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Sexual Behavior Surveys Should Ask More: Covering the Diversity of Sexual Behaviors That May Contribute to the Transmission of Pathogens

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THE HIV EXPERIENCE AND SEXUAL BEHAVIOR

The HIV pandemic of the last 4 decades has sparked an interest in the systematic collection of sexual behavior data. Clearly, differences in population sexual behavior must be one of the factors explaining the stark heterogeneity in HIV incidence and prevalence among (sub-) populations worldwide as well as the declines in HIV prevalence in sub-Saharan Africa.¹ Behavior change could thus also be key to HIV control and consequently has long been a major component of intervention efforts.² Sexual behavior concepts such as rate of partner change, core groups, sex work, and concurrency have drawn considerable attention from both field epidemiologists and mathematical modelers and have been proposed as target parameters for interventions.^{3–8} The World Health Organization has issued guidelines, including standardized forms, to elicit information on lifetime and recent sexual partners, both male and female, and various behaviors including vaginal and anal sex as well as condom use.⁹ These questionnaires have been shaped by what is known are the main transmission modes of HIV and have been used, *inter alia*, to monitor the impact of behavioral interventions.¹⁰

A WORLD OF SEXUALLY TRANSMITTED INFECTIONS OTHER THAN HIV

However, the emphasis on HIV ignores the fact that there are many other sexually transmitted infections (the number is steadily increasing) that have the same routes of transmission as HIV, but may also be transmitted by other sexual practices. All types of (close or intimate) contact between humans are bound to become exploited by, sometimes pathogenic, parasites, some of which may even have evolved to exploit multiple routes of transmission. Such parasites needed to evolve to be transmitted through human-to-human contact, as a matter of sheer survival. The broad diversity of modes of transmission of pathogens maps how humans *contact* each other. Sexually transmitted infections, for instance, must have taken advantage of the different forms of direct sexual contacts between humans. Although some infections evolved to propagate through direct contacts, many others evolved to be transmitted through indirect contacts, taking advantage of the mere *proximity* of humans to each other, such as droplet, airborne, or vector transmission.

EVOLUTION, INFECTIONS, AND MODES OF TRANSMISSION

Pathogens will never stop being creative in exploiting every form of human-to-human interaction. The recent emergence of the severe acute respiratory syndrome coronavirus 2 provides an example. The painful social and physical distancing restrictions imposed to slow severe acute respiratory syndrome coronavirus 2 transmission, which shattered the very fabric of our normal social life, is a poignant example of how pathogens' natural modes of transmission are just a mirror image of how we as humans interact with each other. The analogy between the *condom* and the *mask* hardly escapes notice for HIV/sexually transmitted infection practitioners.

Accordingly, one should expect that this exploitation of human interactions extends to every form of sexual contact; that is, there could be infections that evolved to take advantage of this contact. The modes of HIV sexual transmission thus may just offer a grossly incomplete picture of how infections can be transmitted “sexually.” Possibly, already there are infections that have evolved to be transmitted using every form of sexual contact.

Oral sex—both cunnilingus and fellatio—are known routes of transmission of gonorrhea and human papillomavirus (HPV)^{11,12} and thus the link to head and neck cancers including HPV-16-associated oropharyngeal cancers.¹³ It has been shown that oral syphilis seems to be rising in European countries.¹⁴ Herpes simplex virus type 1 (HSV-1) is typically a childhood orally acquired infection. Nevertheless, it is increasingly transmitted genitally and through oral sex, probably because the oral mode of transmission is no longer as efficient as it historically used to be.^{15–17} HSV-2 is generally considered a genitally transmitted pathogen. Although it can also be transmitted via oral sex, it remains unknown whether this is a common occurrence.¹⁸ A

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better understanding of HSV-2 epidemiology is important in view of the interest in this infection both as a risk factor for HIV acquisition and transmission,^{19,20} and as a marker of both individual and population sexual risk behavior.^{21–23}

Other pathogens such as cytomegalovirus and Epstein-Barr virus, which have been implicated in a wide range of disorders, including tuberculosis, diabetes, and various cancers, may similarly be transmitted along these routes,^{24–28} but their importance has not been thoroughly explored. Human herpes virus 8, the causative agent of Kaposi sarcoma, may similarly be transmitted orally, but much of it remains conjecture.²⁹

ORAL SEX, A MAJOR MODE OF SEXUAL TRANSMISSION?

A recent article in this journal, using data from the National Survey of Family Growth, revealed how widespread unprotected heterosexual oral sex has become in the United States,³⁰ a finding that was confirmed by an analysis of data from the National Health and Nutrition Examination Surveys.^{31s} Apparently, this behavior has become more casual and noncommittal than it used to be several decades ago.^{32s}

Unprotected heterosexual and same-sex oral sex is common not only in the United States; it has also been shown to be a prevalent sexual practice among men who have sex with men elsewhere.^{33s} Recently, it has become clear that among men who have sex with men, kissing could also be an important route of transmission of gonorrhea.^{34s} The role of the oral cavity in gonorrhea transmission may be far from being just a recent phenomenon.^{35s} Oral sex and the microbiome of the oral cavity are increasingly being implicated as drivers of *Neisseria gonorrhoeae* antimicrobial resistance.^{36s} Unfortunately, there is a dearth of information on oral sex and kissing outside of North America or Western Europe. It is known that mouth-to-mouth kissing is a culturally determined erotic/sexual practice,^{37s} but we know little about its spread globally and even less about how it correlates with other sexual practices, for example, to initiate genital sex, or its role in the transmission of pathogens.^{37s}

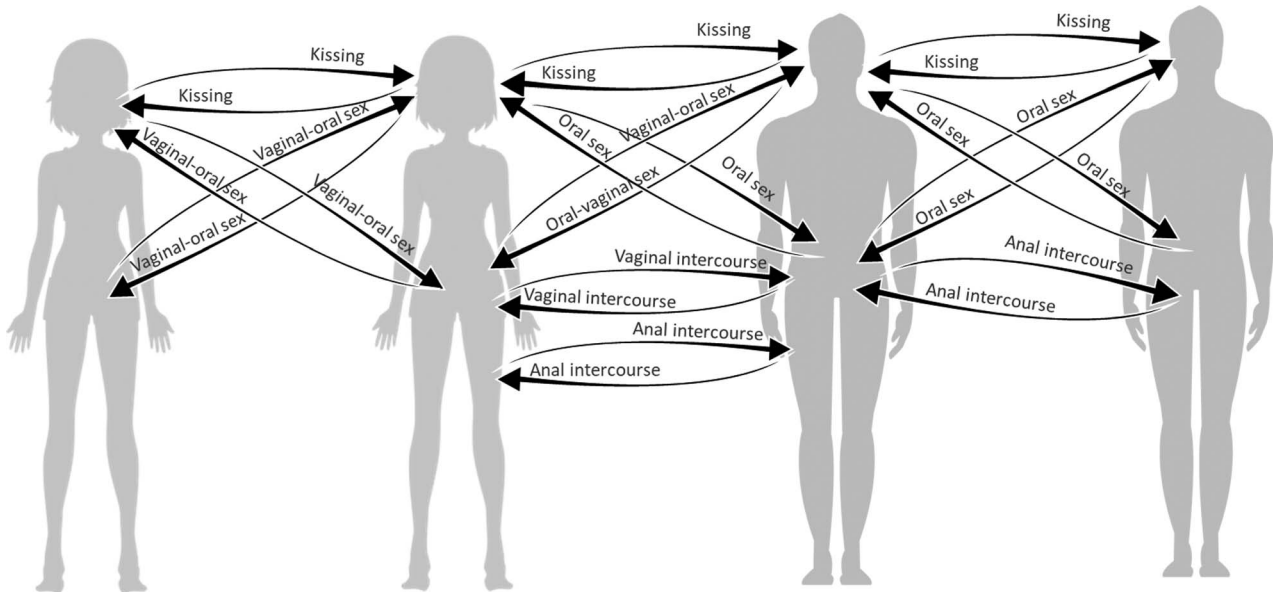
SEXUALLY TRANSMITTED INFECTIONS AND ETIOLOGY OF DISEASES

There is continuing interest in the potential existence of a sexually transmitted etiological factor in the etiology/pathogenesis of prostate cancer.^{38s,39s} Prostate cancer incidence and mortality rates vary widely according to geography and race, with a more than 90-fold difference in incidence between the highest and the lowest.^{39s} Some data within populations seem suggestive of a potential sexually transmitted factor to explain the observed patterns.^{38s} However, the global pattern of incidence and mortality of this cancer, with comparatively low levels in Eastern Asia and parts of Africa and high levels in North America and other Western countries, seems to belie this hypothesis, unless transmission is associated with a sexual practice that is common in North America and other high-incidence regions but rare elsewhere.^{40s}

Perhaps, oral sex might play a role? This remains unknown, as exploring this conjecture is complicated by the virtual absence of knowledge of these oral sex practices outside of Western countries. More generally, identifying sexually transmitted infectious agents as etiological factors of diseases may be particularly difficult when there is a long latency between exposure and onset of disease, as is evidenced by the history of the discovery of HPV as the etiological cause of cervical cancer.^{41s} Systematic collection of all potentially relevant sexual behavior data on a global scale may help spotting such associations and guiding further research.

A CALL FOR A NEW FRONTIER IN SEXUAL BEHAVIOR RESEARCH

We therefore argue for the consistent inclusion of questions on these practices in sexual behavior surveys, and with a global reach that bridges the gap between technical terms and colloquial language across different languages, cultures, and countries. This effort could also benefit from the use of mixed-methods approaches that begin with a qualitative exploration of sexual practices, say using focus groups, that are then converted into survey instruments where “street terms” for sexual acts or body parts are used to improve responses.



Modes of infection sexual transmission

Figure 1. A conceptual schematic diagram of the different possible same-sex and opposite-sex sexual modes of transmission.

We further propose to convene a meeting of epidemiologists, microbiologists, and behavioral scientists to formulate a set of questions and to develop survey instruments that elicit information on sexual behaviors that may play a role in the transmission of the different considered pathogens. To this end, Figure 1 provides a conceptual schematic diagram of the different potential sexual modes of transmission that need to be mapped with concrete and representative population-based behavioral data. Such data may prove valuable in identifying novel associations between behaviors, infections, and disease outcomes, thereby enhancing the potential to reduce the incidence of some diseases or to alleviate some disease sequelae.

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For further references, please see “Supplemental References,” <http://links.lww.com/OLQ/A590>.