

Prevalence of Body Art (Body Piercing and Tattooing) in University Undergraduates and Incidence of Medical Complications

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- **Objectives:** To survey the prevalence of body art (body piercing and tattooing) in university undergraduate students and to determine the incidence of medical complications from these procedures.

- **Subjects and Methods:** Between February and May 2001, students were offered the opportunity to complete an anonymous, voluntary survey at the beginning of class or organizational meetings. The survey instrument requested information concerning body piercing and tattooing (current or removed) by body site, age, sex, height, weight, body mass index, undergraduate class, athletic status, and the occurrence of medical complications.

- **Results:** Four hundred fifty-four (94.4%) of 481 students completed the survey (14.7% of total campus enrollment). The prevalence of body piercing was 51%, and that of tattooing was 23%. The χ^2 analysis showed female students were more likely to be pierced than males

($P=.002$); there was no significant difference in the prevalence of tattooing by sex. Male athletes were more likely to be tattooed than male nonathletes ($P=.02$). No relationships were shown between piercing/tattooing and age or measures of body somatotype. The incidence of medical complications of piercing was 17%, and these complications included bleeding, tissue trauma, and bacterial infections. Pierced navels were particularly prone to infection. There were no reported medical complications from tattooing. Eighteen percent of piercings (58/315) and 4% of tattoos (6/149) had been removed.

- **Conclusions:** Body art is prevalent among undergraduate university students, and there is a significant incidence of medical complications among students with piercing. Male athletes were significantly more likely to be tattooed than male nonathletes.

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Body art, including tattooing and body piercing, is an ancient practice. Tattoos have been found on a 5200-year-old Neolithic mummy,¹ and body piercing was common during the Victorian era. In recent years, body art is an increasing phenomenon² among adolescents and young adults and, in some instances, their parents. Reported medical complications of body art include bleeding,³⁻⁵ tissue trauma and scarring,⁶⁻⁸ bacterial infections,⁹⁻¹³ tetanus,¹⁴ viral infections,¹⁵⁻²² and oral and dental injuries.²⁰⁻²⁶

While performing routine medical examinations, we observed that piercing and tattooing were common among students at our institution, Pace University in Pleasantville, NY. A MEDLINE search revealed tattoo prevalence estimates ranging from 10% in “adolescents” to 25% in “15 to 25 year olds.”²⁷ Rooks et al²⁸ reported the prevalence of tattoos among patients presenting over a 2-day period in a hospital emergency department, and Armstrong et al²⁹ sur-

veyed tattooing prevalence in a large cohort of army recruits. We were unable to discover any studies of piercing prevalence.

We therefore surveyed undergraduate students to determine the prevalence of body piercing and tattooing at our university. We compared the prevalence of body art in varsity athletes vs nonathletes and correlated prevalence with body somatotype among the subjects. In addition, we sought to determine the incidence of self-recognized medical complications resulting from these procedures.

SUBJECTS AND METHODS

A survey questionnaire was created and refined through a pilot study. Between February and May 2001, the questionnaire was offered on a voluntary and anonymous basis to undergraduate students at class and organizational meetings. The survey instrument (Figure 1) was designed to be brief, noninvasive, and easy to complete in order to ensure a high response rate. University Institutional Review Board approval was obtained for the study.

Survey results were entered into the SPSS version 10.0 statistical package (SPSS Inc, Chicago, Ill). In a few instances in which the survey respondent omitted an item such as height or class in school, the item was not entered into the analysis. Descriptive statistics (mean [SD]) were

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This questionnaire is designed to determine the prevalence of body piercing and tattooing among undergraduate college students and to assess the medical risks of these procedures. We ask you to please complete the following questions by marking the appropriate response in the column to the right of each question. All completed forms are anonymous and will be maintained in a confidential manner by the research group. Your participation in this study is voluntary and indicates your understanding of its purpose.

Circle "Y" for Yes Circle "N" for No

Age to nearest year: _____

Sex: male _____ female _____

1. Do you have or have you ever had any body piercings? Y N

If your response was "No," please skip to question 2.

Indicate the area currently pierced by circling "Y." Indicate the area from which a piercing has been removed by circling "R."

Ear (do not report pierced earlobes for women)	Eyebrow	Nose	Cheek	Lip	Tongue	Nipple	Navel	Genitals	Other_____
Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
R	R	R	R	R	R	R	R	R	R

2. Do you have or have you ever had any body tattoos? Y N

If your response was "No," please skip to question 3.

Indicate the area currently tattooed by circling "Y." Indicate the area from which a tattoo has been removed by circling "R."

Hand/arm	Foot/leg	Neck	Chest/breast	Back	Shoulder	Buttock	Abdomen	Face	Other_____
Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
R	R	R	R	R	R	R	R	R	R

3. Are you a varsity athlete at Pace University? Y N

If you are a varsity athlete, indicate your varsity sport by circling "Y." (If you are not a varsity athlete, please skip to question 4.)

Base-ball	Basket-ball	Cheer-leading	Equestrian	Foot-ball	Golf	Lacrosse	Soccer	Soft-ball	Tennis	Track	Cross-country	Volley-ball
Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y

4. Height: _____feet _____inches

5. Weight: _____pounds

6. Class standing (please circle): Freshman Sophomore Junior Senior Fifth year

7. If you now have or have ever had a body piercing, have you suffered any medical complications? Y N
(If never pierced, go to question 9.)

8. If "Yes," please circle: A. Injury or tearing of skin
 B. Bleeding
 C. Infection: bacterial viral
 D. Tooth or gum injury
 E. Other_____

9. If you now have or have ever had a tattoo, have you suffered any medical complication? If never tattooed, you're done!
 Y N

10. If "Yes," please circle: A. Infection: bacterial viral
 B. Scarring
 C. Other_____

Thank you for participating in this study!

Figure 1. Body art study questionnaire.

determined for all demographic data collected. Separate χ^2 tests were used as omnibus tests to determine differences between piercing/tattooing status and undergraduate class, age, sex, height, weight, body mass index, and athletic status. They were also used to ascertain differences relating piercing/tattooing status to a particular sport and to elucidate relationships between piercing/tattooing medical complications and sex. In all cases, specific pair differences within the χ^2 were determined by examining adjusted standardized residual scores. Values greater than 1.96 or less than -1.96 were considered significant. Significance for all other statistics was placed at $P < .05$.

RESULTS

Four hundred fifty-four (94.4%) of 481 students completed the survey representing 14.7% of the total campus enrollment. The calculated maximum margin of error for this sample was 4.6 percentage points (95% confidence). Respondents comprised 218 male students (48%) and 236 female students (52%). Demographic characteristics of the survey respondents are shown in Table 1.

A significantly lower incidence of piercing was found among junior students ($P = .009$) (Table 2). No other relationships were seen between undergraduate class and body art. Student age was not related to piercing ($P = .31$) or tattooing ($P = .45$).

Ninety-two (42%) of 218 male respondents and 137 (60%) of 228 female respondents were pierced ($P = .002$). Table 3 shows the location and frequency of body piercing by sex. Among male students, 83 (38%) had pierced ears with 15 of these having been removed by the time of the survey. Ten (4%) had pierced tongues (5 removed), and 7 (3%) had pierced nipples (5 removed).

Among female students, 67 (29%) had pierced ears with 4 having been removed by the time of the survey. Thirty-seven (16%) had pierced tongues (10 removed), 14 (6%) had pierced nipples (2 removed), and 74 (32%) had pierced navels (7 removed). For the purposes of this survey, female students were asked not to report pierced earlobes in the category of pierced ears.

Eyebrow, lip, and cheek piercing were each reported by less than 2% of students. Nasal piercing had been removed by 4 of 5 females. Genital piercing was reported by 2 male students (1%) and 5 female students (2.4%).

Among 229 pierced subjects, we counted 315 piercings (range of 1-5 sites per individual). Two hundred forty-seven of these were current, and 39 had been removed. No significant difference in the prevalence of piercing existed between athletes and nonathletes ($P = .54$). Among the athletes, there was no significant difference by sport in the prevalence of piercing ($P = .17$).

Table 1. Demographic Characteristics of Body Art Survey Respondents*

Demographics	Males (n=218)	Females (n=236)
Age (y)	21.0 (3.6) (n=218)	21.0 (5.0) (n=236)
Height (cm)	180.6 (7.3) (n=211)	164.9 (7.8) (n=227)
Weight (kg)	84.4 (15.3) (n=215)	61.1 (9.3) (n=216)
BMI (kg/m ²)	25.9 (3.8) (n=211)	22.5 (3.2) (n=215)

*Values are mean (SD). BMI = body mass index.

Forty-seven (22%) of 218 male respondents and 59 (26%) of 228 female respondents were tattooed ($P = .39$). Table 4 shows the location and frequency of tattooing by sex. Twenty-nine male students (13%) had hand/arm tattoos with 2 removed by the time of the survey. Sixteen males (7%) had back tattoos (none removed), 12 (5%) had shoulder tattoos (none removed), and 5 (2.5%) had chest tattoos (1 removed). Thirty-four female students (14.4%) had back tattoos (1 removed), 12 (5%) had foot/leg tattoos (none removed), and 10 (4%) had tattoos on the abdomen (none removed).

Among 106 tattooed subjects, there was a total of 149 tattoos (range of 1-3 sites per individual). Of these, 143 were current, and 6 (4%) had been removed. Male athletes were significantly more likely to be tattooed than nonathletes ($P = .02$). This was not so for females ($P = .54$). Among the athletes, there was no significant difference by sport in the prevalence of tattooing ($P = .68$).

Medical complications reported by the 229 pierced students included 7 (3%) suffering local trauma, 11 (4.5%) with bleeding, and 21 (9%) with bacterial infection. The overall incidence was 17%. No complicating viral infections were reported. Of 47 individuals with pierced tongues, 3 (10%) reported subsequent oral or dental injury. Ear piercing complications among 150 students included bleeding in 4 (3%), local trauma in 3 (2%), and bacterial infection in 11 (7%). The total complication rate for ear piercing was 12%. Nose-pierced students reported 1 instance of bleeding (20%), but 4 (80%) of 5 had removed the

Table 2. Prevalence of Piercing and Tattooing by College Class

Class	No. (%) pierced	No. (%) tattooed
Freshman (n=126)	70 (56)	24 (19)
Sophomore (n=102)	59 (58)	25 (25)
Junior (n=136)	56 (41)*	34 (25)
Senior (n=67)	33 (49)	19 (28)
Fifth year (n=18)	10 (56)	4 (22)

* $P = .009$.

Table 3. Prevalence of Piercing by Body Site in Male and Female College Students*

Body site	No. (%) male students (n=218)			No. (%) female students (n=228)		
	Pierced	Not pierced	Removed	Pierced	Not pierced	Removed
Ear	68 (31)	135 (62)	15 (7)	63 (27)	161 (71)	4 (2)
Eyebrow	2 (1)	216 (99)	0 (0)	2 (1)	224 (98)	2 (1)
Nose	0 (0)	218 (100)	0 (0)	1 (0.4)	223 (98)	4 (2)
Cheek	0 (0)	218 (100)	0 (0)	0 (0)	228 (100)	0 (0)
Lip	0 (0)	218 (100)	0 (0)	1 (0.4)	225 (99)	2 (1)
Tongue	5 (2)	208 (95)	5 (2)	27 (12)	191 (84)	10 (4)
Nipple	2 (1)	211 (97)	5 (2)	12 (5)	214 (94)	2 (1)
Navel	1 (0.5)	216 (99)	1 (0.5)	67 (29)	154 (68)	7 (3)
Genitals	2 (1)	216 (99)	0 (0)	4 (2)	223 (98)	1 (0.4)

*Percentages may not equal 100% due to rounding. Some students had piercing at more than 1 site.

piercing by the time of the survey. Nipple piercing, reported by 21 students, resulted in a 21% incidence of bleeding/injury. Navel piercing, reported by 76 students, was complicated by 2 injuries (3%), 6 instances of bleeding (8%), and 10 bacterial infections (13%). Genital piercing was accompanied by 1 instance of injury/bleeding among 7 subjects (14%).

Piercing complication rates did not differ between athletes and nonathletes ($P=.29$). There was a trend toward an increased complication rate in females compared with males ($P=.06$) explained by the relatively high infection rate in students with currently pierced navels (67 of 68 being female).

No medical complications of tattooing were reported by any of the 106 tattooed students. Tattoos had been removed in 6 (6%) of 106 subjects. There were no significant relationships between body art and height, weight, or body mass index by sex or athletic participation.

DISCUSSION

To our knowledge, this is the first study to survey the prevalence of body piercing and tattooing in a sizable and representative population of university undergraduate students. Although the survey was voluntary, 100% of surveyed athletes and 90% of surveyed nonathletes participated for an overall response rate of 94.4%.

Studies of tattooing prevalence have been reported. Rooks et al²⁸ found that 35% of patients in the 16- to 35-year-old age group presenting to a hospital emergency department were tattooed. Prevalence for ages 36 to 50 years and 51 to 65 years was 28% and 6%, respectively. Of interest, tattooing prevalence among the professional staff attending the patients was 19%, 11%, and 5% by corresponding age groups. Significant correlates of tattooing were cigarette smoking and lower education level, while no relation existed to sex or chief medical complaint.

Armstrong et al²⁹ found tattooing prevalence in 1835 military recruits to be 36%. Sixty-four percent of these trainees entered the military with tattoos, suggesting that the tattoos were acquired in high school. In marked contrast to our students, the military subjects reported a 76% incidence of procedural bleeding. We believe that this difference results from the wording of our survey, which inquired only about infection, scarring, and "other" as complications of tattooing without specific mention of bleeding. Our respondents may not have experienced bleeding severe enough to merit comment under the "other" category.

We report a 51% incidence of body piercing and a 23% incidence of tattooing among university undergraduate students. We found no differences in the prevalence of body art by undergraduate class except for a significantly reduced incidence of piercing in junior students (Table 2). We have no plausible explanation for this finding since the proportion of males to females among juniors was not different from other classes. In general, our data suggest that body art application is a consistent behavioral phenomenon over the past 5 years since the incidence remains fairly constant from freshman to fifth-year classes.

Since athletes are reported to be more prone to risk-taking behaviors such as fighting, weapons possession, alcohol use, and chemical experimentation,^{30,31} we had hypothesized that they would exhibit a higher prevalence of body art. This proved to be true only for tattooing in male students. Our survey instrument aimed for simplicity and brevity to promote the response rate; therefore, inquiries concerning subjects' motivation were not included. However, athletes have reported to us that entire teams may have an identical tattoo applied to a common body site as a bonding symbol. We have not encountered similar reports concerning body piercing.

Table 4. Prevalence of Tattooing by Body Site in Male and Female College Students*

Body site	No. (%) male students (n=218)			No. (%) female students (n=236)		
	Tattooed	Not tattooed	Removed	Tattooed	Not tattooed	Removed
Hand/arm	27 (12)	189 (87)	2 (1)	3 (1)	233 (99)	0 (0)
Foot/leg	8 (4)	209 (96)	1 (0.5)	12 (5)	224 (95)	0 (0)
Neck	0 (0)	218 (100)	0 (0)	3 (1)	233 (99)	0 (0)
Chest/breast	4 (2)	213 (98)	1 (0.5)	1 (0.4)	234 (99)	1 (0.4)
Back	16 (7)	202 (93)	0 (0)	33 (14)	202 (86)	1 (0.4)
Shoulder	12 (6)	206 (94)	0 (0)	6 (4)	230 (98)	0 (0)
Buttock	0 (0)	218 (100)	0 (0)	3 (1)	233 (99)	0 (0)
Abdomen	1 (0.5)	217 (99)	0 (0)	10 (4)	226 (96)	0 (0)
Face	0 (0)	218 (100)	0 (0)	0 (0)	236 (100)	0 (0)
Other (hip)	0 (0)	218 (100)	0 (0)	4 (2)	232 (98)	0 (0)

*Percentages may not equal 100% due to rounding. Some students had tattoos at more than 1 site.

The overall medical complication rate of body piercing among our respondents was 9.2%. Of pierced students, 1.5% reported injury or tearing of the site, 2.4% reported bleeding, and 4.6% had bacterial infection. Oral injuries occurred in 3 (6%) of 47 tongue-pierced subjects. If our prevalence and complication rates are representative for this age group, these morbid events comprise a considerable demand on and cost to the health care system.

The absence of reported medical complications from tattooing among our subjects is noteworthy. It must be emphasized, however, that none of our respondents reported viral infection as a medical complication either from piercing or tattooing. Although our brief survey did not ascertain the time interval since the application of body art to our subjects, it can be surmised (in view of their ages) that most were pierced/tattooed within the previous 3 to 5 years. This interval may be too brief to detect subclinical infection with hepatitis B, hepatitis C, or the human immunodeficiency virus (HIV). Several authors have reported tattooing in a variety of settings as a risk factor for hepatitis and HIV infections.^{13,17,18,21,22} To the contrary, Silverman et al³² reported no increased prevalence of hepatitis in tattooed subjects in their study population of emergency department patients. Greif et al³³ have reported in an extensive survey of tattooed and pierced university students at 19 institutions that 88% reported their body art to have been performed "by professional artists in a studio using sterile, disposable needles, skin disinfection, proper hand washing, and clean latex gloves." Only 2 of those 828 pierced or tattooed students reported contracting hepatitis. Even if the risk of hepatitis/HIV transmission as a consequence of piercing/tattooing is quite low, the high prevalence of these practices may imply a potentially important long-term public health problem.

We had hypothesized that the decision to acquire body art might relate to some aspect of body image, perhaps

reflected by somatotype. However, we found no relation between body art prevalence and standard measures of body somatotype (height, weight, and body mass index). Although self-reporting of body height and weight may be inaccurate in some cases, the failure to provide these data by 4% and 5% of our subjects, respectively, might suggest that those having the most significant "problem" with these questions chose not to respond rather than to distort their numbers.

Our study has several limitations. The results presented here are based on a cross-sectional survey of American undergraduate college students at a single school. We believe that they are a diverse and representative sample (52% female, 48% male; 60% white, 10% African American, 9% Hispanic, 3% international, 18% race not indicated), but additional surveys of students and athletes in different settings are desirable to extend our observations. More studies are also required to delineate accurately the medical complication rates that we are reporting since our students cannot be presumed to have a high degree of medical sophistication. In addition, further follow-up, including serological surveys of pierced and tattooed subjects, will be necessary to assess the risk of acquiring viral illness as a consequence of body art.

REFERENCES

1. Mayor A. People illustrated. *Archaeology*. 1999;52:54-57.
2. Koenig LM, Carnes M. Body piercing medical concerns with cutting-edge fashion. *J Gen Intern Med*. 1999;14:379-385.
3. Bethke G, Reichart PA. Risk of oral piercing [in German]. *Mund Kiefer Gesichtschir*. 1999;3:98-101.
4. Hardee PS, Mallya LR, Hutchison IL. Tongue piercing resulting in hypotensive collapse. *Br Dent J*. 2000;188:657-658.
5. Ram D, Peretz B. Tongue piercing and insertion of metal studs: three cases of dental and oral consequences. *ASDC J Dent Child*. 2000;67:326-329.
6. Simplot TC, Hoffman HT. Comparison between cartilage and soft tissue ear piercing complications. *Am J Otolaryngol*. 1998;19:305-310.

7. Folz BJ, Lippert BM, Kuelkens C, Werner JA. Hazards of piercing and facial body art: a report of three patients and literature review. *Ann Plast Surg.* 2000;45:374-381.
8. Krause H, Bremerich A, Sztraka M. Complications following piercing in the oral and facial region [in German]. *Mund Kiefer Gesichtschir.* 2000;4:21-24.
9. Garcia Callejo FJ, Martinez Beneito MP, Ortega Navarro MC. Body piercing complications in otorhinolaryngology [in Spanish] [letter]. *Acta Otorrinolaringol Esp.* 1998;49:338-339.
10. More DR, Seidel JS, Bryan PA. Ear-piercing techniques as a cause of auricular chondritis. *Pediatr Emerg Care.* 1999;15:189-192.
11. Perkins CS, Meisner J, Harrison JM. A complication of tongue piercing. *Br Dent J.* 1997;182:147-148.
12. Satchithananda DK, Walsh J, Schofield PM. Bacterial endocarditis following repeated tattooing. *Heart.* 2001;85:11-12.
13. Guiard-Schmid JB, Picard H, Slama L, et al. Piercing and its infectious complications: a public health issue in France [in French]. *Presse Med.* 2000;29:1948-1956.
14. Dyce O, Bruno JR, Hong D, Silverstein K, Brown MJ, Mirza N. Tongue piercing: the new "rusty nail"? *Head Neck.* 2000;22:728-732.
15. Tweeten SS, Rickman LS. Infectious complications of body piercing. *Clin Infect Dis.* 1998;26:735-740.
16. Scheig R. Acute and chronic viral hepatitis. *Lippincotts Prim Care Pract.* 1998;2:390-397.
17. Mele A, Corona R, Tosti ME, et al. Beauty treatments and risk of parenterally transmitted hepatitis: results from the hepatitis surveillance system in Italy. *Scand J Infect Dis.* 1995;27:441-444.
18. Brusaferrro S, Barbone F, Andrian P, et al. A study on the role of the family and other risk factors in HCV transmission. *Eur J Epidemiol.* 1999;15:125-132.
19. Braithwaite RL, Stephens T, Sterk C, Braithwaite K. Risks associated with tattooing and body piercing. *J Public Health Policy.* 1999;20:459-470.
20. Sebastian VJ, Ray S, Bhattacharya S, Maung OT, Saini HA, Jalani HJ. Tattooing and hepatitis B infection. *J Gastroenterol Hepatol.* 1992;7:385-387.
21. Ko YC, Ho MS, Chiang TA, Chang SJ, Chang PY. Tattooing as a risk of hepatitis C virus infection. *J Med Virol.* 1992;38:288-291.
22. Haley RW, Fischer RP. Commercial tattooing as a potentially important source of hepatitis C infection: clinical epidemiology of 626 consecutive patients unaware of their hepatitis C serologic status. *Medicine (Baltimore).* 2001;80:134-151.
23. Farah CS, Harmon DM. Tongue piercing: case report and review of current practice. *Aust Dent J.* 1998;43:387-389.
24. Botchway C, Kuc I. Tongue piercing and associated tooth fracture. *J Can Dent Assoc.* 1998;64:803-805.
25. Er N, Ozkavaf A, Berberoglu A, Yamalik N. An unusual cause of gingival recession: oral piercing. *J Periodontol.* 2000;71:1767-1769.
26. De Moor RJ, De Witte AM, De Bruyne MA. Tongue piercing and associated oral and dental complications. *Endod Dent Traumatol.* 2000;16:232-237.
27. Armstrong ML, Murphy KP. Tattooing: another adolescent risk behavior warranting health education. *Appl Nurs Res.* 1997;10:181-189.
28. Rooks JK, Roberts DJ, Scheltema K. Tattoos: their relationship to trauma, psychopathology, and other myths. *Minn Med.* 2000;83:24-27.
29. Armstrong ML, Murphy KP, Sallee A, Watson MG. Tattooed army soldiers: examining the incidence, behavior, and risk. *Mil Med.* 2000;165:135-141.
30. Garry JP, Morrissey SL. Team sports participation and risk-taking behaviors among a biracial middle school population. *Clin J Sports Med.* 2000;10:185-190.
31. Aaron DJ, Dearwater SR, Anderson R, Olsen T, Kriska AM, Laporte RE. Physical activity and the initiation of high-risk health behaviors in adolescents. *Med Sci Sports Exerc.* 1995;27:1639-1645.
32. Silverman AL, Sekhon JS, Saginaw SJ, Wiedbrauk D, Balasubramaniam M, Gordon SC. Tattoo application is not associated with an increased risk for chronic viral hepatitis. *Am J Gastroenterol.* 2000;95:1312-1315.
33. Greif J, Hewitt W, Armstrong ML. Tattooing and body piercing: body art practices among college students. *Clin Nurs Res.* 1999;8:368-385.