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The authors investigated the association between doping agents (mostly anabolic-androgenic steroids) and involvement in violence and experience of violent victimization in Oslo, Norway. The sample consisted of 10,828 adolescents aged 14 to 17 years. Of the adolescents, 11.5% had been offered doping agents and 1.8% had used doping agents. When confounding variables were controlled for, there was an association between exposure to doping agents and own violence for both genders, but use of doping agents had no additional effect. The same pattern was found with regard to victimization. However, when only the most serious victimization episodes were considered, increased risk for users of doping among boys but not girls was found. Doping agents may serve as a marker of a violent subculture more than being a causal factor in the etiology of violence. However, use of doping agents may also result in a big appearance in male users, which may make them a target for youth violence.

Violent Behaviors, Violent Victimization, and Doping Agents

A Normal Population Study of Adolescents

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Certain groups are more involved in violence than others, both as aggressors and victims. Youthfulness and male gender are among the important characteristics (Junger-Tas, 1996; Miethe & Meier, 1994). Furthermore, a large body of research has linked alcohol and violence, and it seems now well documented that heavy drinking is linked with physical aggression and violent offending (Graham, Leonard, & Room, 1998; Rossow, Pape, & Wichstrøm, 1999), even though there is considerable disagreement as to what degree these associations are causal. The most influential alternative explanation concentrates on the wide array of confounding factors potentially influencing both phenomena (Pernanen, 1991). New research has also shown that victims of violence are often heavy consumers of alcohol and often under the influence of alcohol during the violent incident (Lauritsen, Laub, & Sampson, 1992; Sampson & Lauritsen, 1990).

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In many countries, increasing concern is also emerging for violence associated with the use of doping agents, in particular anabolic-androgenic steroids (AAS). Are there reasons to surmise that the use of doping agents plays a role when it comes to carrying out violence or becoming the victim of violent victimization?

Doping Agents, Aggression, and Violence

AAS include the male androgenic hormone, testosterone, its synthetic derivatives, and other less androgenic hormones such as nandrolone. Several studies have reported that a considerable minority of adolescents and young adults in Western countries use these substances. In the United States, the lifetime prevalence is reported to be between 4% and 10% in males and not to exceed 2% in females (Bahrke, Yesalis, & Brower, 1998). In other Western countries, the prevalence rates are lower and reported to lie between 1% and 3% in males and 0.2% and 2% in females (Adlaf & Smart, 1992; Kindlundh, Isacson, Berglund, & Nyberg, 1999; NSSDS, 1993; Williamson, 1993).

AAS are usually considered as a means to enhance athletic performance and physical appearance (Bahrke, Yesalis, & Brower, 1998; Yesalis & Bahrke, 1995). Still, one should note that a large group of AAS users report that they do not participate in competitive sports (Buckley et al., 1988; DuRant, Middleman, Faulkner, Emans, & Woods, 1995). Furthermore, AAS are often used in a polydrug use pattern in groups with a risky lifestyle and in groups with a high consumption of alcohol and illegal drugs (DuRant, Escobeda, & Heath, 1996; Kindlundh, Isacson, Berglund, & Nyberg, 1999; Pedersen & Wichstrøm, 2001). Several studies suggest that use of AAS is addictive (Brower, Blow, Young, & Hill, 1991). AAS use has been reported to be associated with pathological narcissism and low empathy (Porcerelli & Sandler, 1995), and in several studies it has also been linked to mood disturbances and irritability (Pope & Katz, 1992, 1994).

Anabolic steroid use is associated with increases in self-reported aggressiveness. This is a consistent finding across studies looking at male athletes (Bahrke, Wright, Strauss, & Catlin, 1992; Perry, Yates, & Anderson, 1990), female athletes (Strauss, Liggett, & Lanese, 1985), and both genders (Taylor & Black, 1987; Yesalis, Kennedy, Kopstein, & Bahrke, 1993). Experimental evidence suggests that testosterone supplementation may lead to increased aggressive responses in some men in a laboratory setting (Kouri, Lukas, Pope, & Oliva, 1995; Pope, Kouri, & Hudson, 2000). Evidence from real-life events and actual physical aggression or violence is more sparse. However, anecdotal and case-based evidence suggest that use of AAS may lead to aggressive behaviors, serious violence, and even to murder (Choi, Parrot, &

Cowan, 1990; Conacher & Workman, 1989; Pope & Katz, 1990). But these reports are based on single cases, and factors other than AAS use may account for these behaviors. Evidence for such an association was also found in a study by Pope & Katz (1994) in which AAS use was reported to be associated with violence in steroid-related manic episodes in a sample of weight lifters. One AAS user reported to have damaged three cars using his fists and a metal bar because he was annoyed by traffic delay. Another AAS user caused serious property damage during a fit of anger at a sports event, and still another beat and almost killed a dog. Most of the individuals in this study denied comparable aggressive behavior before starting to use steroids. Choi and Pope (1994) compared AAS-using and AAS-nonusing strength athletes with regard to aggression and violence toward wives and girlfriends. They found that AAS users reported more fights, verbal aggression, and violence when using AAS than when not using AAS.

Thus, a number of findings indicate that use of AAS may cause aggression and violent behavior. Still, many researchers have questioned both these effects and their hypothesized pharmacological basis (Bahrke, Yesalis, & Wright, 1990; Riem & Hursey, 1995). First, there are almost no normal population studies in this area. Most studies have been on weight trainers, who probably differ from the normal population in many respects. Second, associations between AAS and violence may be spurious and accounted for by numerous shared risk factors for both phenomena. Sharp and Collins (1998) maintained that most of the research trying to link AAS with aggression and violence was characterized by methodological weaknesses. Still, there is some evidence that the pharmacological properties of AAS are responsible for aggression (e.g., Pope, Kouri, & Hudson, 2000). The effects may be partially mediated by the self-fulfillment of expectations about AAS effects (Bjørkquist, Nygren, Bjørklund, & Bjørkquist, 1994) or users' perceptions of their changing physique (Brower et al., 1991). Furthermore, one could hypothesize that certain youth groups and environments may promote AAS use as part of the norms in the culture. It has been suggested, for example, that the atmosphere in commercial gyms can promote norms associated with AAS use and norms associated with violence (Fuller & LaFountain, 1987). From previous studies, we know that for most users of doping agents, the black market (defined as any source other than medically prescribed) is the main source of supply, and many users in fact obtain doping agents in commercial gyms (Kersey, 1993; Luetkemeier, Bainbridge, Walker, Brown, & Eisenman, 1995). One could further hypothesize that such milieus also function as socialization arenas for learning violent behaviors. Thus, it is important to investigate whether the actual use of AAS gives an increased risk of physical aggression and violent behavior in real-life situations among unse-

lected samples of adolescents, when participation in doping-using milieus is controlled for.

Violent Victimization

For many years, it has been clear that structural characteristics of communities are associated with high rates of violent victimization—in particular, low socioeconomic status and residential mobility (for a review, see Meadows, 1998). In a recent study, Sampson, Raudenbush, and Earls (1997) reported that concentrated disadvantage and residential instability were associated with rates of violent victimization, and that the mediating mechanism seemed to be lack of social cohesion and little willingness among the inhabitants to intervene on behalf of the common good. During the past decades, it has become evident that certain lifestyles are also associated with victimization risk (see Pedersen, 2001). For example, Miethe and Meier (1994) reported that a composite of night activity, including the number of nights spent outside the home in leisure and social activities and the number of nights spent walking alone outside the home, predicted personal assault. However, Jensen and Brownfield (1986), in a critical discussion of the lifestyle paradigm, argued that an artificial dichotomy was created between victims and offenders. Their empirical findings supported this suggestion: Delinquent activities were more strongly related to victimization than other activities. In line with this, Sampson and Lauritsen (1990) found that violent offending and deviant lifestyles were associated with victimization risk, whereas Lauritsen et al. (1992) found that a summary measure of delinquency involvement (e.g., assault, theft, robbery) was associated with victimization risk. In addition, there were associations with use of alcohol in both these studies.

Thus, it seems well documented that use of alcohol and participation in deviant and law-breaking activities enhance the possibility of violent victimization. We know from previous studies that there are associations between use of doping agents and such lifestyles. However, to our knowledge, no studies have investigated whether the use of doping agents play a role in the etiology of violent victimization.

AIM OF THE STUDY

In the present study, we will investigate the relationship between doping agents on one hand and violent behaviors and violent victimization on the other hand. More precisely, we ask the following:

- Are adolescents in milieus in which doping agents are present involved in violent behaviors more often than adolescents in milieus in which doping agents are not used?
- Are adolescents in these milieus more at risk for becoming victims of violent victimization than other adolescents?
- Are there additional effects in this respect from the actual use of doping agents, as regards violent behaviors and risk of violent victimization?

There are reasons to surmise that the use of doping agents plays a different role in men than in women. Thus, possible gender-specific associations will be particularly highlighted. Furthermore, we will investigate whether possible associations can be explained by factors that influence rates of exposure to and use of doping agents, such as alcohol use and alcohol problems, socioeconomic status, parental monitoring, parental unemployment, and, independently of this, violence and violent victimization.

METHOD

Procedure and Sample

The survey data are from the research project Young in Oslo, in which adolescents from Oslo took part in a large survey study in 1996 (Pedersen & Skrondal, 1999). Consent was obtained from the education authorities and the school boards in Oslo. All students gave their consent based on both an oral and a written description of the project formulated according to the standards prescribed by the Norwegian Data Inspectorate. All parents were also informed about the research project. To avoid students influencing each other's responses, all eligible students at each school completed questionnaires at the same time.

The adolescents were recruited from the 8th, 9th, and 10th grades in the school system, and all public and private schools in Oslo were included. Approximately 98.5% of the total population of adolescents were enrolled in the school system in Oslo in the 8th and 9th years of school, whereas approximately 90% of the cohort were in the 10th year. The response rate was 94.3%. Some of those who are most likely to commit violence were clearly concealed in the attrition but, even so, the high response rate made the material well suited for investigating violence.

The sample consisted of 10,828 adolescents, 50.8% of whom were boys and 49.2% girls. The age range was 14 to 17 years old, and the mean age was 15.4 years ($SD = 0.94$). A more detailed description of the sample, dropouts, and methods of sampling is reported elsewhere (Bakken, 1998).

Measures

Violence and violent victimization. Engagement in violent behavior during the past 12 months was assessed by means of four questions: (a) "Have you threatened someone or carried out violence to anyone?" (b) "Have you been in a quarrel or fight with someone with a different skin color or cultural background than yourself?" (c) "Have you threatened anyone to obtain money or goods?" and (d) "Have you taken part in a fight using a weapon (e.g., a knife)?" The answers were dichotomized (no/yes), then all four items were combined in the violence index, with values 0 to 4. The questions about violence were taken from Windle (1990) and Olweus (1989). We also asked about a wide range of victimization experiences: "Have you, during the past 12 months, been a victim of any of the acts or threats mentioned below?" This introduction was followed by three statements related to (a) being hurt without getting bruises; (b) being hurt so seriously as to get wounds, but without needing medical treatment; and (c) being victimized so seriously as to need medical treatment. The answers were combined in the victimization index, with values 0 to 3.

Doping agents. We first asked, "Have you ever been offered doping agents (anabolic steroids, etc.)?" Then we asked, "Have you ever used doping agents?" Thus, we were able to identify two groups. First, the group that had been exposed to the use of doping agents. This type of exposure was taken as a crude indicator of participation in a milieu in which doping agents were present. Second, we identified the group that had used doping agents. Thus, we were also able to analyze whether the two groups differed on central characteristics.

Alcohol and drugs. To measure frequency of alcohol consumption, the respondents were asked, "Do you ever drink any kind of alcohol?" Possible answers ranged from "Do not drink alcohol" to "Drink more than twice a week." However, earlier research has shown that drinking episodes with more than five drinks or leading to intoxication are more strongly related to alcohol-related harm than are measures of alcohol consumption frequency (Room, Bondy, & Ferris, 1995; Single & Wortley, 1993). Therefore, we also asked how many times during the past 4 weeks the respondent had drunk more than 5 units of alcohol. The answers were transformed into an ordinal scale with values from 0 (*never*) to 6 (*8 or more times*). We further asked how many times the respondent had been intoxicated by alcohol during the past year, with values from 0 (*never*) to 7 (*101 or more*). Finally, to measure alcohol problems, four items from Rutger's Alcohol Problem Index (RAPI) were

used (White & Labouvie, 1989). The instrument measures various consequences of alcohol consumption, related to depression, blackouts, dependence, and social problems and captures the most important aspects of alcohol abuse and dependence, as conceptualized in *DSM-IV* (American Psychological Association [APA], 1994). None of the items were related to violence, and the index had a range from 0 to 8 and a Cronbach's alpha of .72. The respondents were also asked whether they had sniffed glue (2.5%) or used cannabis, ecstasy (MDMA), or amphetamines during the past 12 months. Due to a high degree of polydrug use, we created a drug involvement variable, fitting the drug involvement sequence in this sample previously documented by Pedersen and Skrondal (1999). The variable had five categories: no illegal drug use (86.0%), cannabis use only (9.9%), use of amphetamines (1.2%), use of MDMA (1.4%), and the combination of use of amphetamines and MDMA (1.6%). The last three categories often included use of cannabis.

Gender role identification. Masculinity and femininity were measured by a brief version of Bem's Sex Role Inventory (alpha = 0.71 and 0.77, respectively) (Bem, 1974).

Leisure-time activities. Two questions were asked about the number of days the respondents had taken part in the following sports activities during the past week: "Have you been to a commercial gym?" and "Have you taken part in self-defense or martial arts training (boxing, karate, kickboxing)?" We also wanted to get a picture of whether the adolescents frequented the central parts of Oslo, which are well known for violence and where much of the drug dealing takes place. Thus, we asked participants the following: "Have you been in the center of Oslo during the past week (the past 7 days)? (Do not include journeys to/from school/work)". There were reply options for all weekdays and also a column for "evening" and "at night (after midnight)" for each day. The answers were combined to give two indices with values from 0 to 7 for "evenings in town" and "nights in town." Finally, we asked about participation in various unorganized leisure time activities during the past week, such as "hanging around at a street corner" and "driving around with a car or motorbike just for fun (as driver or passenger)." The answers were combined into the unorganized leisure index with values from 0 to 45. We also asked three questions about two best friends' use of alcohol and cannabis, and whether these two best friends had been in contact with the police due to something illegal they had done (all variables with values 0 to 2).

Sociodemography. Oslo is divided into 25 city districts, and we asked the respondents in which of these city districts they lived. We asked about the

father's and mother's education and work, and this information was combined into a measure of parental social class, which was classified according to the occupation standard ISCO 88 (International Labour Organization, 1990). A fivefold classification was used, with a range from upper managerial (9.1%) to working class (26.8%). Furthermore, 11.6% of the respondents had parents who were unemployed or living on social welfare. Due to Statistics Norway's definition, adolescents with both parents born in another country were regarded as immigrants. Based on this definition, 14.2% had an immigrant background from non-Western countries, most commonly from Pakistan, Morocco, Turkey, and Vietnam, whereas 3.5% were immigrants with a background from Western countries.

Family factors. The Parental Bonding Instrument (PBI) was used to measure the emotional relationship between parents and our respondents (Parker, Tupling, & Brown, 1979). This instrument captures two dimensions: One group of statements is connected with care ("have been affectionate towards me") and another with control or overprotection ("have allowed me to decide things myself"). A high care score implies that the parents were considered to be empathetic, warm, understanding, and friendly. A low score indicates that the parents were cold, not very helpful, rejecting, and provided insufficient care. At one end of the control scale, parents were described as overprotective in that they caused their children to remain dependent and infantile and were invasive and controlling. At the other end of the scale, parents gave their children autonomy, as much freedom as they wished, and let them make their own decisions. (Cronbach's alpha was .72 for the control dimension and .71 for the care dimension.) Based on Olweus (1989), a measure of parental control and monitoring was included (scale 0 to 16; alpha = .80). Exposure to alcohol in the home was measured using three questions pertaining to whether the adolescent obtained alcohol from his or her parents in various situations ("particular occasions," "Sunday dinner," or "to take with me to a party"). The answers were combined to give an index with values 0 to 3.

Statistical Methods

The bivariate analyses were conducted by means of contingency tables with chi-square tests and one-way ANOVAs. In the multivariate analyses, we had two dependant variables: an index for the number of violent behaviors (values 0 to 4) and an index for the experience of violent victimization (values 0 to 3). Both variables were analyzed by logistic regression models, and the regression results are presented with their odds-ratio statistics. Logistic regression models normally rest on the assumption of proportional odds,

implying that the odds ratios are constant whatever the level of the explanatory variables. This is also the case for the ordinal logistic regression model used here. The odds ratios are assumed to be constant whatever the level of other explanatory variables and cut-point levels of the dependent variable (between 0 and 1, 1 and 2, etc.) (Liao, 1994). Note that our sample of adolescents was collected from all the schools in Oslo. Such data may lead to correlated residuals within each school. To account for possible clustered data, we have applied a Huber (sandwich) estimator of the standard errors (the variance-covariance matrix), which assumes that the pupils are statistically independent between schools and not necessarily within schools (Rogers, 1993).

Two explanatory variables were central in our analysis: the effect of being offered doping agents (being in milieus in which doping agents are present) and whether there were additional effects of the actual use of doping agents. We assumed that those who had used doping agents had also been offered such substances. The first dummy variable (exposure to doping agents) compared all those who had been offered doping agents, regardless of whether they had actually used them, with those who had not been offered them. The second dummy variable (use of doping agents) compared those who had used doping agents with those who had only been offered them. This coding scheme is called contrast (orthogonal) coding, and it is typically used when a third group is cancelled out (had no logical value) in a comparison between three or more groups (see Hardy, 1993). In our analysis, those who had neither been offered nor used doping agents were given the value 0 in the second dummy variable, but they had no impact on this coefficient. For our analysis, it allows more straightforward interpretation of the results compared with the more familiar indicator-coded dummy variables.

RESULTS

Table 1 gives a summary of our most central variables. The items measuring violence carried out during the past 12 months varied from a high of 16.6% for "Having been in a quarrel or fight with someone with another skin color or cultural background" to a low of 3.0% for "Have you obtained money or goods from anyone by threatening them?" A total of 22.8% had carried out at least one of these kinds of violence, 32.3% of the boys and 12.9% of the girls. On the violence sum index (range 0 to 4), the boys had a mean score of 0.52 and the girls 0.17.

More than 1 in 3 of the adolescents reported that they had been victims of the least serious forms of violence during the past 12 months ("hurt without getting bruises"). Of the participants, 6.2% reported that they had been injured

TABLE 1: Use of Doping Agents, Participation in Violence, and Experience of Violent Victimization, by Gender (N = 10,828)

	<i>Boys</i>		<i>Girls</i>		<i>Total</i>	
	%	n	%	n	%	n
Violence						
Threats						
No	84.1	4,623	94.4	5,019	89.2	9,642*
Yes	15.9	873	5.6	297	10.8	1,170
Ethnic conflict						
No	76.2	4,189	90.9	4,830	83.4	9,019*
Yes	23.8	1,307	9.1	486	16.6	1,793
Fight with weapon						
No	92.2	5,066	98.6	5,239	95.3	10,305*
Yes	7.8	430	1.4	77	4.7	507
Confronting a victim						
No	95.1	5,226	99.0	5,261	97.0	10,487*
Yes	4.9	270	1.0	55	3.0	325
Victimization						
Hurt without bruises						
No	60.0	3,295	71.7	3,809	65.7	7,104*
Yes	40.0	2,201	28.3	1,507	34.3	3,708
Hurt with wounds, no medical treatment						
No	78.4	4,397	88.7	4,717	83.5	9,024*
Yes	21.6	1,189	11.3	599	16.5	1,788
Hurt and needed medical assistance						
No	91.2	5,010	96.6	5,135	93.8	10,141*
Yes	8.8	486	3.4	181	6.2	667
Doping agents						
No exposure/use	84.1	4,623	89.3	4,749	86.7	9,372*
Exposure (no use)	13.6	746	9.4	499	11.5	1,245
Use	2.3	127	1.3	68	1.8	195

* $p < .001$.

so badly as to need medical treatment (8.8% of the boys and 3.4% of the girls). On the victimization sum index (range 0 to 3), the boys reported a mean of 0.81, whereas the girls had a mean of 0.49.

Finally, 2.3% of the boys and 1.3% of the girls reported a lifetime ever use of doping agents, whereas 11.5% had been offered doping agents without using them. All gender differences in Table 1 were significant ($p < .001$).

All forms of violence were more prevalent among those who had been exposed to doping agents, and they were even more prevalent among the users of doping agents (see Table 2). However, as Table 2 reveals, there were also numerous other variables with strong associations to the violence items.

This was true for RAPI scores (alcohol problems), use of illegal drugs, and the number of evenings in the city center. The table further shows associations between violence and peer, family, and sociodemographic variables. There were no clear associations between ethnic background and violence, and only marginally more violence among those with a working-class background. The analysis also revealed correlations between the use of commercial gyms and violence. Further analysis also uncovered correlations between the use of commercial gyms and the use of doping agents, alcohol, and illegal drugs, indicating that these gyms, in a Norwegian context, may be socialization arenas for the use of doping agents and for violent behavior.

In Table 2, the last three columns show that exposure to and use of doping agents were associated with the experience of victimization. There was a significant increase in all kind of victimization experiences, but as much as a fivefold increased risk of the most serious victimization in the users of doping agents (25.6%) as opposed to the group without use or exposure (5.2%). But also for this variable, we see associations with other sociodemographic, family, and individual variables. Note that both immigrant backgrounds were positively associated with serious victimization risk, but the opposite pattern was found with regard to milder victimization.

In summary, exposure to and use of doping agents were strongly associated with variables measuring own violence and the experience of victimization. However, numerous confounders should be controlled for to establish whether these associations were spurious.

Multivariate Analyses

In Table 3, the dependent variable was the sum-index of violent behaviors (values 0 to 4). In Model 1, exposure to and use of doping agents were the only explanatory variables included. The exposure estimate is an average of the use and the exposure groups compared with the nonexposure group, whereas the use estimate compares the use and the exposure groups only (contrast coding). Both variables had effects, which implies that there was an association between exposure to doping agents and violence but that there was an additional effect from the actual use. In Model 2, sociodemographic, family, and peer variables were included and the exposure variable still remained significant, whereas the use of doping agents lost much impact and was no longer statistically significant. In the final model, Model 3, variables relating to gender role identification, leisure-time activities, and variables measuring use of alcohol and drugs were included as well. The effect of exposure (measured as the logarithm of the OR statistics) was reduced by 70%, whereas there was no remaining effect at all for use of doping agents. There

TABLE 2: Violent Behaviors and Victimization, by Sociodemographic, Family, and Individual Characteristics (N = 10,828)

<i>Variable</i>	<i>n</i>	<i>Any Violence</i>	<i>Sum-Index Violence</i>	<i>Any Victimization</i>	<i>Serious Victimization</i>	<i>Sum-Index Victimization</i>
Ethnic background						
Norwegian	8,589	23.2	0.36	53.4	5.1	0.76
Western immigrant	433	24.2	0.39	49.2	9.0	0.81
Non-Western	1,806	20.3 ^a	0.32 ^a	37.4	10.3	0.70
Working class background						
No	7,230	22.1	0.34	51.5	5.6	0.73
Yes	2,557	25.0	0.39	50.6 ^a	7.9	0.80
Parents unemployed or on social security						
No	9,572	22.3	0.34	50.7	5.6	0.74
Yes	1,256	26.2	0.43	49.3 ^a	10.4	0.83
Parental monitoring						
0 to 1 (high)	3,575	15.0	0.21	42.7	6.1	0.65
2 to 3	2,340	20.3	0.29	49.1	4.3	0.68
4 to 5	2,372	24.3	0.34	54.5	5.1	0.78
6 to 7 (low)	2,541	34.4	0.61	59.3	8.9	0.94
Parental alcohol exposure						
None	5,283	19.3	0.29	48.4	5.9	0.71
Some	4,793	25.3	0.39	57.3	5.9	0.86
High	426	35.0	0.68	60.5	12.0	1.01
Peers' police contact						
None	8,543	16.5	0.22	46.1	4.8	0.66
One	1,492	39.1	0.67	65.3	9.4	1.03
Both	793	59.3	1.21	71.5	14.8	1.22
Evenings in city's center						
0	7,043	19.2	0.28	48.2	5.3	0.70
1 to 2	2,864	26.2	0.41	53.5	6.0	0.79
3 to 4	640	35.3	0.68	59.1	10.6	0.98
5 to 6	156	48.1	0.87	62.2	17.9	1.17
7	125	48.8	1.02	60.6	19.2	1.16
Days using commercial gyms						
0	8,749	20.6	0.30	49.2	5.2	0.71
1 to 2	1,351	28.5	0.46	54.5	8.0	0.85
3 to 4	382	35.5	0.60	63.4	10.2	0.99
5 to 6	160	38.8	0.76	50.6	13.1	0.91
7	186	41.9	0.91	61.8	22.0	1.21
Doping agents (DA)						
No exposure/use	9,009	19.4	0.28	48.0	5.2	0.69
Exposure only	1,193	43.4	0.76	67.0	10.4	1.08
Use	191	52.3	1.28	71.8	25.6	1.44

(continued)

TABLE 2 Continued

Variable	n	Any Violence	Sum- Index Violence	Any Victimization	Serious Victimization	Sum- Index Victimization
RAPI score						
0	6,943	16.9	0.23	42.9	4.3	0.60
1	1,260	25.6	0.39	54.5	5.2	0.78
2	853	29.2	0.47	58.5	8.9	0.87
3 to 4	931	35.0	0.58	63.5	8.4	0.96
5 to 6	492	40.0	0.75	67.6	11.4	1.14
7 or more	349	55.6	1.16	77.3	26.9	1.45
Drugs						
No illegal drug	9,307	17.9	0.24	47.6	5.4	0.70
Cannabis only	1,068	47.6	0.84	67.6	8.1	1.03
Amphetamines	128	65.6	1.32	69.5	4.7	1.07
Ecstasy (MDMA)	150	54.0	1.19	70.7	15.3	1.23
Amphetamines and MDMA	175	71.4	1.73	74.3	26.3	1.48

NOTE: RAPI = Rutger's Alcohol Problem Index. If nothing else is reported, $p < .001$.

a. Not significant.

were only two variables with effects that differed statistically between boys and girls. Unorganized leisure had a stronger effect in girls, but alcohol intoxication had a stronger effect in boys. Note, however, that several explanatory variables had significant effects in both genders (e.g., unemployed parents, parental monitoring, and peers' police contacts). Furthermore, three alcohol-related measures (alcohol consumption frequency, intoxication frequency, and alcohol problems), glue sniffing, and the drug items all showed positive associations to violence. Neither use of commercial gyms nor participation in self-defense sports was associated with violence when other variables were controlled for.

In Table 4, the experience of victimization was the dependent variable (values 0 to 3). In Model 1, exposure to and use of doping agents were explanatory variables. We note highly significant associations to both variables in boys, whereas the effect as regards use was weaker in girls. In Model 2, sociodemographic variables were included, but this had little impact on the doping agent variables. Finally, in Model 3, variables related to leisure-time activities, training in commercial gyms, use of alcohol and drugs, and violence were also included. The effects of exposure to doping agents was weakened but remained significant, whereas there was no longer any effect from use in either gender. Note that victimization was also highly associated with alcohol problems and own violence in both genders.

TABLE 3: Odds Ratios for Effect of Exposure to and Use of Doping Agents on Violent Behaviors

Variable	Boys		Girls		Total p >
	aOR	95% CI	aOR	95% CI	
Model 1					
Exposure to DA	4.88	3.76-8.59	4.03	2.84-8.01	.392
Use of DA	1.97	1.12-1.97	2.30	1.16-2.30	.727
Model 2					
Exposure to DA	3.31	2.61-5.60	2.77	1.95-5.38	.411
Use of DA	1.49	0.88-1.48	1.86	0.96-1.86	.600
Model 3					
Exposure to DA	1.52	1.20-2.45	1.53	1.04-2.26	.974
Use of DA	0.63	0.39-1.01	1.19	0.60-2.34	.133
Parents unemployed	1.24	1.05-1.47	1.37	1.06-1.76	.531
Parental monitoring	1.05	1.03-1.15	1.04	1.00-1.08	.754
Peers' police contact	1.76	1.60-1.93	1.67	1.45-1.91	.530
BEM masculinity	1.12	1.09-1.15	1.10	1.06-1.15	.569
BEM femininity	0.93	0.91-0.95	0.95	0.92-0.99	.265
Unorganized leisure	1.02	1.01-1.03	1.05	1.03-1.07	.001
Evenings in city center	1.06	1.01-1.11	1.12	1.05-1.19	.139
Commercial gyms	1.01	0.96-1.06	1.01	0.92-1.13	.960
Self-defense sports	1.03	0.98-1.08	1.01	0.91-1.17	.827
Frequency alcohol cons	1.10	1.05-1.15	1.09	1.00-1.20	.779
Intoxication frequency	1.23	1.17-1.30	1.13	1.06-1.12	.028
RAPI scores	1.04	1.00-1.07	1.07	1.01-1.64	.406
Glue sniffing	2.38	1.65-3.43	2.55	1.66-3.93	.808
Use of drugs					
No drugs	1.00	—	1.00	—	—
Cannabis only	2.05	1.63-2.58	1.90	1.46-2.47	.664
Amphetamines	3.20	1.90-5.37	3.17	1.89-5.33	.986
Ecstasy (MDMA)	1.82	1.06-3.11	3.14	1.64-6.00	.204
Amphetamines and MDMA	2.56	1.74-3.77	2.87	1.41-5.84	.786

NOTE: aOR = adjusted odds ratios, CI = confidence interval, DA = doping agent, BEM = Bem's Sex Role Inventory, and RAPI = Rutgers Alcohol Problem Index. The ORs are estimated in models controlling for sociodemographic, family, and peer variables, and sociodemographic, family, peer variables, BEM masculine and feminine sum-score and measures of leisure time activities, alcohol-related measures, and use of drugs. The estimated Model 3 is also described for covariates. Separate models are estimated for boys and girls, and tests for significant differences in estimators for boys and girls are reported.

One could hypothesize that violent victimization is a different phenomenon from the milder victimization episodes. Thus, we conducted the same analyses as reported in Table 4, but now with serious victimization ("so seriously as to need medical treatment") as the dichotomous dependent variable. In boys, the associations became stronger for exposure to doping agents (OR,

TABLE 4: Effect of Exposure to and Use of Doping Agents on the Experience of Victimization

Variable	Boys		Girls		Total p >
	aOR	95% CI	aOR	95% CI	
Model 1					
Exposure to DA	3.07	2.50-3.77	2.55	1.92-3.40	.304
Use of DA	2.33	1.57-3.45	1.18	0.70-1.99	.042
Model 2					
Exposure to DA	3.09	2.52-3.80	2.47	1.85-3.30	.217
Use of DA	2.34	1.59-3.45	1.24	0.73-2.09	.056
Model 3					
Exposure to DA	1.56	1.27-1.90	1.50	1.14-1.96	.821
Use of DA	1.29	0.91-1.84	0.86	0.52-1.43	.195
Ethnic background					
Norwegian	1.00		1.00		
Western immigrant	0.84	0.64-1.09	0.92	0.68-1.25	.643
Non-Western	0.70	0.58-0.85	0.58	0.46-0.72	.210
Parents unemployed	1.06	0.89-1.26	1.23	1.01-1.49	.271
Commercial gyms	0.99	0.95-1.03	0.97	0.92-1.03	.573
Unorganized leisure	1.01	1.01-1.02	1.03	1.02-1.04	.004
RAPI scores	1.16	1.13-1.19	1.14	1.11-1.17	.369
Glue sniffing	1.33	0.96-1.83	1.77	1.26-2.50	.230
Fight with weapon	1.62	1.29-2.03	1.63	0.91-2.90	.985
Ethnic conflict	2.28	2.04-2.56	2.55	2.11-3.09	.326

NOTE: aOR = adjusted odds ratios, CI = confidence interval, DA = doping agent, and RAPI = Rutgers' Alcohol Problem Index. The odds ratios are estimated in models controlling for sociodemographic, family, peer, and lifestyle variables (commercial gyms, unorganized leisure, evenings in city center), and sociodemographic, family, peer, lifestyle variables, alcohol problems, glue sniffing, and items pertaining to own violence. The estimated Model 3 is also described for covariates. Separate models are estimated for boys and girls, and tests for significant differences in estimators for boys and girls are reported.

1.70; 1.28 to 2.25), and even the associations for use of doping agents (1.68; 1.02 to 2.78) became marginally significant. In girls, none of the doping agents variables were significantly associated with violent victimization. (Exposure: OR, 0.79; 0.42 to 1.47; use: OR, 0.49; 0.15 to 1.59.)

DISCUSSION

Main Findings

The present study revealed that 11.5% of mid-adolescents in Oslo had been offered doping agents without using them, whereas 1.8% had used dop-

ing agents at some time during their life. Exposure to doping agents was bivariately associated with violence and victimization, a pattern even more evident for the users of doping agents. Thus, doping agents were found among adolescents who were involved in violence, both as aggressors and victims.

However, when other variables were controlled for, a different picture was revealed. There were still associations between exposure to doping agents and own violence in both genders. However, there was no additional effect from the actual use of doping agents. With regard to the experience of victimization, a more complex picture was uncovered: When all kinds of victimization were considered, exposure to doping agents had an effect in both genders, but no additional effects were found for the use of doping agents. When the most serious victimization episodes were investigated, we again found associations to exposure and even a weak additional effect from use of doping agents in boys but not in girls. We will return to possible interpretations of these findings.

Study Limitations

Our sample consisted of three almost total cohorts of adolescents in Oslo, and we had a high response rate. Thus, the sample must be regarded as well suited for studying low-prevalent phenomena, such as violence and use of doping agents. Still, one should note that the attrition from our study (approximately 5%) and the small group that is not found in the school system probably have higher rates of violence and use of doping agents.

In general, adolescents tend to give valid and reliable information about antisocial behaviors and drug use in anonymous surveys (see Rutter, Giller, & Hagell, 1998). In our study, well-validated measures pertaining to violence, violent victimization, and use of alcohol and drugs were used. But what about our question regarding the use of doping agents? First, one should note that anonymous self-reports from large, unselected populations—as in the present study—is generally regarded to be the best way of getting truthful information about use of doping agents (DuRant, Rickert, & Ashworth, 1993). Note also that the prevalence rate for use of doping agents in the present report was in reassuring accordance with other European studies. Still, there are some particular problems in this research area. Beckett (1991) found that most of the doping agents used were AAS. However, Bahrke et al. (1998) found that some doping agent users reported use of other substances, such as ephedrine, amphetamines, peptide hormones, or human growth hormones. It is difficult to know how large this proportion may be in our sample, but in a previous study of adolescents in Norway, 28% of those admitting lifetime use

of doping agents had used substances other than AAS (Wichstrøm, unpublished data, 2000). Hence, a considerable minority may report experiences with substances other than AAS. Furthermore, a previous study in which self-reports were compared with urine tests indicated that a minority of users of doping agents may also be misinformed about which substances they actually have used (Thompson, Zmuda, & Catlin, 1993). Inactive substances may be distributed as active ones, especially to novice users, who are likely to be found among adolescent purchasers. However, DuRant et al. (1993) found acceptable predictive values of anabolic steroid metabolites in self-reports when they were compared with urine samples and also acceptable test-retest reliability over a 4-month span. Thus, the findings are not in agreement as regards this potential source of error.

A final problem is related to frequency of doping agent use. Previous studies show that even within defined subpopulations of AAS users, the intensity and frequency of use vary from groups who take AAS for very brief periods to other groups who repeatedly go on cycles involving large dosages (Dillon, 1995). We have no information as to the number of times or cycles the respondents had used AAS, and—in particular given the low age of our sample—one could hypothesize that some of the use of doping agents was low-frequent and experimental. In the present study, we gathered only information about lifetime use. A considerable time gap could therefore exist between the intake of these substances and the violence or victimization. This, along with the cross-sectional nature of this study, precludes positive causal conclusions.

In summary, even if our data seem to have acceptable validity compared with other studies in this area, one must keep in mind that we have not investigated the impact of regular use of substances confirmed as AAS over prolonged periods of time.

Doping Agents and Violence

The association between alcohol and violence has been more intensely researched than that between doping agents and violence, and most researchers conclude that there is probably a causal relation between the two. Still, according to Fagan (1990), the link between alcohol and violent behavior is less certain than has been implied in much of the research. The association, he argues, may instead be explained by a common cause model. In real life, one may expect a sizable proportion of the correlation to be spurious and a result of shared predisposing factors or confounders. Rossow et al. (1999) pointed out that social learning theory (Bandura, 1977) may be compatible with such an approach, in that both heavy drinking and physical aggression may be

learned through modeling, reinforcement, and individual expectations—processes in which both individual and environmental factors are important.

There is much to indicate that such a perspective fits well with our findings as well. Bivariately, there were strong associations between use of doping agents on one hand and violence on the other hand. The group exposed to doping agents without using them was systematically found in a position in between that of those not exposed and the users. However, several socio-demographic variables (parents on social welfare), family variables (parental monitoring), and peer variables (peers' delinquency) were also associated with violence. When entering these variables in a multivariate analysis the use of doping agents no longer had any effect, whereas exposure to doping agents still had effects. These effects also remained significant when other individual characteristics, such as leisure-time activities, use of commercial gyms, and use of alcohol and drugs, were controlled for. Thus, being in a milieu in which doping agents were present showed a significant association with participation in violence. But there were no differences between those in these milieus who used doping agents and those who did not. Thus, although the present design did not allow for strong positive causal conclusions, this finding suggests the negative conclusion that use of doping agents does not play a significant causal role in real-life violence among adolescents.

Even if several studies have suggested an association between the use of doping agents and aggressive behaviors, no study has so far demonstrated a causal link between the two. On the contrary, several studies cast considerable doubt as to AAS being a singular causative factor in the etiology of aggression in AAS users. Bjørkquist et al. (1994) demonstrated an expectancy effect associated with testosterone administration. They conducted a double-blind study in which the placebo group experienced a greater degree of anger and irritability than either the control group or the experimental group that received testosterone. The conclusion was that AAS use "causes expectation of, rather than a direct increase in aggression" (p. 17). Other researchers present similar points of view. The most common position today seems to be one whereby aggression is not understood as directly caused by the pharmacological impact of AAS as such, but rather best explained as a result of a complex interaction between social, psychological, and biological factors (for a review, see Sharp & Collins, 1998).

Previously, we have shown that a host of variables predict exposure to doping agents: male gender, evenings in the city center, use of commercial gyms, and variables indicating alcohol-related problems (Pedersen & Wichstrøm, 2001). Thus, doping agents are found in milieus with norms that most likely accept violence. It is well established that aggressive behaviors may be instrumental in reaching particular goals in such milieus, such as

social acceptance in the youth group, confirmation of one's identity, and establishing physical competence. Thus, aggressive behavior patterns may be acquired not only through manipulation of testosterone, but also through ongoing social reinforcement. Thus, a social learning perspective, such as the one outlined above, may be compatible with our findings.

Such reinforcement may operate at several levels within these subcultures. Previous studies have pointed to the particular importance of the socialization process in the commercial gyms and weight-training subcultures (Rada et al., 1976). In such subcultures, the overt expression of aggression is common, and the language of the weight-trainers is often full of slang, such as *blitzing*, *bombing*, and *attacking* the weights (Yesalis & Bahrke, 1995). Several researchers have suggested that these subcultures probably lower the members' aggression thresholds. Social sanctions that usually restrict the overt expression of aggression are often relaxed. On the contrary, aggressive acts are often positively reinforced because aggression is often seen as a desirable emotion as it improves the training intensity (Bahrke et al., 1990; Conacher & Workman, 1989).

As shown in Table 3, the impact of exposure to doping agents was reduced considerably when sociodemographic, family, and peer variables were controlled for, and we witnessed an even larger reduction when gender role, leisure, and alcohol and drug variables were entered. Thus, a considerable part of the association between doping agent exposure and violence was due to confounding factors. But when all other variables were controlled for, a significant association still remained. The most reasonable interpretation for this finding is that exposure to doping agents is a marker for a violent subculture, with characteristics not measured by any of our other variables. Note also that neither the use of commercial gyms nor participation in self-defense sports had a significant impact in the full models.

Doping Agents and Violent Victimization

Wolfgang and Ferracuti (1967) formulated the theory of violent subcultures. Their proposition was that in certain groups on the outskirts of society, there were subcultural value systems that gave acceptance and legitimacy to violence. Persons in these systems would often alternate between roles as victims and offenders. The victims would sooner or later become offenders as retribution for harm. The offenders would become victims because they had values supportive of violence to solve disagreements. Whereas the theory of violent subcultures focused on small and marginal groups, Jensen and Brownfield (1986) found lifestyle variables to be important risk factors for violent victimization in normal population samples as well. They suggested

that “criminal or delinquent routines are the most victimogenic of all routines” (p. 87). Later studies have given support to these findings (Lauritsen et al., 1992; Sampson & Lauritsen, 1990).

Our findings indicated that exposure to doping agents was associated with increased risk for victimization in both genders when milder forms of victimization were considered. Thus, the picture was quite similar to the one uncovered with regard to violence. However, when the more serious forms of victimization were considered, the pattern changed: Here, the associations to doping agents were restricted to males, and in addition to the association to exposure we found an additional effect from the actual use of such substances.

No previous studies have investigated the importance of doping agents in relation to violent victimization. Still, it was hardly surprising to see that exposure to doping agents was associated with increased victimization risk, when the variable was so strongly associated with violence. But why was there an additional effect of actual use of doping agents, with regard to the more serious forms of violence, in males?

First, increased upper torso strength is a body ideal for many men, and to “be big” is a prime motive for use of doping agents among gym-based weight trainers (Gridley & Hanrahan, 1994) and among the two most common motives in the general adolescent population (Buckley et al., 1988; Whitehead, Chillag, & Elliot, 1992). It is generally accepted that doping agents may have enhancing effects on skeletal muscles if combined with resistance training (Celotti & Negri-Cesi, 1992). Thus, many of the users of doping agents most likely will be perceived as strong and big by other adolescents, and it seems reasonable to hypothesize that this may make them visible and prestigious targets for aggressive youth in the center of the city. Sharp and Collins (1998) suggested that a more complex mechanism labeled as “reverse expectancy” may also be at work: Individuals meeting persons whom they believe to have used doping agents may send out provocation cues, which may lead to quarrels and fights. Bahrke et al. (1990) suggested the following interaction between AAS effects and personal coping inadequacies: AAS use may result in increased arousal and better self-confidence. In the absence of external constraints or social coping skills, such factors may lead to the expression of aggression at inappropriate times. In this context, one should note that even if users of doping agents are big, they may not necessarily be good fighters. Thus, they may overestimate their power and ability in street fights, putting them at risk for becoming victims of violence.

Why was there no such associations in girls? First, the subcultures we have identified here are obviously based on principles of masculinity associated with physique, size, and social dominance (Junger-Tas, 1996), and all

victimization studies show that men are more often victims of violent victimization in public places than women. On the other hand, women are more exposed to family violence and violence between spouses (Gelles, 1987; Pernanen, 1991). The age of our sample indicates that few girls in our sample would be in stable relations with boys or men and therefore not at risk for spouse violence. Later studies in older samples should address whether women are put at risk for victimization by doping partners; however, there is little reason to surmise that their own use of doping agents plays any important role in the etiology of their own victimization.

CONCLUSION

The study revealed that adolescents in milieus in which doping agents are present (measured as having been offered doping agents) often report violent behaviors. This association remained significant even when other variables were controlled for. However, there was no additional effect of actual use of doping agents. Thus, we suggest that such substances may serve as a marker of a violent subculture of adolescents, more than being a direct causal factor in the etiology of violence.

Basically, the same pattern was uncovered with regard to victimization when all forms of victimization were considered: There were associations between the exposure to doping agents and victimization in both genders but no additional effects from the actual use of such substances. However, a different picture was revealed with regard to the most serious and violent forms of victimization: Boys in milieus in which doping agents were used became victims of violent victimization more often than other boys, and we also found an association with the actual use of such substances. It is suggested that use of doping agents may result in a big and muscular appearance, which may make the male user visible in the public space and also a target for youth violence.

The study indicates that doping agents, most often AAS, are found among adolescents characterized by high levels of violence. Obviously, we need more knowledge about supply sources, patterns of use, and possible consequences of the findings.

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