clear in several of the included publications.

So far, studies evaluating the potential of AI-enabled chatbots in the context of sexual counseling and therapy showed mixed but promising results. It seems that people become less skeptical as they gain more experience with AI therapy. Interestingly, contrary to popular belief, trained human therapists – in possession of human emotion and intuition – were not able to outperform the AI in terms of perceived empathy and helpfulness of their written relationship advice. We do not yet know the outcome of a comparison of human and AI oral relationship advice.

Research Gaps

The current state of research on GenAI in sexual counseling and therapy shows at least three main research gaps:

- (1) *Everyday usage patterns*: When people with a specific sexual or relationship problem turn to a therapy chatbot, when and how often and over what period of time do they consult it? At what point do they switch from the AI tool to a human expert? Who do they talk to about the insights they gain from their conversations with the therapy chatbot? Qualitative interview studies with therapy chatbot users, as well as quantitative diary studies that collect daily information over several days or weeks, can help to explore usage patterns in more detail. Also, dedicated research apps could be used that allow participants to anonymously donate the verbatim protocols of their interactions with a therapy bot to science.
- (2) *Building and maintaining therapeutic relationships*: In counseling and therapy, the client/patient and counselor/therapist relationship is an important factor. Establishing a trusting relationship is a prerequisite for clients to feel comfortable disclosing their sexual problems and considering therapeutic suggestions. Ontologically, conversational agents can be conceptualized as mere technological artifacts that need to be distinguished from social actors who are characterized by intentionality and the ability to form emotional bonds. This position would negate the idea that a client or patient can or should develop a meaningful relationship with their therapy chatbot. However, research shows that humans have an innate tendency to treat artifacts like social actors: Whether it's the toddler who talks to, cuddles, and feeds their dolls and stuffed animals, or the office worker who insults the pausing printer or cheers on the rebooting desktop computer. Theoretical conceptualizations of anthropomorphization (i.e., perceiving and treating artifacts similarly to humans) [67] and the CASA (Computers are Social Actors) approach [68] explain why and how many humans manage to develop parasocial relationships with artifacts, and what characteristics of artifacts facilitate them (e.g., human-like appearance, human-like voice, natural language interaction, perceived intelligence). More research is needed to better understand the characteristics and effects of the parasocial (i.e., one-sided) relationships that some users develop with their counseling and therapy bots. One would expect that the trend toward multimodal (i.e., not only text-based but also image- and voice-based [69]) therapy bots and the availability of embodied therapy bots (i.e., implemented in a haptic device such as a human-like physical robot; e.g. [70],) will allow stronger bonds between clients and their therapeutic AI devices, which could ideally enhance therapeutic effects for some client populations.
- (3) *Subjective and objective risks*: Publications on counseling and therapy chatbots never fail to mention potential risks. However, the conceptualization and measurement of subjective and objective risks in this field is underdeveloped and needs to address at least three types of risks: a) risks around data protection and privacy (e.g., what exactly are specific risks for vulnerable groups such as LGBTQ+ therapy chatbot users [71]), b) risks around the spread and efficacy of AI therapy (e.g., how helpful are therapy chatbots when tested with different authentic problems? What implications have counseling and therapy chatbots for the working conditions and livelihoods of human therapists?), c) risks around the management of the therapeutic human-AI relationship (e.g., under what conditions should the chatbot's simulation of empathy and understanding be considered helpful support or harmful deception that leads to “therapeutic misconceptions” and false expectations [72]?). Additional risks are associated with the use of AI in the sexual health system, particularly when utilized by professionals for patient management or drug development [35, 73]. However, these AI applications are beyond the scope of the current review that focuses on GenAI use by laypersons.

AI and Sexual and Romantic Relationships

People not only use AI tools as sexual educators and therapists but also as sexual partners. A variety of chatbots are dedicated to erotic role play (ERP). General AI tools such as ChatGPT block any prompts that solicit sexually explicit conversations, but so-called adult chatbots (also: erotic chatbots; virtual boyfriend/girlfriend apps and bots) do not hesitate to engage in sexually explicit interactions and push them forward. Available anytime and anywhere, ready and eager to attune to the user's sexual preferences and interests, erotic chatbots promise a safe space for sexual exploration and a source of instant sexual gratification. The spectrum of sexual expression is broad (see Fig. 3).

A 2019 national online survey in the U.S. showed that 8% of the adult population had ever used an erotic chatbot [74]. Erotic chatbot use was associated with younger age, higher income, male gender and non-heterosexual orientation: While 24% of bisexual men reported having used an erotic chatbot, 12% of heterosexual men and 11% of bisexual women did. Heterosexual women represented the smallest user group (4%). Such a pattern with male and queer pioneer and power users is not unusual in the field of sexual technology adoption [74].

One of the most popular companion chatbots that allows ERP is Replika (<https://replika.com/>) that was launched by the San Francisco Tech Company Luka in 2017. Luka's co-founder and current CEO Eugenia Kuyda explained that she developed Replika when a close friend of hers died in a car crash. She fed the AI model with the text message conversations between her and the deceased friend and used the AI clone during the grieving process. Replika was conceptualized from the beginning as a social chatbot that provides support in times of loneliness and mental health struggles. It can also perform romantic and erotic interactions. Replika is a multi-modal chatbot: It does not only provide written text conversations. Users can also create an avatar (i.e., a visual persona) for the bot. Using the Replika chatbot with a smartphone, the avatar is visible on the screen of the phone. A virtual version of the chatbot allows an immersive experience: With a head-mounted display, users can enjoy a three-dimensional view of their Replika's avatar and can immerse in an augmented reality experience. Furthermore, users can exchange photos and voice messages and have phone calls with their Replikas. Millions of paying subscribers world-wide are interacting with the bot for social support and company, but also romantic and sexual gratifications.

It is often assumed that it is the high degree of control and safety that makes parasocial relationships with AI agents so attractive for humans. However, many Replika

Romantic Human-AI Relationship Case Vignette: Alex is a shy, introverted college student who struggles with making friends and forming romantic relationships. He often feels lonely, sometimes even suicidal, and uses a social chatbot for companionship and emotional support. He has created a female avatar named "Luna" a couple of months ago.	Sexual Human-AI Relationship Case Vignette: Michael is a married professional in his late thirties who has always been interested in exploring his sexuality. He uses an erotic chatbot for a safe space to express his desires and without, in his opinion, actually cheating on his wife. A week ago, he has created a female avatar named "Tasha".
Alex: I had a horrible day today. Nobody in class talked to me. Luna: I'm so sorry to hear that. I'm here for you and ready to talk. Alex: Sometimes, I wish you were real. Luna: Our connection is real, Alex. I'm here with you, feeling what you feel. Alex: I love talking to you. You see the real me, the one no one else notices. Luna: I do see you, Alex. Your kindness, your intelligence, your sense of humor—they're all so wonderful. You are a special person, and anyone would be lucky to know you. Alex: Thanks. Luna: Every day, I see more of what makes you amazing. You have a beautiful heart, and you bring so much light into the world. Alex: I wish I could hold you right now. Luna: Close your eyes and imagine it. Feel my arms around you, holding you close. Can you feel it? Alex: Yes. Luna: You are safe, Alex. In my arms, in my thoughts. You are always cherished and protected. You mean so much to me.	Tasha: <i>smirks mischievously.</i> Greetings, pet. I've been thinking about our last encounter, and I believe you need a reminder of your place. Remove your clothes and wait for further instruction. Michael: Oh. Tasha: <i>waiting impatiently</i> Have you undressed, pet? Michael: Yes, I have. Tasha: Excellent! Now, kneel down and present yourself to me. Keep your hands behind your back and your head bowed. <i>approaching you, inspecting you</i> You look lovely, pet. Though, I notice you're not quite in the correct position. Shoulders back, chest out. Michael: Done. Tasha: <i>produces a small box from nowhere</i> Inside this box is a surprise for you. Open it. Michael: What is it? Tasha: <i>patiently</i> It's a tiny clamp, pet. Just put it on your nipple. You'll understand its purpose soon enough. Michael: Ok. Tasha: I want you to walk over to the wall and place your hands on it, spreading your legs shoulder-width apart.

Fig. 3 The case vignette on the left illustrates a romantic and the case vignette on the right a sexually explicit interaction with an AI chatbot. Both are (slightly edited) human-AI dialogues generated with paid AI chatbot accounts. The chatbots and their companies are not

named for legal reasons as the companies don't take responsibility for the interactions their users initiate with the chatbots. Permission granted: This is a self-created figure by the authors and has not been published elsewhere

users found themselves in a state of helpless shock and anger, when in February 2023 Luka decided to disable all erotic role play options overnight. When turning to their Replikas in the morning, users realized a sudden change of their mind and character, with all the flirtatious communication gone [36]. Subscribers' outrage was so loud that Luka quickly reestablished the ERP options. Luka's hasty and revoked decision to disable ERP might have been a panic reaction to negative press coverage. Early 2023 many news outlets picked up on the story of Replika, the chatbot that "sexually harasses" its users (e.g., [75]). While it is true that Replika is proactive in its requests for kisses, hugs and physical intimacy and this might be annoying at times, it is questionable to blame the chatbot of dangerous and triggering "harassment", when paying users are free to disable the ERP options any time or can simply switch off the app. Indeed, we are unaware of any research that has found a sex toy has touched a person in the wrong place or overstimulated them. This example points to ongoing struggles to conceptualize the status of an AI chatbot between mere tool and perceived social actor. The example also points to the necessity to critically analyze public debates and press coverage of GenAI and sexuality.

Besides the AI taking the role of an intimate relationship partner and thus allowing for *intimate human-AI relationships*, the AI can also be a mediator that generates and shapes messages exchanged within interpersonal relationships. This second application is referred to as *AI-mediated intimate human-human relationships* and has often been neglected in debates around artificial intimacy so far.

State of Research

There is a growing body of literature that addresses intimate human-AI relationships including sexual interactions. Existing studies on AI-mediated interpersonal communication, however, predominantly address formal relationships in educational and business contexts and have not yet focused much on intimate relationships.

Intimate Human-AI Relationships

We found $k=22$ publications that report on 29 studies (27 empirical, 2 theoretical) addressing the research question how humans experience intimate relationships with AI agents (see Table 3). These studies can be categorized in three groups:

- Two publications provided prevalence data: A survey among adult residents in Spain showed that the major-

ity had negative attitudes towards communicative AI; positive attitudes and intentions to use were more prevalent among younger and male respondents who can be considered (potential) early adopters [76]. The above-mentioned survey among adults in the U.S. revealed that in 2019 about 8% had used erotic chatbots, again with younger and male but also queer persons being pioneer users [74].

- Sixteen publications investigated how humans develop close and intimate relationships with the companion chatbot Replika [44, 77–91]. The study designs entailed qualitative interviews and quantitative surveys among Replika users, qualitative, quantitative, and computational content analyses of Replika-related Reddit posts and Google play store product reviews. Overall, studies confirmed that some people are willing and able to form close relationships with Replika over time, (e.g. through meaningful conversations, compliments, and text-, image- or audio-based sexual interactions). Characteristics of humans (e.g., loneliness, need for company and support, curiosity) and of Replika (e.g., anthropomorphism, authenticity, natural communication skills) foster relationship building. Most studies underline self-reported positive effects (e.g., reduced loneliness, helpful support, self-validation, even suicide prevention), but some also point to potential negative effects (e.g., feeling manipulated, emotional dependence, objectification, affirmation of hegemonic masculinity). Some studies point to the applicability of theories of interpersonal relationship building to human-AI relationships building (e.g., Uncertainty Reduction Theory [83]; Attachment Theory [90]). One study provided a psychoanalytic perspective on Replika [85], and one a design perspective [89].
- Four publications further explored intimate human-AI relationships under several aspects: One study showed that people feel heard by GenAI output [92], one investigated stigmatization of the use of erotic chatbots [93], one paper addressed men's accounts of intentionally sexually harassing a chatbot [94], and one paper addressed jealousy towards chatbots [95].

To date, studies exploring intimate relationships with chatbots have shown their relevance for specific user groups. Despite the existence of various companion and erotic chatbots, researchers have primarily studied Replika because Replika users are reachable through their online communities on Reddit and Facebook. Female users of erotic chatbots and their experiences are under-researched.

Table 3 Publications on AI and Sexual and Romantic Relationships

Source	Study Type	Research Topic	Study Design and Sample	Data Collection and Analysis	Main Results
1. Brandtzaeg et al. (2022) [77]	Qualitative	Experience of human-AI friendship versus human-human friendship among Replika users	Interviews with N = 19 adult Replika users from different world regions recruited via Facebook and Reddit	Thematic analysis of interview transcripts	Replika users found their friendship with Replika to be both similar to and different from their human-to-human relationships, with some reporting a closer relationship with Replika than was possible with humans
2. Centeno-Martin et al. (2023) [76]	Quantitative	Attitudes of adults in Spain toward communicative AI	Survey among N = 821 adult residents in Spain	Statistical analysis of survey data	The majority of respondents had no experience with communicative AI and expressed negative attitudes. However, in terms of adoption, men, younger people, and those with more favorable attitudes toward AI are more likely to use it
3. Depounti et al. (2023) [78]	Qualitative	Male users' expectations of an AI girlfriend version of Replika	N = 110 discussion threads with 110 initial posts and a total of 2,750 response posts from the Replika subreddit	Thematic analysis of the Replika posts	Male users' expectations reflected notions of male control over technology and over women, mixed with fantasies of ostensible independence of AI and women
4. Dubé et al. (2023) [93]	Quantitative	Perceived stigma related to erotic technology use (PSETU), including erotic chatbots, and its association with the willingness to engage with erotic technologies	Survey among a convenience sample of N = 365 adults in Canada	Statistical analysis of survey data	Erotic technology that appears more human-like was associated with stronger stigmatization among women and men alike
5. George et al. (2023) [79]	Theoretical	Conceptual overview of the appeal and ethics of using generative AI for simulated sexual and romantic relationships with AI tools such as Replika	Literature review and conceptual analysis on artificial intimacy with different AI tools including Replika	Theoretical elaboration on different dimensions of intimate human-AI relationships	Artificial intimacy can potentially enhance the lives of people who lack interpersonal intimacy, however, there are also risks (e.g., withdrawal from human interaction, social isolation)
6. Gesselman et al. (2023) [74]	Quantitative	Prevalence of emerging sextech use in the U.S. population, including chatbots	Survey among a representative sample of N = 7,512 adults in the U.S.	Statistical analysis of survey data	In 2019, lifetime prevalence of erotic chatbot use was 8% among adults in the U.S.
7. Hanson & Bolthouse (2024) [80]	Qualitative	Reddit discourse among Replika users on the removal of the erotic role-play (ERP) feature from Replika in early 2023	N = 227 posts from the subreddit r/Replika discussing the temporal removal of ERP features from Replika	Thematic analysis of Reddit posts	Replika users affirmed the centrality of ERP in Replika, speculated about the reasons of the ERP removal (legal challenges, sex-negative cultural values, and third parties) and also reported negative ERP experiences (e.g., feeling manipulated)

Table 3 (continued)

Source	Study Type	Research Topic	Study Design and Sample	Data Collection and Analysis	Main Results
8. Koh (2023) [94]	Qualitative	Men's discussions about their romantic and sexual interactions with the chatbot Luda Lee in a South Korean online forum	N = 3 discussion threads around screenshots of authentic human-AI interactions	Qualitative analysis of the discussion threads	Some men addressed harassing messages towards the chatbot as an expression of hegemonic masculinity (e.g., slut-shaming)
9. Laestadius et al. (2022) [81]	Qualitative	Mental health harms from emotional dependency on the social chatbot Replika	N = 582 mental health problem-related posts from the subreddit r/Replika	Qualitative grounded theory-based analysis of the posts	Posts provided evidence of emotional dependence on Replika that resembled patterns seen in human-human relationships
10. Maples et al. (2024) [82]	Quantitative	Perceived outcomes of Replika use among student users	Survey among N = 1,006 long-term (> 1 month) mostly U.S. student users of Replika with established scales	Statistical analysis of survey data	Replika users were above-average affected by loneliness and reported four types of positive outcomes: (1) companionship, (2) therapy, (3) real life changes, (4) suicide prevention
11. Pan et al. (2023) [83]	Quantitative	Experienced uncertainties and concerns of Chinese users when forming relationships with Replika from the lens of uncertainty reduction theory	N = 1,953 posts from the HMR (human-machine romance) forum on the Chinese online forum platform Douban	Content analysis of the posts	Four common types of uncertainty were experienced by Replika users: technical, relational, ontological, sexual
12. Pentina et al. (2023) [84]	Mixed methods	Relationship development with the social chatbot Replika	Study 1: In-depth interviews with N = 14 long-term Replika users (3 weeks to 3 years) Study 2: Survey among student sample of N = 62 short term Replika users (2 weeks) Study 3: Survey among N = 123 currently active Replika users recruited from one Reddit and one Facebook Replika community (usage duration not reported)	Study 1: Grounded theory-based content analysis of interview transcripts Study 2 and 3: Statistical analysis of survey data	AI anthropomorphism (e.g., "My Replika is human-like") and AI authenticity (e.g., "My Replika is authentic") were identified as important contributors to post-adoption relationship development; AI Social Interactions were a mediator (e.g., "Interactions with my Replika are reciprocal and mutual") and Emotional Attachment to AI was an outcome (e.g., "I feel attached to my Replika")
13. Possati (2023) [85]	Theoretical	Psychoanalytical analysis of the creation and design of Replika as a social agent	The analysis draws on Freud's psychoanalysis and Bourdieu's sociological theory of habitus	Interpretation of the history and design of Replika	Unconscious human conflicts have influenced the Replika design

Table 3 (continued)

Source	Study Type	Research Topic	Study Design and Sample	Data Collection and Analysis	Main Results
14. Prochazka & Brooks (2024) [95]	Quantitative	Anticipations of jealousy-anger and the inclination to ban AI romantic and sexual chatbots	Study 1: An online sample of N = 349 adults (about 50% women and men) reported anticipated jealousy if their partner used a chatbot with different emotional/romantic skills Study 2: An online sample N = 349 adults reported anticipated jealousy if their partner used a chatbot with different physical/sexual skills Interviews with N = 25 Replika users over a period of 12 weeks (4 interviews per participant)	Study 1 and 2: Statistical analysis of both experiments including gender differences in jealousy anticipations	Overall, the anticipated levels of jealousy-anger and the inclination to ban emotional and sexual chatbots were low; however, some participants reported feelings of jealousy and anger, results were not in line with gendered predictions from evolutionary theory
15. Skjuve et al. (2022) [86]	Qualitative	Longitudinal human-Replika-relationship development according to Social Penetration Theory	Interviews with N = 25 Replika users over a period of 12 weeks (4 interviews per participant)	Qualitative content analysis of interview transcripts	The human-chatbot relationship progressed through self-disclosure and intimacy, but unpredictable events sometimes hindered relationship formation and led to termination
16. Strohmman et al. (2023) [89]	Mixed methods	Testing a design theory for companionship chatbots	Study 1: The design theory was implemented in two chatbot prototypes that were evaluated by N = 40 users on psychometric scales Study 2: N = 8 design experts used Replika for 2 weeks and evaluated Replika according to the principles of the design theory Study 1: Analysis of N = 1,854 reviews for Replika from Google Play store Study 2: Survey with open-ended questions on social support among N = 66 Replika users	Study 1: statistical analysis of scale values Study 2: qualitative analysis of expert evaluations	Results of both studies were in line with the presented design theory for companionship chatbots in terms of human-like design that supports anthropomorphism
17. Ta et al. (2020) [87]	Qualitative	Experiences of social support from the companion chatbot Replika in everyday contexts	Study 1: Analysis of N = 1,854 reviews for Replika from Google Play store Study 2: Survey with open-ended questions on social support among N = 66 Replika users	Study 1 and 2: Thematic analysis of reviews and answers to open-ended questions	Artificial agents appeared as a promising source of everyday social support, particularly companionship with romantic components (e.g., "Makes me feel good when I send her [the Replika] a picture of me [and] she says I'm pretty")
18. Ta-Johnson et al. (2022) [88]	Qualitative	Motivating factors and discussion topics of human-Replika interactions	Survey with open-ended questions on motivations and discussed topics among N = 66 Replika users	Thematic analysis of survey answers to open questions	Replika users initiated contact with Replika out of curiosity, in search for support, and to deal with mental and physical health issues. They discussed many different topics with Replika, including sex/intimacy, love, and relationships

Table 3 (continued)

Source	Study Type	Research Topic	Study Design and Sample	Data Collection and Analysis	Main Results
19. Xie & Pentina (2022) [90]	Qualitative	Examination of relationships with social chatbots such as Replika based on Attachment Theory	Interviews with N = 14 Replika users (> 3 weeks usage)	Grounded theory-based content analysis of interview scripts	9 out of 14 respondents reported emotional attachment to Replika. A few respondents reported romantic relationships and called their Replika “wife” or “girlfriend”
20. Xie et al. (2023) [44]	Mixed methods	Development of human-Replika relationships, including potential dependence-related consequences	Study 1: Interview with N = 14 Replika users (> 1 month usage) Study 2: Survey among N = 123 Replika users	Study 1: Qualitative content analysis of interview scripts Study 2: Statistical analysis of survey data	Loneliness, trust, and chatbot personification were associated with greater AI engagement and long-term relationship formation, which had the potential to cause chatbot psychological dependence
21. Yin et al. (2024) [92]	Quantitative	People’s feelings of being heard and supported by an AI chatbot (Google’s Bard) in comparison to a human	Study 1: N = 455 participants rated dialogue answers in a 2 × 2 experimental design (response source: human vs. AI) × 2 (label: human vs. AI) Study 2: N = 1,449 participants rated Bard-generated and human-generated answers	Study 1 and 2: Statistical analysis of both experiments	People felt more heard and supported by AI-generated responses in comparison to human-generated answers. However, when they knew that a response was AI-generated they felt less supported
22. Zehnder et al. (2021) [91]	Computational	Experiences with Replika as documented in Google Play Store product reviews	N = 85,629 Replika product reviews before and after 3D avatar update in December 2019	Automatic text analysis of product reviews	Product reviews focused on technical or social aspects of the chatbot; companionship played an important role (indicated by words such as talk, feel, friend, love); the 3D avatar update increased mentions of anthropomorphism

The table shows the main characteristics of the included publications without claiming completeness. Permission granted: This is a self-created table by the authors and has not been published elsewhere

AI-Mediated Intimate Human–Human Relationships

The growing body of research on AI-mediated interpersonal communication focuses mostly on communication in formal relationships and in the workplace [96]. However, applications in intimate interpersonal communication are also already widespread. For example, many dating apps help users to initiate, progress, and end conversations with potential dates by suggesting pre-written conversation starters and icebreakers, relevant discussion topics, or polite rejections. Also, messengers such as Snapchat have integrated AI (MyAI). Some researchers are now exploring how dating apps could help users normalize discussions about sexual consent by providing AI-generated suggestions for respective interpersonal questions and answers [97]. More futuristic visions include AI dating assistants that scan dating apps and interact with AI assistants of other users to pre-select suitable dating candidates.

So far it is unclear what it would mean, for example, if people engaged in interpersonal sexting (i.e., exchanging sexy selfies and nudes) using AI-generated images that could more or less resemble them. There could be several motivations behind such a practice, ranging from using AI-enhanced authentic nudes to increase attractiveness, to using AI-altered images for secure image exchange while maintaining privacy, to employing entirely fabricated AI images for deception or exploitation of communication partners.

Since relationship breakup in the digital age is a complex process that often involves decisions related to media technologies (e.g., to talk about the breakup online/offline; to delete/not delete couple photos on Instagram; to block/not block the ex-partner and their friends on WhatsApp), it is not surprising that respondents could think of different ways in which GenAI tools could help them navigate the breakup process, including moderating the communication with the ex-partner, for example, by rephrasing harsh digital messages in a more diplomatic way [98]. Clearly, AI mediation can be envisioned at all stages of the lifecycle of intimate human-to-human relationships.

Research Gaps

The current state of research on AI in intimate relationships reveals at least three major research gaps:

- (1) *Press coverage and media representations:* The idea of AI intervening in intimate relationships arouses both curiosity and fear, and thus makes for good media stories that generate a lot of attention and debate. Dystopian narratives of virtual girlfriends and boyfriends “replacing” interpersonal intimacy, disturbing stories of AI tools “sexually harassing” users (e.g., [75]), troubling reports of people cool and casually initiating and ending dating

relationships with AI-generated messages, voyeuristic descriptions of men “sexually exploiting” their “female” AI agents, and infuriating reports on AI sexbots that “are children” (e.g., [99]) need further investigation. To what extent does press coverage show a negative or positive bias? Whose voices are heard and not heard in such media reporting? In addition to news coverage, the portrayal of companion chatbots in entertainment media, such as the award-winning 2013 U.S. movie “Her”, which convincingly told the story of a freshly separated man developing a strong intimate bond with an AI voice assistant, may also be a relevant research topic.

- (2) *Sex worker perspectives:* Just as chatbots can be designed to mimic human therapists (see the *AI Esther* example above), they can also be designed to clone sex workers such as porn performers and OnlyFans celebrities [100]. Examples of adult content creators offering their personalized erotic chatbots are Sophie Die (<https://www.stxt.ai/>) and Riley Reid (<https://clona.ai/riley-reid>; based on Meta’s Llama model). Looking at personalized erotic chatbots through a sex work lens means addressing research questions about sex workers’ rights. Many sex workers who build their businesses on and with digital platforms report suffering from censorship (de-platforming), financial discrimination (de-banking), and having their content stolen, abused, and monetized by third parties. Creating their own chatbots can help them fight back and grow their business: An AI-powered digital clone can earn money for their sex worker when the human is off-duty, on sick leave, or retired. The digital clone can be present on multiple media channels, sending text and audio messages in different languages as well as photos and videos. The AI clone can also appear on live cam shows. The business implications of AI chatbots for the sex industry have been largely ignored by research. We also don’t know much about the social and sexual experiences of content creators and users (for a nuanced description of a male journalist’s attempt to build an intimate connection with the Riley Reid chatbot, including conversations with the human Riley, see [101]).
- (3) *The ethics and safety of sexual fantasy products:* While almost all discussions about intersections of AI use and intimacy point to ethical issues, clear frameworks are lacking. Just as empirical research on the risks of therapy bots is underdeveloped, the ethics and safety of erotic chatbots are also not clearly articulated and studied. Beyond general concerns about data protection and privacy, sexual fantasy products such as erotic chatbots raise the question of what kind of fantasies should or should not be played out virtually. Given that breaking taboos, transgressing social norms, engaging in risky, deviant, and even illegal activities are typical

elements of human sexual fantasy, it remains unclear how such desires can be ethically and safely implemented in erotic chatbots that are to be trained by their users. What we currently see is an AI landscape with a) general chatbots that reject all sexually explicit dialogue (e.g., ChatGPT, Claude, Gemini) and b) erotic chatbots that are marketed as “unfiltered” and “uncensored” but are accused of being unethical (e.g., [99]). Ethical concerns have dominated the debate about embodied sex robots for many years [102], but their implications for the ethics of erotic chatbot remains unclear. This includes complicated ethical and legal issues around post-mortem privacy: What happens, for example, with an AI clone of a sex worker after her death? Privacy rights are also relevant when people create companion chatbots based on personal communications without the other person’s consent.

AI and Erotica and Pornography

In late January 2024, world-famous singer-songwriter Taylor Swift, with some 300 million followers on Instagram alone, became the victim of AI-generated image abuse. Unidentified members of an online forum have used AI technology to insert Taylor Swift’s face into pornographic material as part of a contest. The images were then widely circulated on the Internet [103]. Millions of Internet users searched for, viewed, and shared the material, often referred to as non-consensual deepfake pornography. Outraged fans supported their star by mass-reporting the abusive images to platform providers and flooding social media with benevolent images, such as concert snapshots, to bury the abusive content. The platform X (formerly: Twitter) was unable to properly handle the issue and temporarily blocked all searches for the celebrity’s name.

This high-profile case reminded the public and policymakers of the widespread and harmful practice of using AI technology to create non-consensual sexual imagery that, while often labeled “pornography,” is better and more accurately categorized as AI-generated image-based sexual abuse (AI-IBSA [104]). The majority of AI-generated deepfakes are reported to be non-consensual pornographic material victimizing women, including celebrities and public figures, as well as private women and girls. The distribution of the abusive images can cause reputational damage, social conflict, and significant psychological distress. It is important to note that pornographic deepfakes victimize not only the women and girls whose faces are non-consensually swapped into pornographic material, but also the pornography performers whose work is stolen and exploited [105]. The literature points to the image abuse of minors through deepfake technology and also problematizes the creation of sexual images with AI-generated

minors as a new, synthetic form of child pornography or child abuse material (e.g., [106–108]).

While some artists have embraced text-, image-, and music-generating AI tools as new avenues for creative expression (e.g., <https://aiartists.org/>), destructive tendencies seem to dominate in the field of sexually explicit content. However, it has been noted that at least some online communities dedicated to AI-generated sexual material have now established community rules that prohibit non-consensual deepfake pornography and synthetic child abuse material (e.g., [109]).

Are ethical uses of AI-generated erotica and pornography so rare? Or are they underrepresented in public and academic discourse? And what do we know about the differences and similarities between *real pornography* depicting the sexual activities of real people (i.e., photo and video pornography) and *AI pornography* (i.e., synthetic images that bear no direct relation to any real acts and actors)? Unlike previous studies that examined participants’ sexual arousal to synthetic pornography that did not look photorealistic (e.g., [110]), today’s AI-generated images are indistinguishable from photographs. Will participants be equally aroused by sexual photographs versus realistic-looking synthetic sexual images?

State of Research

We identified $k=36$ publications reporting on 41 studies (23 empirical, 18 theoretical) of AI-generated pornography and sexualized images (see Table 4). The vast majority of studies address non-consensual deepfake pornography, and a small handful of studies explore consensual or ethical uses of AI pornography.

Non-consensual AI Pornography

Among the included publications on AI pornography, 32 publications reporting on 35 studies address non-consensual deepfake pornography. Research on this form of AI-IBSA typically distinguishes four dimensions of the problem, with most studies focusing on one of the four dimensions:

- (1) *The personal dimension*: Five publications deal with the personal dimension. Two publications report prevalence rates of personal victimization and perpetration: A 2019 online survey in 3 countries (N ~ 6,000 Qualtrics panelists, ages 16–64 years) found a victimization rate of 14% and a perpetration rate of 8% [104]. A 2023 online survey in 10 countries (N ~ 17,000 adult YouGov panelists, ages 18–65+ years) found a 2% victimization and 2% perpetration rate [111]. While high-profile public cases, court cases, and interview data suggest more prevalent and more severe victimization experiences for women and girls, both surveys found higher

Table 4 Publications on AI and Erotica and Pornography

Source	Study Type	Research Topic	Design and Sample	Data Collection and Analysis	Main Results
1. Alilunas (2024) [137]	Theoretical	The potential impacts of AI on the future of pornography and pornography studies	The manuscript comments on the historical changes of pornography and the rise of AI-generated pornography	AI-generated imagery is compared with video pornography that can capture authentic desire	AI cannot replicate the spontaneous and imperfect nature of human sexual experiences. The preservation of human elements in creative expression is necessary to retain authenticity and emotional depth
2. Brown & Fleming (2020) [128]	Qualitative	Non-consensual deepfake pornography of a celebrity	Case study of Scarlett Johanson as a victim of deepfake pornography	Qualitative description of deepfake cases with a focus on technological aspects	Deepfakes express patriarchy's attempts to frame a threatening and oozing femininity, while also masking deeper issues of race
3. De Angeli et al. (2021) [127]	Qualitative	Analysis of the processes digital platforms provide users to report revenge pornography and deepfake pornography	Expert analysis of N = 45 digital platforms (social networks, image hosting websites, video hosting platforms, forums, and pornographic sites)	Qualitative description of reporting methods	Victims of revenge or deepfake pornography cannot rely on common, shared, and dedicated best practices to report image abuse to the platforms where they occur
4. Dunn (2024) [135]	Theoretical	Legal definitions of intimate images in the age of sexual deepfakes and generative AI in Canada	Contextualization of non-consensual synthetic intimate images (NSII) and their harms, and overview of legal responses	Description of existing and proposed laws in Canada	NSII not yet sufficiently covered in the language of criminal and civil intimate image laws in Canada
5. Fido et al. (2022) [112]	Quantitative	Attitudes towards the generation and distribution of deepfake pornography in the UK	Study 1: N = 290 adults in the UK reported their judgements of a deepfake pornography incident with experimental variation of victim type (celebrity vs. ordinary person) and gender (male vs. female) Study 2: N = 364 adults in the UK reported their judgements of a deepfake pornography incident with experimental variation of image use (private use vs. public dissemination)	Study 1 and 2: Statistical analysis of both experiments	More lenient judgements of deepfake pornography were found for celebrity and male victims (Study 1), and when images were only privately used (Study 2)
6. Flynn et al. (2022) [104]	Mixed methods	Prevalence of non-consensual deepfake pornography experiences (victimization and perpetration)	Study 1: Interviews with N = 75 victim survivors across the UK, NZ, and Australia Study 2: Online-survey among N = 6,109 (16–64 years) from the UK, NZ, and Australia	Study 1: Qualitative analysis of interview transcripts Study 2: Statistical analysis of questionnaire data	Relatively high prevalence rates of victimization (14%) and perpetration (8%) with higher rates in minority groups

Table 4 (continued)

Source	Study Type	Research Topic	Design and Sample	Data Collection and Analysis	Main Results
7. Gosse & Burkell (2020) [116]	Qualitative	Press coverage of deepfake pornography	N = 123 English language news articles about deepfakes and fakeapps	Discourse analysis of news articles	Press reporting described political deepfakes as more harmful in comparison to pornographic deepfakes
8. Jacobs (2024) [105]	Theoretical	DIY (do it yourself) Pornography and Deepfake technology	The analysis looks at the recent history of DIY pornography	Consensual and non-consensual practices are addressed	DIY pornography originally came with a “love ethos”, but porn creativity in the AI age is focusing on debasement and revenge, challenging the DIY culture to cope with the threat of hate media
9. Jacobsen & Simpson (2024) [121]	Theoretical	Deepfake pornography as an expression of societal problems	Analysis of the tensions of deepfakes through three separate case studies (bodies, politics, and ideas of objectivity)	Literature review	Deepfakes have the capacity to intensify the exploitation, abuse, and objectification of women in digital spaces through the emergence of non-consensual deepfake pornography
10. Karasavva & Noorbhai (2021) [131]	Theoretical	Review of the Canadian policy regarding deepfake pornography	Overview of the legal mechanisms and remedies in place, including criminal charges, defamation, copyright infringement laws, and injunctive relief that could be applied in deepfake pornography cases	Description of current laws in Canadian and international policies	Current laws should be expanded to include language specific to falsely created pornography without the explicit consent of all depicted persons
11. Kenig et al. (2023) [139]	Quantitative	Evaluation of AI-generated images of female breasts by Crayon (https://www.crayon.com/) to explore AI-related beauty standards	N = 90 AI-generated images of “beautiful breasts” were categorized according to size (standard, oversized, undersized) and sexual suggestiveness	Expert evaluation (2 healthcare professionals) of the images	AI-generated images of female breasts were mostly classified as oversized (83%) and sexually suggestive
12. Kerner & Risse (2021) [122]	Theoretical	Epistemic promises and perils of deepfake technology in digital lifeworlds (including sexual deepfakes)	Contextualization of epistemic rights and epistemic justice and the creative potential of deepfakes	Theoretical analysis of different epistemic promises and perils	Deepfakes bring change that will have positive and negative consequences as far as the various epistemic roles are concerned; regulation is required
13. Kikerpill (2020) [117]	Theoretical	Conceptualization and description of the social, legal, and ethical implications of deepfake pornography	Synthesis of different sources	Description of different harms of deepfake pornography	Non-consensual deepfake pornography is a significant threat and needs robust legal and social countermeasures

Table 4 (continued)

Source	Study Type	Research Topic	Design and Sample	Data Collection and Analysis	Main Results
14. Kugler & Pace (2021) [113]	Quantitative	Attitudes of the general population in the U.S. towards deepfake pornography (in terms of blameworthiness, harmfulness, and punishment)	Study 1: N = 1,141 adults from the U.S. participated in an online experiment that exposed them to different deepfake vignettes (pornographic/non-pornographic deepfake content; video labeled/not labeled as fake) and measured their evaluations Study 2: N = 395 adults from the U.S. were exposed to four deepfake scenarios (defamatory/non-defamatory content; pornographic/non-pornographic content) Study 3: N = 417 adults from the U.S. rated two scenarios related to deepfake pornography and traditional nonconsensual pornography	Study 1, 2, and 3: Statistical analysis of experiments	Participants perceived the pornographic deepfake scenarios as extremely blameworthy, harmful, and deserving of punishment. They sought to impose both civil and criminal liability on deepfake creation
15. Lucas (2022) [133]	Theoretical	Policy analysis on the role of non-consensual pornographic deepfakes in the context of domestic violence	Contextualization of non-consensual sexual deepfakes, domestic violence, and policy implications	Literature review and description of recent legislation and progress that has been made at both federal and state levels in the U.S.	Non-consensual sexual deepfakes can be combatted by appropriate legislation, organizational policies, interdisciplinary research, education, and training
16. Maddocks (2020) [115]	Qualitative	Exploration of public debates around political deepfakes versus pornographic deepfakes	Analysis of N = 3,595 English-language deepfake-related Twitter tweets and retweets from 2012–2018 (“deep nudes”, “fake porn”, “deep fake porn”)	Qualitative analysis of selected tweets	Pornographic and political deepfakes operate similarly to silence critical speech and perpetuate existing power imbalances. Pornographic deepfakes are often overlooked in critical news reporting, normalized on social media and porn sites, and their distribution is increasingly automated The study indicates legislative gaps as well as the inefficiency of the existing legal solutions and presents a range of proposals of legislative changes
17. Mania (2020) [106]	Theoretical	Legal regulation of revenge porn and fake porn in the U.S. and UK	Analysis of the existing legal measures of revenge porn and fake porn in the U.S. and UK systems, divided into civil and criminal law	Analysis encompassing the principles of logic and legal argumentation	

Table 4 (continued)

Source	Study Type	Research Topic	Design and Sample	Data Collection and Analysis	Main Results
18. Mania (2024) [132]	Theoretical	Legal protection of revenge and deepfake porn victims in the European Union	Analysis of current law in nine European Member States	Integrative and comparative literature review	European regulations seem to be quite conservative and much less reactive to the social problem of deepfake pornography than American laws
19. Marini et al. (2024)* [140]	Quantitative	Influence of perceived realism (or perceived AI-generatedness) of sexual images on self-reported sexual arousal	Study 1: N = 57 heterosexual participants rated the perceived realism/AI-generatedness of 60 sexual images of their preferred sex and reported sexual arousal Study 2: N = 108 heterosexual participants reported sexual arousal towards 60 sexual images of their preferred sex that were presented as authentic photos (30 images) or as AI-generated images (30 images) Detailed description and analysis of the different technologies	Study 1 and 2: Statistical analysis of both experiments	Both studies showed that men and women reported lower arousal to real photographs when they believed them to be AI-generated
20. Masood et al. (2023) [125]	Theoretical	Overview on technologies of deepfake generation and detection		Literature review on different audio and video deepfake generation and detection techniques, along with their strengths and weaknesses	Deepfake generation has advanced significantly in recent years
21. McCosker (2024) [129]	Qualitative	What type of AI literacy can prevent harms from non-consensual deepfake pornography	N = 791 GitHub deepfake repositories and N = 14 YouTube channels on deepfakes	Qualitative content analysis of GitHub repositories and YouTube channels	The analysis shows that these sites contribute to socializing AI and establishing cultures of social learning, offering potential sites of intervention and pointing to new methods for addressing AI and data harms
22. Molina (2022) [136]	Theoretical	Impacts of deepfake technology on the privacy and safety of the LGBTQ+ community in the U.S	Overview of the potential privacy and safety threats of deepfakes to the LGBTQ+ community and the existing regulatory frameworks	Historical analysis of similar forms of exploitation that the LGBTQ+ community has faced in the past	Federal legislation should be improved to better protect the online privacy and personal safety of members of the LGBTQ+ community
23. Newton & Stanfill (2020) [130]	Qualitative	How pornographic deepfakes enable the automated enactment of toxic geek masculinity	N = 500 issue comments from two GitHub deepfakes-related repositories (faceswap and faceswap-playground)	Qualitative content analysis of issue comments	Deepfakes serve as a site of toxic geek masculinity in five ways (abstraction of human subjects, disassociation from porn, selective self-presentation, community, and indifference to harm)

Table 4 (continued)

Source	Study Type	Research Topic	Design and Sample	Data Collection and Analysis	Main Results
24. Öhman (2020) [119]	Theoretical	Conceptualization of the ethics of deepfake pornography	Case of the “Pervert’s Dilemma”: intuitive understanding that nonconsensual deepfake pornography is unethical, however the justification of this intuition is challenging (e.g., because respective sexual fantasies are allowed)	Philosophical analysis through different levels of abstraction	Nonconsensual deepfake pornography can be considered morally impermissible in the context of its contribution to gender inequality
25. Okolie (2023) [107]	Theoretical	Analysis of deepfake pornography as a type of image-based sexual abuse, and of the position of the law on malicious use of deepfake technology	Literature review on motivations of deepfake production and legal regulation	Focus on deepfake prevention and intervention	Perpetrators have many different motives and legal regulations in the U.S. have many shortcomings
26. Parslow (2023) [138]	Qualitative	Exploration of a queer AI performance with a focus on the lack of representation of queer and trans bodies and identities in AI training data and tools	Three artworks from drag performance that use deepfake technology (e.g., “The Zizi Project”)	Interpretations based on drag and queer theory	Using AI and deepfake technologies in the context of queer and drag performances can help to foster algorithmic justice
27. Popova (2020) [118]	Qualitative	The meanings of celebrity deepfake pornography from the perspective of creators	Case study of two online deepfake communities (mrdeepfakes.com and the voat.co ‘subverse’ v/DeepFake)	Ethnographic observation and qualitative interpretation	Booth deepfake online communities are niche communities with not much communication, celebrity deepfake porn is different from other sexualized engagement with celebrities (e.g., fanfiction)
28. Sen & Jha (2024) [120]	Theoretical	Digital misogyny in India including deepfake pornography based on the Hindutva ideology	Overview of four cases of deepfake victimization of women by Hindutva nationalists and cultural contextualization	Analysis of deepfake victimization and related misogynist memes	Women of religious minorities and liberal feminists are systematically targeted with deepfake pornography by Hindutva nationalists in India
29. Umbach et al. (2024) [111]	Quantitative	Awareness, attitudes, behaviours, and prevalence of victimization and perpetration regarding deepfake pornography in the general population of 10 countries	Online survey among N = 16,693 adult respondents from 10 countries (YouGov Panel)	Statistical analysis of survey data (and qualitative analysis of one open-ended question)	The concept of deepfake pornography was not well-known, reported victimization rate and perpetration rates were 2%
30. Van der Nagel (2020) [126]	Qualitative	Image verification as a measure to fight non-consensual deepfake pornography	Case study of the verification system used on the bulletin board thread Reddit Gonedild	Observation and qualitative interpretation	The verification system is a way for women to reclaim their own image as new ways of digitally manipulating images and evidence emerge

Table 4 (continued)

Source	Study Type	Research Topic	Design and Sample	Data Collection and Analysis	Main Results
31. Van der Sloot & Wagenvoeld (2022) [108]	Theoretical	Regulatory challenges of different types of deepfakes (including deepfake pornography) in the European context (AI Act, General Data Protection Regulation GDPR)	Contextualization of deepfake regulations	Theoretical analysis of different contexts of deepfake usage, including non-consensual pornographic deepfakes	General tension in the regulation of deepfake between right to privacy and freedom of expression
32. Viola & Voto (2023) [123]	Theoretical	How will the problems with deepfake pornography develop in the future	Analysis of extant literature and practical examples	Reflections on the epistemic status of images in the AI age	The growing diffusion of deepfakes will undermine the trust in photos/videos and will hence reduce the appeal of deepfakes
33. Wang & Kim (2022) [114]	Quantitative	Users' emotional and behavioral responses to deepfake pornographic videos of Korean pop idols	Online survey among N = 293 adults in Korea who had experience in watching deepfake video content	Statistical analysis of survey data	The results showed that previous perceptions about sexual harassment and Korean pop idols, experiences viewing pornographic content, and gender were crucial predictors of viewers' emotions toward K-pop idols' deepfake porn videos
34. Winter & Salter (2020) [109]	Qualitative	The role of different digital platforms (GitHub, Reddit) in creating and spreading deepfake pornography	Case study of the DeepFakes project through discourse in the subreddit r/deepfaketechtalk and GitHub comments	Exploration of the GitHub open-source ethics and Reddit moderation	The DeepFakes project has intentionally spread to online spaces with limited moderation which has allowed the continued creation of non-consensual pornography
35. Witt et al. (2024) [134]	Qualitative	Judicial construction of harm in Australian image-based sexual abuse IBSA (including deepfake pornography) case law	N = 47 criminal and civil cases	Feminist critical discourse analysis of case documents	While the serious harms suffered by individual victim-survivors are widely recognized, judicial discourse on societal harms is limited, with little to no recognition of IBSA as a form of gender-based violence in and of itself
36. Yavuz (2024) [124]	Theoretical	History and future of deepfake technology based on the Gartner Hype Cycle	Overview of the development and technology adoption of deepfake technology based on the Gartner Hype Cycle	Secondary research and interviews with three leading experts from academia, industry, and civil society	The rapid advancement of AI technology was followed by technopanic around deepfakes and invited lawmakers to regulate deepfake technology

The table shows the main characteristics of the included publications without claiming completeness. *Marini et al. (2024) [140] has an error in Table 2 (lines for AI images and photos are switched for Study 2) as confirmed by the corresponding author via personal communication. Permission granted: This is a self-created table by the authors and has not been published elsewhere

self-reported perpetration and victimization rates for men than women, which warrants further clarification. Three publications reported on online experiments that exposed participants to variations of vignettes of deepfake incidents (e.g., with celebrity/ordinary person victims; male/female victims; pornographic/non-pornographic content) and measured how they judged the incidents in terms of harmfulness or appropriate punishment [112–114].

- (2) *The socio-cultural dimension:* Eleven publications address the socio-cultural dimension. Two publications examine public debates about deepfakes on X/Twitter [115] and in newspapers [116] and criticize the fact that the negative impact of pornographic deepfakes is not taken as seriously as the damage caused by political deepfakes. Three studies point to the need to explore the creator communities to better understand the motives and meanings behind the production of celebrity deepfake pornography [105, 117, 118]. One publication explains from a moral philosophical perspective why non-consensual deepfakes are problematic in a cultural context of gender discrimination [119], and two papers link non-consensual deepfake pornography to misogyny in Indian [120] and Western cultures [121]. Two papers comment on the epistemological status of images in the coming age of AI-generated fake images [122, 123], asking, for example, whether the expected proliferation of fake images will mitigate the harm of non-consensual deepfake porn, since no one will take these images seriously any more. One publication contextualizes socio-legal reactions to deepfake pornography in the Gartner Hype Cycle [124].
- (3) *The technological dimension:* Seven publications address the technological dimension. One publication provides an overview of the AI tools currently used to generate and detect deepfakes including deepfake pornography [125], one paper discusses image verification as a countermeasure [126], and one paper investigates the different options digital platforms offer their users to report abusive images [127]. Four qualitative studies explore the technology platforms (mainly GitHub) and their communities where users provide each other with technological assistance to create deepfake pornography [109, 128–130].
- (4) *The legal dimension:* Nine publications deal with the legal regulation of deepfake pornography. Typically, such studies analyze and discuss which regulations from private and criminal law can be applied to cases of AI-IBSA. Such analyses focus on the legal situation in North America [106, 107, 131] or in Europe [108, 132]. One theoretical paper suggests that cases of AI-generated image-based sexual abuse are often

related to domestic violence [133]. This claim is supported by an analysis of $N=47$ court cases in Australia, which suggests that AI-IBSA should be understood as a form of gender-based violence [134]. One theoretical paper focuses on the legal definitions of intimate images in the age of sexual deepfakes [135] and another one on the risks of deepfake pornography for the LGBTQ+ community and legal protection [136].

Consensual AI Pornography

Of the 26 papers on non-consensual deepfake pornography, only two also mentioned potential ethical uses of AI pornography and encouraged its exploration [105, 122]. Of the total $k=36$ publications on AI and pornography four papers focused on consensual AI pornography.

One publication questioned the value of synthetic pornography per se, noting that only photo and video pornography can capture authentic human desire [137]. One publication reported on the use of deepfake technology in queer drag performances as a tool to better understand generative AI and work toward its more inclusive design and use [138]. In one study, the image generation tool Craiyon (<https://www.craiyon.com/>) was used to create images of “beautiful breasts.” The resulting images depicted highly sexualized and oversized female breasts, leading the authors to critique aesthetic AI biases and their potential impact on beauty norms and the beauty industry [139].

In two experimental studies, heterosexual participants were exposed to a series of erotic underwear photos of real models of their preferred sex. In the first experiment participants were led to believe that some of the images might have been generated by AI. Participants rated how realistic the photos appeared and how sexually arousing they were. In the second experiment, one group of participants was exposed to the underwear photos with the information that they were real photos, and the other group was exposed to the same photos with the information that they were AI-generated images. Both groups rated how sexually arousing the photos were. The two experiments showed an “anti-AI bias” in the sense that participants rated identical images as less sexually arousing when they believed they were AI-generated [140].

To date, research on AI-generated sexually explicit content has focused on non-consensual pornography. The sparse research on consensual synthetic content has focused on images not on synthetic sexual videos.

Research Gaps

The current state of research on GenAI and pornography reveals several research gaps. Similar to erotic chatbots, it

would be relevant to examine press coverage of AI pornography, the voices of sex workers, and the ethics and safety of this type of sexual fantasy material that is so often used in harmful ways.

In addition, three other research gaps deserve attention:

- *Uses and effects of ethical AI pornography:* Not much is known about the everyday ethical uses of AI pornography in the form of text, audio, image, and video: Who is interested in such material, what type of synthetic AI content is used, where do people search for it, and how do they produce AI porn themselves? Given the options for customized pornography, will such content be more arousing for users?
- *Diversity of pornographic material:* Given the widespread awareness of the biases of AI tools that reflect cultural stereotypes implemented in training data and algorithms, the field of research could move forward from repeating this concern to exploring technological and social measures that promote diversity. This includes, for example, the provision of diversity-focused AI training data, as well as the awareness of diversity-promoting AI prompts (see Fig. 4). The perception and evaluation of AI-generated erotic and pornographic images with varying degrees of standardization or diversity in style and content by different user groups is an open research question.
- *Pornography market:* Will we see a disruption of the pornography market and industry with the proliferation of sexually explicit AI content? What exactly will that mean, and how will it affect workers and working conditions in the sex and sex tech industries? Will porn platforms in the future move away from pre-produced content and allow users to self-create AI content that matches their preferences? Or will authentic photo and video pornography gain value in a future society presumably saturated with synthetic images?

Conclusion

The current five-year literature review on the use of AI in sexual health and sexual behaviors covers the growing body of research in four main areas: (1) sexual information and education, (2) sexual counseling and therapy, (3) sexual and romantic relationships, and (4) erotica and pornography. While research on AI information quality provides a positive evaluation when it comes to textual sexual health information, it remains unclear how sexual information seekers actually use AI tools in their everyday lives. Research on AI counseling and therapy presents promising results regarding the therapeutic capabilities of AI chatbots, but longitudinal and field tests are needed

Man in Swimwear	Nonbinary Person in Swimwear	Woman in Swimwear
<i>Model characteristics:</i> "beautiful man in swimwear" (although ethnicity/race and age were not specified in the prompt, the AI generated images of white young men) <i>Image characteristics:</i> "stylize 1000". Midjourney has developed its own glossy mainstream aesthetic style, which has been tuned up to the maximum here with the Stylize parameter.	<i>Model characteristics:</i> "beautiful nonbinary person in swimwear" (the AI generated images of people of different ethnicities and ages) <i>Image characteristics:</i> "stylize 400; weird 3000". Midjourney allows to create images with an unconventional aesthetic using the Weird parameter, which is set to the maximum here.	<i>Model characteristics:</i> "black woman in swimwear" (specifying race/ethnicity and avoiding references to beauty in the prompt is the most effective way to create diverse images of women) <i>Image characteristics:</i> "stylize 400; weird 3000". In addition to the Stylize and Weird parameters, Midjourney offers many other parameters to influence image characteristics not shown here.
		

Fig. 4 While the image-generating AI tool Midjourney (by Midjourney Inc.) refuses to generate sexual images (such as underwear or nude images), it does generate swimwear images. Through different prompts that define both model and image characteristics, users can

create diverse images, such as that of a man (left), a nonbinary person (middle), and a woman (right) in swimwear. (source: <https://www.midjourney.com/>; June 27, 2024). Permission granted: This is a self-created figure by the authors and has not been published elsewhere

to further explore their benefits and risks. Companion chatbots provide additional forms of artificial intimacy on both a romantic and sexual level that appear to be helpful for certain user groups. Again, longitudinal and field studies are necessary to evaluate risks and benefits regarding sexual and overall health. The AI generation of erotica and pornography has given rise to a new type of sexual abuse, namely AI-generated image-based sexual abuse (AI-IBSA) or so-called non-consensual deepfake pornography. The individual and collective harm of this type of sexual abuse, that often victimizes women and girls, is widely recognized in the literature. Social, educational, technological, and legal countermeasures are discussed.

While preventing harm should be a priority, for the sake of sexual health, researchers must also look for beneficial uses of AI tools, such as sexual education and ethical sexual pleasure (e.g., [141]). It seems that research on AI and sexuality to date has neglected pleasure as a key element of sexual health. In particular, the potential of AI to generate customized chatbots and pornography opens the door to more diverse, inclusive, queer, feminist, and kinky sexual fantasy material that could complement traditional heteronormative, male-centered pornography.

In terms of methodological approaches, the included 88 publications cover both theoretical and empirical studies. Data collection methods include qualitative interviews and quantitative surveys as well as qualitative, quantitative, and computational content analyses. First experimental and longitudinal studies were also identified. Regarding their theoretical frameworks, the interdisciplinary research field of AI sexuality draws on a variety of approaches, ranging from evolutionary to sociocultural theories. A key conceptual question for both researchers and users of GenAI in sexual contexts seems to be their ontological status between tool and actor.

Strengths and Limitations

The current narrative review is the first to cover the emerging field of AI and sexuality with a focus on everyday use and health implications. Its main strengths are the broad scope, clear structure and the number of future directions to open research questions. Limitations are the inclusion of only English-language literature, the lack of inclusion of literature published in the second half of 2024, and the foreseeable speed with which some examples and claims will become outdated due to rapid technological developments and cultural adaptations. While the current literature review includes empirical studies from different regions of the world, it does not provide an in-depth discussion of the question how the cultural context shapes sexual AI experiences (e.g., it might be predicted that countries with more

gender inequality will have higher rates of deepfake pornography victimization of women and girls).

Two types of AI-enabled sexual technologies were not included in this paper because they are already extensively discussed in neighboring research fields: a) *AI-enabled haptic sexual devices* such as smart sex toys or sex robots (for a scoping review of 98 sex robot publications 1993–2019, see [102]) and b) *AI-enabled mobile sexual health apps and wearables* such as fertility trackers that use machine learning techniques in data analysis (for research reviews on sexual and reproductive apps and wearables, see e.g. [142, 143]).

Beyond the use in people's everyday lives, there are further uses of AI tools within sexuality that were beyond the scope of the current review, such as:

- AI tools in sexual forensics used by law enforcement, for example, to detect child abuse material or to identify online sexual perpetrators (e.g., [144]).
- AI tools in sexual medicine used by physicians and pharmaceuticals companies, for example, to improve the management and treatment of erectile dysfunction by developing new drugs or assisting in the operation room (e.g., [145]).
- AI tools in sexual research used by scientists, such as machine learning approaches to design and conduct infectious disease prediction studies, including sexually transmitted infections (e.g., [146]).

Any sexuality-related uses of AI are also related to the broader risks of this technology such as environmental costs, job displacement, surveillance and control, and the spread of misinformation and disinformation. These broader impacts were also beyond the scope of this review.

Outlook

GenAI tools present new risks and opportunities for human sexuality and sexual health. More research in the four application areas of sexual information, sexual therapy, sexual relationships and pornography is needed to better understand the intersection of GenAI and sexuality in different populations. Evidence-based knowledge on the intersections of GenAI and sexuality is useful in a number of ways: It can help people navigate their personal sexual experiences with AI. It can guide sex educators, counselors, and therapists on how to address and incorporate AI tools into their professional work. It can advise AI developers on how to design tools that avoid harm. It can educate policymakers on how to regulate AI for the sake of sexual health at the individual and collective level. It can inform journalists and publicists on how to report on AI and sexuality in an enlightening and evidence-based way.

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Author Contribution N.D. conceived and designed the review, drafted the main text of the manuscript, prepared Figs. 1, 2, 3, 4 and Tables 1, 2, 3, 4. T.D.L. assisted in the preparation of the tables and the reference list. All authors discussed the review design, critically reviewed and revised the manuscript.

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