

## Frequency of Pubic Hair Transfer During Sexual Intercourse\*

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**ABSTRACT:** This study measured the frequency of pubic hair transfer between a limited number of consenting heterosexual partners. The results derive from controlled experiments with a number of human subjects rather than forensic casework. Standardized collection procedures were observed, situational variables were tracked.

Participants (forensic laboratory employees and their spouses) were six Caucasian couples who collected their pubic hair combings immediately following intercourse. Subjects provided informed consent in accordance with the protocol for human subjects approved by the U.A.B. institutional review board. The experiment was replicated ten times for five couples, and five times for another couple (total  $n = 110$ ). Transfer frequencies were calculated from instances where foreign (exogenous) hairs were observed.

Results showed at least one exogenous pubic hair in 17.3% (19/110) of combings. Transfers to males (23.6%, or 13/55) were more prevalent than transfers to females (10.9%, or 6/55). Only once were transfers observed simultaneously between both male and female. A total of 28 exogenous pubic hairs were identified. Subjects reported intercourse duration of 2–25 min, intervening intervals of 1–240 h, pre-coital bathing intervals of 0.25–24 h, and predominantly missionary position (76%). No clear relationship among these other survey variables was observed.

The prevalence of female-to-male pubic hair transfers suggests the importance of collecting pubic hair combings from the male suspects as well as from female victims, provided the time interval is not extreme. Even under these optimum collection conditions, pubic hair transfers were observed only 17.3% of the time.

**KEYWORDS:** forensic science, criminalistics, hair transfer, sexual assault, transfer evidence

Forensic scientists rely on hair as transfer evidence capable of (1) associating assailants and victims of violent crime, (2) excluding innocent persons, (3) placing an individual at a scene, and (4) corroborating witness statements. It is well known that pubic hairs may be transferred during certain sexual offenses. Law enforcement agencies use associations between the hair of a suspected assailant and a victim to arrest and aid prosecution of assailants as well as to exclude innocent suspects. Few controlled studies

have been reported which could allow predictions of how frequently examiners might expect to observe such transfers.

The actual transfer of pubic hair between individuals during sexual intercourse poses many questions which have not been investigated. Prior to this study, research concerning the transfer frequency of pubic hair was based on either forensic casework or limited human subject data, both lacking information on situational variables.

The present study was intended to measure the frequency of pubic hair transfer between a limited number of partners during heterosexual intercourse and to evaluate its potential significance in forensic science. For this study, hair combings were collected from several individuals following heterosexual intercourse and compared with standard hair collections of the participants using standard macroscopic and microscopic techniques. From these data, an estimate of the frequency of pubic hair transfer between individuals under optimum collection conditions was established.

Hair is common to mammalian skin and follows a cycle of shedding and reappearance. The abundance of hair, its resistance to degradation, and differentiation among people make hair a good biological source of comparison. Forensic scientists use microscopic characteristics to differentiate animal from human hair and further as to racial origin and body location. Frequently, human hairs can be differentiated between individuals based on various microscopic characteristics. This differentiation has made hair a valuable source of associative and exculpatory evidence.

Many studies have investigated the transfer of hair and hair-like materials among various media and the association of a particular hair to an individual. Gaudette and Tassarolo report that the secondary transfer of scalp hair is common during hair transfer, even more so than direct transfers (1). A direct transfer occurs when a person transfers his or her own hair to an object. In contrast, a secondary transfer of hair occurs when the hair transferred does not originate from the person. Quill, studying the transfer of hair during a normal workday, concluded that hair transfer is a direct result of close personal contact (2). In a separate study, Simons showed that 65% of human hairs, and 71% of animal hairs, persisted on clothing following laundering (3). She further states that hair transfers do occur during laundering, thus decreasing the evidentiary value when a suspect and victim launder their clothes together. Several studies, including those of Gaudette, investigated probabilities and human hair comparisons (4–12). Recently, Wilson et al. developed techniques to directly sequence the mitochondrial DNA from a human hair shaft (13).

These studies demonstrate the evidentiary value of hair in forensic science. A paucity of research reports on the frequency of pubic hair transfer between individuals during sexual intercourse reveals how little attention this topic has received in the scientific literature, with varying results (14–17).

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Soules et al. first evaluated the transfer of pubic hair in conjunction with a study of acid phosphatase and spermatozoa persistence in alleged rape victims (14). Fifteen couples engaged in three separate acts of sexual intercourse, resulting in no observation of hair transfer to the 15 females. Time of collection after intercourse and the transference from female to male subjects were not evaluated.

Keating first introduced the issue of cross transference of pubic hairs during sexual intercourse, evaluating the transfer between only one couple (15). Of the 20 occasions of intercourse analyzed, Keating determined that pubic hair was transferred a total of 22.5% ( $n = 9/40$ ) of the time, exclusively from the male to the female. The hairs were differentiated based on macroscopic characteristics, and microscopic techniques were used to examine the roots to determine the growth phase of the recovered hairs. Keating concluded that pubic hair transfer does occur; however, the results of only one couple were not a basis for significant conclusions.

A survey by Riis regarding sexual assault combing evidence suggests that pubic hairs were found to associate a victim and assailant in 15% ( $n = 17/107$ ) of submitted cases (16). Riis surveyed 79 laboratories throughout the United States. Sixty-eight percent of the laboratories responded; however, only 32% of the labs returned the survey with results.

Finally, case studies concerning hair transfer in sexual assaults were completed by Mann (17) and Stone (18). Mann reported from casework that 4% ( $n = 4/96$ ) of female pubic hair combings and 0% ( $n = 0/18$ ) of male combings contained pubic hairs consistent with the partner. These values fell within the range determined by Riis of 0% to 15%. Stone described a slightly lower occurrence of foreign pubic hair in victim pubic hair combings of 2%. These results were based on the examination of approximately 2500 sexual assault victims.

The information evaluated by Riis, Mann, and Stone remains the most substantial estimate of pubic hair transfer to date. The present study gives hair examiners a potential "ceiling" value of pubic hair transfer under optimum collection conditions, perhaps unattainable during actual casework, on which to base these estimates.

## Materials and Methods

### Subjects

Ten couples agreed initially to participate in the study. Participants were forensic laboratory employees and their spouses. Subjects provided informed consent in accordance with the protocol approved by the institutional review board for human subjects. The only participation incentive was altruistic advancement of research. Results include specimens collected from a total of six couples. Of the six couples, five completed the entire ten investigations while one couple completed the protocol for only five. All were Caucasians. Coded numbers were assigned to protect the anonymity of individual specimens.

### Sampling

To study day-to-day variability, couples were asked for combings from ten separate occasions after sexual intercourse. Couples received uniform instructions for collecting post-coital combings from both male and female partners, according to standard pubic hair combing protocols. Briefly, subjects placed a 0.9-by-0.9 m (3 ft  $\times$  3 ft) swabby towel under the buttocks of their partner following intercourse, and combed the pubic regions thoroughly, allowing loose hairs to fall on the towel. The comb was placed on

the towel with any loose hairs collected and folded, sealed in an envelope, labeled, and attached to a survey questionnaire (see below). In addition, each subject collected known control hairs for comparison from different areas in the pubic region. These hairs served as a standard from which a comparison with hairs collected in the combings would allow foreign hair verification.

Subjects recorded the following experimental variables on survey forms: duration of intercourse, hours between intercourse, position of subjects during intercourse, and interval from bathing prior to intercourse. Transfer frequencies were calculated for how often and how many exogenous hairs were identified.

### Comparison

The laboratory comparison of the pubic hairs was accomplished utilizing accepted hair comparison techniques used in routine forensic casework. Briefly, hair specimens were mounted on standard 75  $\times$  25 mm microscope slides with Permount mounting medium and covered with 22  $\times$  40 mm microscope cover slips. Each recovered hair (collected combing) was compared with each of the hair standards collected from each partner. The comparison utilized a transmitted light, compound comparison microscope with variable magnifications ranging from  $\times 100$  to  $\times 400$ . All pubic hairs identified initially as foreign were verified by a second examiner.

### Estimation of Growth Phase

The growth phase of the transferred hairs was estimated by analyzing the characteristics of the root with a compound light microscope. A hair was classified as telogen if it possessed a bulbous root with no follicular material surrounding the root area. Catagen hairs possessed a semi-bulbous root with small amounts of follicular material. The presence of an elongated root or a large amount of follicular material or both was regarded as an indication of the anagen growth phase.

## Results and Discussion

Pubic hair combings totaled 110 (55 from males and 55 from females) for the six couples. From these, 210 pubic hairs were recovered from the male combings and 134 from the female combings. Individual samples ranged from 0 to 20 collected hairs. In addition, a total of 42 hairs were identified in the combings as being other than pubic hairs. These were: 7 head hairs, 20 body hairs, 1 animal hair, and 14 pubic hair fragments not suitable for comparison. These hairs were disregarded for the purposes of this study.

Foreign pubic hairs were present in 19 out of the total 110 combing collections, leading to a transfer frequency of 17.3%. One foreign pubic hair was present in 14 of the combings, 2 foreign pubic hairs were present in 2 combings, 3 foreign pubic hairs were present in 2 combings, and on one occasion 4 foreign pubic hairs were recovered from the pubic hair combing. Thus, a total of 28 foreign pubic hairs were present in the 19 incidences where transfers were observed.

Foreign pubic hairs consistent with the subject's partner were present in 6 of the 55 female combings (10.9%) and 13 of the 55 male combings (23.6%).

All of the foreign pubic hairs recovered from the combings were identified as being in the catagen or telogen growth phase. The results of the growth phase of the transferred hairs indicate that the contact and forces exerted during sexual intercourse were not

sufficient to extract hair in the active growth phase from an individual.

The number of hairs shed by an individual varied greatly between individuals, suggesting that combing procedures for some couples were more stringent than for others. Nine of the 55 (16%) male combings and 17 of the 55 (31%) female combings contained no hair in the pubic hair combings. However, the distribution of foreign hairs found for each couple ranged from 3 to 6, except for couple 6, who did not complete 10 collections. These results indicate that the combing process used by each couple was adequate. A possible explanation for the range of hairs shed may lie in personal hygiene or other physiological factors.

Only on one occasion did a cross-transfer of pubic hairs occur. A cross-transfer was defined in this study as a transfer of pubic hair from male to female and a transfer from female to male during the same act of intercourse.

The number of loose hairs collected in the combing of an individual did not affect the rate of foreign hairs recovered in the partner combing. In one example, 78 pubic hairs were collected in the total combings of one individual, while no foreign hairs were identified in the combing of the partner. In contrast, only 8 loose hairs were collected in another individual's total combings, with five separate occasions of pubic hair transfer to the partner. Also, on four separate occasions, a foreign pubic hair was collected from the female combing, while no hairs were collected in the male combing for that act of intercourse. These results indicate that the transfer of pubic hair was not dependent on the number of loose hairs collected in the combings.

Duration of intercourse varied from 2 to 25 min. The majority of pubic hair transfer ( $n = 17/19$ ) occurred in the time range of 5 to 15 min; however, this was the range most often reported (80% of the time). Time between intercourse ranged from 1 to 240 h. Bathing prior to intercourse ranged from 0.25 to 24 h with no influence on transfer evident. Thirteen of 84 transfers occurred in the missionary position (15.5%) while 6 of 26 (23.1%) occurred in positions other than this. Because these variables surveyed were not observed independently, their correlation with hair transfer appeared to be more anecdotal than significant; no clear pattern emerged.

The frequency of pubic hair transfer obtained in this study is slightly higher than the upper level tabulated in the Riis survey of 0% to 15%. This is undoubtedly due to the lack of optimum collection conditions found in everyday casework.

Although the results involving female-to-male pubic hair transfer differ from the studies of Keating and Mann, correlations still exist. First, pubic hair transfer does occur during sexual intercourse, and is significant forensic evidence when found. Second, further studies in the area of hair transfer frequencies are needed to better evaluate hair transfer evidence.

The authors' results conflict with those of Mann and Keating in that pubic hair transfer did occur from the female to the male, in fact, twice as often. A likely explanation for this difference lies in the amount of male combings collected in the respective studies and the time intervals between intercourse and collection.

The information derived from this area of research could greatly influence the manner in which pubic hair evidence, from a variety of criminal sexual offenses, is interpreted in forensic casework. Until now, when asked in court about the frequency of pubic hair transference, experts could rely only on experience because of the lack of scientific literature. This baseline study can help forensic scientists seeking to apply frequency data to casework observations.

## Conclusions

Although the identification of foreign pubic hair in the combing of a sexual assault victim may aid in associating a suspect with a victim, this limited study indicated a low frequency of pubic hair transfer during sexual intercourse. The results suggest that transferred pubic hair may not be available to trace evidence examiners in many sexual assault cases.

The results of these limited studies demonstrated that female-to-male pubic hair transfers were twice as common as those of male to female. This suggests the importance of collecting pubic hair combings from the male suspects, as well as from female victims, provided the time interval is not extreme.

This limited study of pubic hair transfer was an attempt to estimate the maximum frequency of detectable pubic hair transfer during sexual intercourse when optimum collection conditions were used. Under actual casework conditions, examiners observe a lower frequency of pubic hair transfer between a suspect and victim due to variables that cannot be controlled. These variables include (1) combing procedures among emergency room personnel; (2) post-coitus events such as collection time interval, physical activity, and garment removal/changing; (3) region of pubic area exposed during contact; and (4) false accusations by alleged victims. Even absent these variations, however, the data suggest a low frequency of transfer under optimal collection conditions. Thus, failure to find transferred pubic hairs does not indicate that intercourse did not occur.

Without additional studies, it is not clear that our results with a limited number of people would be found if larger numbers of individuals were examined, even under the controlled conditions described. Further, the results may differ in other racial groups.

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