JOURNAL OF INSURANCE MEDICINE

J Insur Med 2024;51:171–174

MORTALITY

Non-Physiologic Doses of Androgenic Anabolic Steroids: Mortality and Underwriting Assessment

John R. Iacovino, MD, FACP, FACC, DBIM

Little evidence based information exists in the medical literature on the mortality of abusers of anabolic androgenic steroids. These individuals range from competitive athletes and body builders to those whose who use physician prescribed mega-doses. Life insurance medical directors have little guidance on how to underwrite these individuals when presented with their applications. A recent article presented a Kaplan-Meir mortality curve accompanied with a control population demonstrating the mortality of these individuals over a 13-year period. Users of non-physiologic doses of anabolic androgenic steroids experience a mortality about two times the expected mortality of the control population. They should be underwritten with ratings commensurate with their anabolic androgenic steroid abuse and demonstrated mortality.

Address for Correspondent:
John R. Iacovino, MD, FACP, FACC, DBIM, Fasano Associates Wallace, NC United States.

Key words: androgenic anabolic steroids, life insurance underwriting, mortality.

Received: June 20, 2024

Accepted: June 22, 2024

What is the appropriate underwriting action on an application when the attending physician notes the proposed insured is self-administering or is being prescribed non-physiologic doses of androgenic anabolic steroids (AAS)?

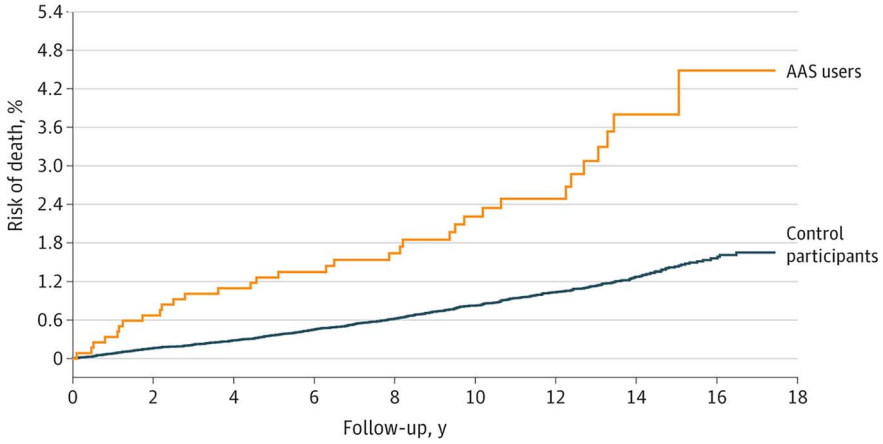
There is a wide range of use and abuse of AAS, from physician prescribed, physiologic replacement for testicular, androgenic insufficiency to non-physiologic mega doses used by body builders and competitive athletes. In between, AAS are used by longevity clinics, body builders and prescribed at the request of patients who wish to enhance their sexual prowess. The doses and duration of use are variable.

Men are prescribed non-physiologic doses of AAS under the poorly veiled guise of testicular insufficiency. If possible, this diagnosis should be verified by testosterone levels in the attending physician's statement. Any young male applicant taking AAS should be treated with suspicion of abuse.

The most commonly abused AAS are testosterone, trenbolone, oxymetholone, methandrostenolone, nandrolone, stanozolol, boldenone and oxandrolone. Common street names for these drugs are Arnolds, gym candy, pumpers, roids, stackers and juice.

Another pharmaceutical, selective androgen receptor modulators (SARM) need to be noted in the context of AAS abuse.[1] No SARM has been approved by the Federal Drug Administration, and its use is banned by the World Anti-Doping Agency. SARMs dissociate androgenic effects on the prostate while maintaining their anabolic effects on muscle and bone enhancement. Initially, they were believed to have a therapeutic effect over testosterone in select populations such as men with prostate cancer. Their illicit use is proliferating in the same population as AAS users and abusers as strength and muscle builders. SARMs are hepatotoxic in the doses needed for an effect compared to testosterone. They are easily available as OTC food supplements and via the internet and personal suppliers. Their potential toxicity precludes insurability.

The life insurance medical director has little, if any, evidence-based guidance on how to assess long-term mortality in cases of AAS use. Medical Impairment Manuals (MIM)



No. at risk

AAS users	1189	1178	1169	1107	935	750	547	294	77
Control participants	59450	58130	57474	54047	45617	36765	27096	14708	3784

Time to death for users of androgenic anabolic steroids and controls.

are often vague or even silent on this topic. Most cases of non-physiologic use of AAS result in no adverse underwriting action, which is not supported by medical literature. These applicants have a significant increase in mortality as demonstrated by the Kaplan-Meier mortality curve shown in the Figure.[2]

Mortality Methodology combined with the understanding of confounding factors in the population studied can be used by medical directors to update their MIM. Too often, manual ratings are subjective whereas this method provides an evidence-based structure to buttress underwriting decisions if challenged by applicants, attending physicians, and legal claims.

DEMOGRAPHICS OF STUDY COHORTS

The observed study cohort was Danish males, mean age was 27 years at baseline, who received a 2-year sports sanction for illegal use of AAS and, thus were high-end, illegal users. The underwriting implication of this select group will be discussed later.

The control or expected mortality population was, for each AAS abuser, 50 random matched, males from the general Danish population. The use of a general population expected mortality table and its applicability to life insurance mortality and underwriting will also be discussed later.

The study period was from 2006 to 2018. During observation, 33 men died with a near equal distribution of unnatural deaths, usually accidents and natural deaths, preponderantly cancer and cardiovascular disease. How many unnatural deaths could have been related to medical/mental health and additional risk-taking personalities of the study population is unknown.

The authors noted study limitations that included being observational which would not establish causality, and an absence of adjustment for potential confounding variables affecting health.

STATISTICAL ANALYSIS

The Figure is a Kaplan-Meier mortality curve with the vertical axis representing the percent risk of death (mortality), and the horizontal axis the years follow up. The red curve is observed mortality (Q) of AAS users during the study period. The black curve represents the control population or expected mortality (Q′) of the matched population of Danish males.

Observed and expected mortality were measured from a copy of the published article. With printing and copying, errors in measurement accuracy are inevitably introduced, thus

calculations are approximate and presented to only 1 decimal place. As expected, the mortality slope of the control population curve was constant until the 12th year, then very slowly increased. Fortunately, the authors provided an expected mortality. If not presented, expected mortality would have to be calculated from Danish mortality tables for an appropriate age-matching cohort. For the observed population, beyond year 13, there were not enough subjects for the curve to be meaningful.

Expected mortality of a control population is ultimately 100%. Mortality ratios are the quotient of observed mortality (or survival) divided by the expected mortality (or survival), O/E. By conventional mortality methodology, every 1% increment in the mortality ratio (MR) above 100% is a 1% increase in expected mortality and represents 1 debit.[3–5] For example, a mortality ratio of 200% represents a doubling of the expected mortality and represents 100 debits or 4 tables, 1 table being 25 debits.

RESULTS

The Table shows the observed and expected percent mortality at the end of 5, 10, and 13 years and their corresponding MR, which were rounded to the nearest 5%. Using a simplified, abbreviated mortality analysis[6–9] adapted from Dr. Richard Singer's Life Table Methodology,[5] MR for each interval is shown. The reader should question why the resultant MRs are so high with so few deaths (33) over the observation period. This is due to the young mean age (27) of the observed population which has a very low expected mortality, reducing the denominator of O/E. The overall mortality of study subjects was 2.75 to 3.1 times expected or about 300% over the study period.

DISCUSSION

What are the implications and limitations of this mortality analysis for life insurance underwriting?

Observed and Expected Mortality and Mortality Ratios from Figure

	Interval 0–5 years	Interval 0–10 Years	Interval 0–13 Years
Observed Mortality Q	1.3%	2.2%	3.7%
Expected Mortality Q′	0.4%	0.8%	1.2%
Mortality Ratio Q/Q′	325%	275%	310%

The study or observed population was free standing and unselected, except for AAS use. It was composed of Western European males akin to a United States male population. The life expectancy of a male Dane, age 27, is 53.15 years (2022-23), whereas their United States counterpart was 52.5 years in 2020. The authors do not state the duration of AAS use prior to suspension. As noted earlier, the observed population was at the high end of the spectrum of AAS abuse. Considering a non-selected, insurance-buying population, fewer deaths from lower dose AAS use would decrease the numerator, observed deaths, the O in O/E, and the MR would be lower.

The controls were a matched, general Danish population. Insurance populations are select with expected mortality less than the general population. If the denominator of O/E is decreased as in a select insurance table, the resultant MRs for an insurance applying population would be higher than in the Table.

Unfortunately, a follow up of only 13 years is hardly an expected lifetime. Did the ultimate AAS mortality continue to increase as suggested by the observed curve, flatten, or even decrease?

We have two opposite MR factors to consider in applying this mortality analysis when underwriting an insurance applying population. An increased MR derived from the selected high end AAS user observed population is inappropriate for most life insurance applicants and a decreased MR created by the use of a general population, expected mortality table with a higher expected mortality is also inappropriate for an insurance applying population. These can balance each other making the calculated MRs broadly applicable.

CONCLUSIONS

Although this is a highly select mortality assessment of heavy AAS users with an overall mortality of about 300% or double that expected, it is a guideline for medical directors to assess mortality of non-physiologic AAS use by applicants. The clinical characteristics of each case will determine the final underwriting assessment. Minimally, non-physiologic users of AAS should not qualify for preferred or standard risk classifications.

REFERENCES

1. Hahamyan H, Basaria S. Selective Androgen Receptor Modulators-Transformative Drugs or Heralds of the Next Drug Epidemic? *JAMA, Viewpoint*. 2024;331: 1359–1360.
2. Windfeld-Mathiasen J, Heerfordt IM, Dalhoff KP. Mortality Among Users of Anabolic Steroids. *JAMA Research Letter*. 2024;331:1229–1230.
3. Tiessen R. An Expansion On - The Conversion of Mortality Ratios to a Numerical Rating Classification for Life Insurance Underwriting. *On The Risk.* 1999; 15:91–92.
4. Iacovino J. The Origin and Mortality Significance of Debits and Credits in the Medical Impairment Manual. *On The Risk.* 2003;39:36–38.
5. Singer RB. The Application of Life Table Analysis Methodology to Risk Appraisal. In: Brackenridge RDC, eds. *Brackenridge's Medical Selection of Life Risks*, 5th ed, New York, NY: Palgrave McMillian; 2006:45–71.
6. Iacovino JR. A Quick Hit Method of Evaluating Mortality Using Percent Survival at Five and Ten Years. *J Insur Med.* 1997;29:185–186.
7. Iacovino J. A Rapid Method of Assessing Mortality from Medical Articles. *On The Risk.* 2000;16:54–55.
8. Naslafkih A, Sestier F. A Quicker Method for Calculating Mortality Ratios Based on Survival Rates in Clinical Trials and Other Follow Up Studies. *J Insur Med.* 2001;33:339–248.
9. Ingle D. Creating Comparative Mortality Experience Mortality Table from Survival Curves: A Step by Step Guide. *On The Risk.* 2000;16:69–83.