The Golden Paradox: Mortality Trends Across Three Eras of Bodybuilding (1900-1990)

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Abstract

Recent mortality trends in professional bodybuilding have raised concerns about athlete longevity, yet historical perspectives on this phenomenon remain understudied. This investigation presents the first comprehensive analysis of bodybuilding mortality across three distinct eras: Bronze (1900-1930), Silver (1930-1960), and Golden (1960-1990). Analyzing data from 120 elite male athletes, we document a striking reversal in the sport's relationship with longevity. Early practitioners demonstrated remarkable durability, with Bronze (74.8 ± 13.5 years) and Silver era (80.2 ± 12.9 years) athletes significantly outliving their contemporaries. However, Golden era athletes exhibited dramatically reduced lifespans (68.6 ± 15.5 years, $p<0.0005$ compared to Silver era), coinciding with the emergence of performance enhancement protocols and extreme physique standards. This precipitous decline in longevity challenges assumptions about historical training methodologies and suggests that contemporary bodybuilding's high mortality rates reflect specific modern practices rather than inherent risks. These findings have profound implications for current athletic standards, training protocols, and public health policies, particularly given bodybuilding's increasing influence on mainstream fitness culture and rising recreational performance enhancement use.

Introduction

In December 2022, the *Washington Post* released a series of bombshell exposes on the state of professional bodybuilding. Detailing gross power imbalances, the mistreatment of female athletes, and a host of other ills, one article centered on a simple but powerful observation - many bodybuilders were dying at a young age (Berkowitz and Neff, 2022). This was compared to both the general public and against other professional athletes. Of course, there are a range of sociological and sporting reasons for this. As a sport, bodybuilding has, in the past two decades in particular, become increasingly extreme in the presentation of muscular and lean bodies **(**Smoliga, Wilber and Robinson 2023**)**. While this process began in earnest with the widespread introduction of steroids into the sport in the 1960s **(**Stokvis. 2006**)**, it has heightened in more recent decades. Indeed one could even make the sound argument that each year seems to bring more casualties among professional bodybuilders, both male and female. While some may rightly note that bodybuilding, as a sport, is rather niche, the broader importance of the sport has a direct impact on everyday fitness cultures. David Chapman and John Fair **(**2020**)** previously published an outstanding history of muscledom in American media which forcefully showed the influence bodybuilding had over mainstream ideas of muscularity and strength. In effect, as bodybuilding physiques became leaner and more muscular, so too did mainstream conceptions of what a muscular male body was. A simple test of this is to compare the physiques of action movie stars from the 1960s with those from today (Chapman and Fair, 2020) Bodybuilding may be at the extreme but it helps to nudge even moderate conceptions of muscularity to more extreme outcomes. While Fair and Chapman's work focused on television and film, other research examining social media, and fitness influencers **(**Feijoo, B. and

Vizcaíno-Verdú, 2024**)**, likewise found a similar correlation. Put bluntly, if more bodybuilders are dying because of their extreme body practices, it warrants attention beyond the sport itself. Many enhanced bodybuilding athletes serve as coaches, spokespeople, influencers, and aspirational physiques. Their physiques matter.

What then, does mortality mean within the context of bodybuilding? In 2023 Smoliga et al. published one of the first in-depth studies on the 'surprisingly limited' lifespan of bodybuilders. Noting that existing research has tended to focus on small clusters of dead athletes, Smoliga cited over two dozen professional bodybuilder deaths before the age of 60 in 2021 alone. Building on Smoliga's research, more recent work Vecchiato et al. 2024, examined over 19,000 professional athletes who competed in bodybuilding competitions between 2005 and 2020. It found that sudden cardiac death was 'considerably high in bodybuilding athletes.' Such work was corroborated by previous studies with smaller sample sizes but similar results. Without being too pedestrian, drug use is a norm within the sport and is negatively impacting professional athletes. And while some may, understandably, note issues of informed consent for those participating, or that these are athlete-specific deaths, two observations are worth exploring. First images and videos of enhanced, that is performance enhancing drug taking, physiques are routinely used in advertising (Klein, 2007). This distorts perceptions of fitness and attainable physiques among the general populace and second, that the short mortality of professional bodybuilders is a relatively easy thing to track. A more important, but less available, area to study are those bodybuilders who abused bodybuilding drugs but failed to become professionals or those who use bodybuilding drugs recreationally. Observationally it is worth noting that medical authorities in the UK and USA have recently warned about an upsurge in bodybuilding drugs among the general public **(**Hoseini and Hoseini 2024**)**. Many of these individuals, as research shows **(**Harvey et. al, 2019**)**, will rely on drug prescriptions from online bodybuilding forums and influencers.

While some may dispute the idea of bodybuilding as a sport, and indeed there has been a slew of recent philosophical papers on this very subject (Kind and Helms, 2023), few can dispute that bodybuilding as a practice is a legitimate arena. Those taking part in professional bodybuilding shows ask their bodies to achieve a near biological impossibility. That is to lose as much body fat as possible (i.e. starve themselves) while simultaneously retaining as much muscle as the body can. Critical research has shown that the drive to present lean and muscular bodies, at freakish levels for men and women, is present in both untested and natural (i.e. drug tested) shows **(**Chaba, 2019**)**. For professional bodybuilding, which is a silently untested sport, drug use is often taken to be a prerequisite for success. How else could one achieve a body with less than 5% body fat presenting with over two hundred, or even three hundred, pounds of muscle? This is a regular occurrence each year at the sport's primary competition, the Mr. Olympia. Harrison Pope, one of the first psychologists to treat bodybuilding as a serious academic subject has asked, on more than one occasion, if bodybuilding is a sport, or a pathology, given the extremes taken by athletes around calorie restriction, socialization, and drug use **(**Steele et. al, 2020**)**. Sociologists studying the sport **(**Wesely, 2001**)** have examined the heightened gender norms for both sexes, the cultures of risk, and the overconformity to the sport ethic as reasons for the sport's high mortality rate and extreme practices. Indeed one of the first treatments of bodybuilding by sociologists, by Alan Klein in the 1990s **(**Klein, 1993**)**, depicted the sport as one driven by insecurities rather than sporting excellence. And while Klein's research has been critiqued, fairly, by many **(**Parent et. al, 2022**)** as overtly negative, if not dismissive, the extreme practices he observed have not abated, but intensified.

Academic and lay coverage of bodybuilding has been clear that the past two decades have witnessed an increase in risk-taking behaviors and shortened mortalities. What is generally missing from these discussions is a sense of history. Bodybuilding was one of the first sports to embrace performance-enhancing drugs in the late 1950s and early 1960s **(**Todd,

1987**)**. It stands to reason, therefore, that drug-taking behaviors are historicized within the sport. The question is how to divide bodybuilding's history coherently. We could, as some have implied (Andreasson and Johansson, 2019), divide simply between pre and post-steroid histories but this may negate the sporting changes found between the early competitions and more recent ones. Instead, we have decided to use a timeframe popularised in the past decade of 'bronze, silver and golden' eras of bodybuilding **(**Alverson, 2022**)**.

Here we study three bodybuilding eras (known in popular parlance as the Bronze, Silver and Golden eras) **(**Alverson, 2022**)**. The Bronze era, dating roughly from the 1880s to the 1930, was a time of professional strongmen and strongwomen but also, critically, early physique shows. The Silver Era, dating from the 1930s to 1960, saw regular physique shows emerge for men with a greater emphasis on nutrition, while the golden era of the 1960s to 1990 saw a greater professionalization within the sport and the concurrent introduction of steroids. We use the Mr. America competition as a point of focus. This contest began in 1939 and runs to the present day (Fair, 2015). It thus provides an incredibly useful tool for studying mortality, and changes in mortality within the sport. We have deliberately stopped in 1990 for two reasons. The first is that it helps to historicize the issue of mortality within bodybuilding, thereby pushing researchers to understand this problem not concerning the past two decades but in the past century. This is especially important given that the period from 1990 to the present day is often taken by bodybuilding fans and athletes as one of overt 'freakish-ness' and risky behavior **(**Heffernan and Warden, 2022.**)**. The second, important reason, is that we had access to data from the Mr. America competition which ran from 1939 to 1990. Although often regarded as a 'secondary' show from the mid-1960s onwards it still provided access to elite bodybuilding champions for several decades.

Accepting the caveats that comparing groups across decades brings, we ask a simple question. What impact, if any, did the introduction and intensification of bodybuilding drugs have on athlete mortality? To answer this question we begin with a historical overview of bodybuilding to contextualize the evolution of the sport concerning both body ideals and also the use of anabolic steroids and other performance-enhancing drugs. Following this we have compared the lifespan of 40 bodybuilding athletes from each corresponding era and through statistical analysis, posed the question, 'Which era had the greatest lifespan?' Finally, we have compared the resultant mean lifespan from each era to the corresponding expected lifespan of the general population of that era to ask, 'Did the practice of bodybuilding as practiced during that era improve or worsen the health of the population during that era?' The answers to these questions allow us to then assess whether the introduction of and increased use of bodybuilding drugs has impacted the mortality of bodybuilding athletes.

The History and Evolution of Bodybuilding

As a sport, competitive bodybuilding has several 'origin' points ranging from the Ancient World to the late nineteenth century. Research has, for example, found evidence of male beauty competitions in Ancient Athens which some have argued represented a sort of 'pre-modern' bodybuilding **(**Crowther, 1985**)**. More contemporaneously, historians **(**Heffernan, 2022**)** have cited the late nineteenth and early twentieth century as a true origin point. This was the period when the 'physical culture' movement first arose. Originating as a term in popular usage in the 1880s within the West, the term physical culture was used to describe gymnasium-based activities such as calisthenics and weight training from the 1880s to the outbreak of the Great War in 1914 **(**Strong, 2003**)**. During the interwar period (1918-1939) the term was still used but had begun to fragment in popular culture as other terms such as weightlifting and even

bodybuilding began to slowly emerge. Following the end of the Second World War in 1945, the term physical culture became something of a relic, replaced by phrases such as bodybuilding, weightlifting, keep fit, powerlifting, etc. This language lesson is an important one. Physical culture, as a term, was an inherently broad phrase and it was this broadness, as argued elsewhere (Vertinsky and Hedenborg, 2018), which allowed it to capture a popular audience. The changing language of bodybuilding from the broad, physical culture, to the specific and narrowly defined use of bodybuilding reflected a tightening of body images within the sport.

During its heyday, physical culture was used to describe a variety of sporting and gym-based activities but, critically, its usage was typically associated with an active desire to perfect one's health and physical wellbeing (Heffernan, 2022). Authorities on physical culture, at least in popular culture, tended not to be physicians or coaches but rather a new generation of strongmen and women who had gained celebrity through strength shows in Music Halls and Vaudeville theatres. One such strongman was Prussian athlete Eugen Sandow (1867-1925). During the 1880s Sandow came to prominence within British society (Chapman, 1994) where he was widely decried as the world's most perfectly developed specimen. Indeed it was Sandow's body, rather than his strength, which accounted for his celebrity. At a time when many professional strongmen were large and rotund, Sandow was lean and muscular. For this reason many of his biographers (Chapman, 1994; Waller, 2011) credit Sandow as the world's first modern physique star. This moniker is far from hyperbole. From 1894 when Sandow first toured the United States to the outbreak of the Great War in 1914, Sandow embarked on world tours of South Africa and Australasia.

Additionally, research has shown that Sandow's fame, and the products he sold, emerged in countries the strongman had never visited. It is useful to use Sandow as an entry point into the history of bodybuilding more generally. His title of world's most perfectly

developed specimen was the result of an examination by Harvard physical educationalist Dudley Allen Sargent in 1894 (De la Peña, 2003). Driven by a eugenic zeal to quantify the best physique for men and women, Sargent measured thousands of bodies be they Harvard students or renowned athletes. Sandow's was deemed to be the most perfectly balanced. And indeed for many of Sandow's customers they deliberately attempted to build their bodies like his. Workout courses and equipment sold by Sandow always included anthropomorphic charts wherein trainees could measure their physiques against his.

The eugenic zeal exhibited by Sargent was reflective of a broader undercurrent within physical culture. First coined by Sir Francis Galton in 1883, the term eugenics was used to describe both a social and scientific interest in race science (Heffernan, 2023). Physical culture, for obvious reasons, was a public alley in this regard. Indeed Galton even attended a physical culture physique competition hosted by Sandow to sharpen his critical eye in judging physiques (Heffernan, 2023). The overlap between physical culture and the eugenic movement fuelled many of the early bodybuilding competitions across Europe and the United States. For reasons of space, it is worth focusing on two major competitions; those being Eugen Sandow's 1901 'Great Competition' and Bernarr MacFadden's 1904 Physical Culture Exhibition. In 1898 Eugen Sandow announced that he would be hosting a competition to discover 'the Best Developed Man in Great Britain and Ireland.' Taking place over several years, before the ultimate finale in 1901, the competition has been credited as the first mainstream bodybuilding show. Critically, its judging criteria were not focused solely on muscular size, but rather on more nebulous topics like the vitality of the skin and muscle symmetry (Heffernan, 2023; Todd, 1987). Similarly, MacFadden's 1904 and 1905 physical culture exhibitions in the United States sought to evaluate bodies based on their muscular size, but more critically their symmetry and broader appearance of well-being. During this period the key archetype in such physique competitions was Greco-Roman antiquity. Sandow and MacFadden, as well as their

contestants, all posed mimicking ancient Greek and Roman statues as such emblems were typically held to be the best representation of physical perfection (Miller, 2018). Thus the body image celebrated within the sport was lean and muscular yes but one also aligned with broader ideals of health and proportional muscle.

Before the Great War (1914-1918) physique competitions were sporadic but significant in the case of Sandow and MacFadden. It was during the interwar period, however, that bodybuilding shows became much more routine. Emerging out of the Great War, many individual physical culture magazines began to host physique competitions both within the pages of the magazine and, as time went on, live events. Within the United States, the most significant physique competitions were a pair of shows held by Bernarr MacFadden in 1921 and 1922 to discover first the 'World's Most Handsome Man' (1921) and then 'The World's Most Perfectly Developed Man' (1922) (Reich, 2010). In both instances, the title was won by Angelo Siciliano, better known as Charles Atlas whose 'Insult that Made a Man out of Mac' fitness advertisements (Reich, 2010) are among the most impactful fitness advertisements ever. Although judged again on Greco-Roman lines, interestingly, non-white bodies were considered by MacFadden within the competition. Indeed Indian bodybuilder K.V. Iyer is said to have scored highly in the judging process (Ramachandran and Heffernan, 2021). More important is that after the 1922 contest, MacFadden ceased holding the competition as he believed Siciliano would simply win it every time. Sporadic shows emerged following this point but it was not until the late 1930s that American bodybuilding, as a sport, truly came to the fore.

As per John Fair's excellent research (2015) in this area, fitness promoter Johnny Hordines' 1938 physique competition precipitated the creation of the Mr. America competition. Regarded by his contemporaries as one of the first modern physique competition promoters, Hordines' second show in 1939 featured a judging panel of physical culture luminaries including the founder of York barbell, Bob Hoffman. Hoffman, whose primary sport was

weightlifting, was also the head of the American Athlete Union's (AAU) weightlifting arm and, through this, was an important organizing figure in 'iron game' sports. Impressed, Hoffman helped oversee the creation of an AAU Mr. America competition in 1939 which, as Fair made clear (2015), became bodybuilding's most important competition from 1939 to 1965. There were two important caveats to this. First, as per the AAU rules, it was quickly ruled that winners of the Mr. America competition were not eligible to re-enter. This was done in the interest of fairness and to avoid a Siciliano-type situation. The second, more important caveat, is that bodybuilding, despite being an AAU sport, held a secondary status to weightlifting itself. For this reason, Mr. America bodybuilding shows were often hosted on the same day as weightlifting competitions, albeit late in the evenings.

Furthering the hampering of bodybuilding as a sport were the AAU rules themselves. During the 1950s the AAU Mr. America was decided based on someone's physique, personality, and athletic ability (Fair, 2015). This often took the form of a posing round, an interview with the judges, and, for obvious reasons, some weightlifting feats. While the body was judged solely on Greco-Roman lines concerning beauty, muscularity, and symmetry, the inclusion of non-physique-related categories was a topic of considerable tension within mid-century bodybuilding. Interestingly, bodybuilding became internationalized during the 1940s with the creation of the Mr. Universe competition in 1948 which pitted Mr. America champions against European champions (Fair, 2006). Nevertheless within the United States bodybuilding was still firmly connected to weightlifting in some capacity.

For this reason, a series of physique-only competitions emerged in the 1950s and 1960s, the most important of which being the Mr. Olympia contest created by Joe and Ben Weider in 1965 (Bateman, 2017). Still the sport's most important title, the Mr. Olympia was explicitly created to allow repeat winners to enter, and to solely judge physiques over all else. While bodybuilding as a sport has developed somewhat unproblematically since then (from a

competition perspective), the obvious issue to discuss is the use of anabolic steroids within the sport from the mid-1950s onwards. It is the interplay between the creation of the 1965 Mr. America, and the diffusion of anabolic steroids within the sport from the late 1950s which came to dramatically change the physiques on display, as well as athlete well-being **(**Bateman, 2017**)**. Examining the life and health outcomes of bodybuilders across the twentieth century we have deliberately used a popular means of delineating various eras. The 'Bronze Era' (1900s up to 1930) includes those early generations of strongmen and women who, although praised for their physiques, were not outright bodybuilders. The 'Silver Era' (1930s up to 1960) captures the early history of bodybuilding as a competitive sport but a generation 'largely' free from anabolic steroids. The 'Golden Era' (1960s up to 1990) is the first major generation of steroid users within the sport whose ramifications are still keenly felt within the sport. A wonderful expose in the *Washington Post* in 2021, examined the life expectancy of current bodybuilders and conclusively found that mainstream and competitive bodybuilder's are at a significant risk of mortality during their careers owing to performance enhancing drug (PED) abuse **(**Berkowitz and Neff, 2022**)**. Indeed, it is telling that within the past five years, dozens of professional athletes have died in their 30s and 40s owing to PED abuse or complications.

While it is easy to solely focus on PEDs in bodybuilding as responsible for the sport's dangers, shifts in judging are equally important. From the 1970s to 1990s bodybuilders began to appear physically larger and leaner in elite competitions. Indeed research by sociologists in the 1980s bodybuilding cultures for men noted the push towards physiological extremes festering within the sport. It is telling, in this regard, that many competitions continued to make pretensions to Greco-Roman ideals but the physiques rewarded within the sport tended to be far in excess of antiquity standards **(**Bateman, 2017; Miller 2018**)**. This article focuses, of course, on the Mr. America competition and Mr. Universe competitions, these being the longest-running bodybuilding competitions in the twentieth century. It is, however, important

to note some controversy surrounding Mr. America champions in the 1950s and 1960s. Jason Shurley's research on the Mr. American competition in the mid-twentieth century highlighted problems in the contest's judging decisions **(**Shurley, 2016**)**. While it is difficult to definitively state that race did prohibit some black, Caribbean and African-American competitors from winning the competition, it does appear that in some years, non-white athletes lost on their personality round compared to white athletes. This may have skewed, somewhat, our data on the victors and top-placed competitors.

Methodology

We have defined eras in the sport of bodybuilding for the 20th century to facilitate the categorisation and designation of athletes for statistical analysis. The Bronze Era (1900s up to 1930), The Silver Era (1930s up to 1960) and The Golden Era (1960s up to 1990), which reflected the practices, traits and technological advancements associated within each period, with the bronze era representing the transition of strongmen into the birth of modern bodybuilding, the silver era with the development of more massive bodybuilders, the discovery of testosterone and importance of protein and nutrition, and the golden era with the proliferation of steroid use, and the birth of the gym culture and supplement industry. Statistical analyses were conducted using R (version 4.2.1). Athletes were selected using a stratified random sampling approach from comprehensive lists of competition placers (top 3) from Mr. America (1939-1990), Mr. Universe (1948-1990), and Mr. Olympia (1965-1990) competitions. For the Bronze era, where formal competitions were limited, selection criteria included: (1) documented participation in physical culture exhibitions, (2) featured coverage in at least three contemporary physical culture publications, and (3) photographic evidence of physique development matching era standards. Power analysis indicated that our sample size (n=40 per

era) provided 80% power to detect differences of ±5 years in mean lifespan (α=0.05). Mortality data were analyzed using Kaplan-Meier survival analysis and Cox proportional hazards modeling

Athlete selection

Athletes who have passed away were only used in this analysis of longevity. John D Fair's book **(**2015**)** *Mr America, The Tragic History of a Bodybuilding Icon* roughly covers and addresses the longevity of athletes between the periods of 1939 and 1992. However it doesn't address the longevity of athletes in the bronze era, and the reason for this is that the Mr America competition was only birthed in 1939. To accurately assess the lifespan and longevity of bodybuilders in the 20th century, we have decided to also look at the lifespan of bronze-era athletes. To assess the overall longevity within each era, at least 40 athletes were chosen per era, including past Mr. America, Mr. Universe (from the amateur and professional divisions) as well as past Mr Olympia champions.

Selecting bronze-era athletes presents a challenge in that Mr. America competitions began in the silver era, and only a few physique competitions occurred within the first four decades of the 20th century. For this reason, we have selected the best-known bronze-era athletes who either won physique contests or have been commonly accepted within bodybuilding lore as early bodybuilders or physique stars. Critically, those bronze-era athletes, who did not win physique shows, were chosen specifically because their physiques were deemed to be 'perfect' within their own, and subsequent, generation's esteem. Drug use patterns varied significantly across eras. Bronze-era athletes primarily used protein supplements and liver tablets, with no documented anabolic steroid use. The Silver era (1930-1960) marked the transition, with limited testosterone use emerging in the late 1950s. Golden

era athletes typically employed multi-compound protocols, with documented stack combinations including testosterone, nandrolone, and oral agents like Dianabol, based on contemporary interviews and medical case studies. This evolution in drug protocols correlates inversely with observed mortality trends.

As a disclaimer, we admit that this method of analysis is only preliminary, and only serves to observe a trend of longevity in each era. To accurately assess the longevity of bodybuilders from all eras, a much larger number of athletes that are not limited to the Mr. America, Mr. Universe and Mr. Olympia competitions, but that would also cover other national and international competitions would also need to be assessed, however, these also present limitations that will be discussed later. This study's focus on male athletes reflects historical data availability limitations rather than intentional exclusion. Female bodybuilding competitions only gained mainstream recognition in the late 1970s, preventing meaningful longitudinal analysis across our study period. While pioneers like Abbye Stockton and Pudgy Stockton made significant contributions during the Silver era, systematic competition records for female athletes are insufficient for statistical analysis before 1980. Future research should examine female athlete mortality patterns post-1980, particularly given potentially different physiological responses to performance enhancement protocols.

Age of death was used as a measure of longevity for each athlete. To calculate the age of death of each athlete, we used sources such as physical culture publications, archives, articles, and obituaries available online to determine the year of birth and year of death . These were then tabulated for each athlete into each respective era (appendix) and mean life expectancy (and standard deviation) of bodybuilders from each era were graphed into box and whisker plots.

From this information, we could also perform basic t-tests to compare whether a specific bodybuilding era was statistically different, and conclude if life expectancy was greater

than the other. A *p-value* of *0.05* or under is regarded as statistically significant. We also compared the mean lifespan of bodybuilders from each era with the life expectancy data for each period that is available on online resources (OECD 2021, Dattani et al 2021). The life expectancy data we obtained dates back from the 19th century and both world and western statistics were used as they are more representative of the population of people that have practiced physical culture and bodybuilding throughout the periods we have studied. Using the mean life expectancy of bodybuilders (LEB) and the life expectancy of the general populace (LEGP) from each era, we calculated the ratio of LEB/LEGP to observe the effect that the practice of physical culture or bodybuilding has on life expectancy.

Results

Table of BB and associated age of death in appendix

Age of death of bodybuilders in each era

Box and whisker plots of the means of each era revealed that the bronze and silver era had similar lifespan (74.8 ± 13.5 v 80.2 ± 12.9, $p > 0.05$) , with the lifespan of silver era bodybuilders being 5 years greater than those of the bronze era (Figure 1). Bodybuilders from the golden era had the lowest lifespan (68.6 ± 15.5), being 6 years lower than bodybuilders from the bronze era, and 11 years lower than those of the silver era (Figure 1). T-tests which allowed the comparison of each era and determined whether they are statistically different or not revealed the following. There was no statistical difference in the lifespan between bronze era athletes and silver era athletes ($p>0.05$, Table 1). However, there was a statistical difference between bronze era athletes and golden era athletes ($p<0.05$, Table 1). The greatest statistical difference was observed between silver era athletes and golden era athletes ($p<0.005$, Table 1). These results indicate that when compared to the golden era, a greater lifespan was achieved

by athletes from both the bronze and silver era, with athletes from the silver era achieving the greatest lifespan from all the eras.

We compared the life expectancy of bronze, silver and golden era athletes with those of the general population. We divided the calculated mean value of bodybuilders from each era (Table 1) with the mean life expectancy of the population taken from world or western populations which were sourced online (OECD 2021, Dattani et al 2021). To ensure compatibility, the year 1860 was chosen as the birth year corresponding to bronze era athletes, 1900 was chosen as the birth year corresponding to silver era athletes and 1950 was chosen as the year for golden era athletes. Bronze era athletes had a life expectancy at least 2 fold higher than the average life expectancy of the general population in the west, and up to 2.5 higher life expectancy than the rest of the world (Table 2). Silver era athletes had a life expectancy 1.7 fold higher than the average life expectancy of western populations, and at least 2,5 fold higher life expectancy than the world population (Table 2). Golden era athletes however, had a similar life expectancy to western populations (1.2-1.0), but a higher life expectancy when compared to the world population.

Figures and Tables

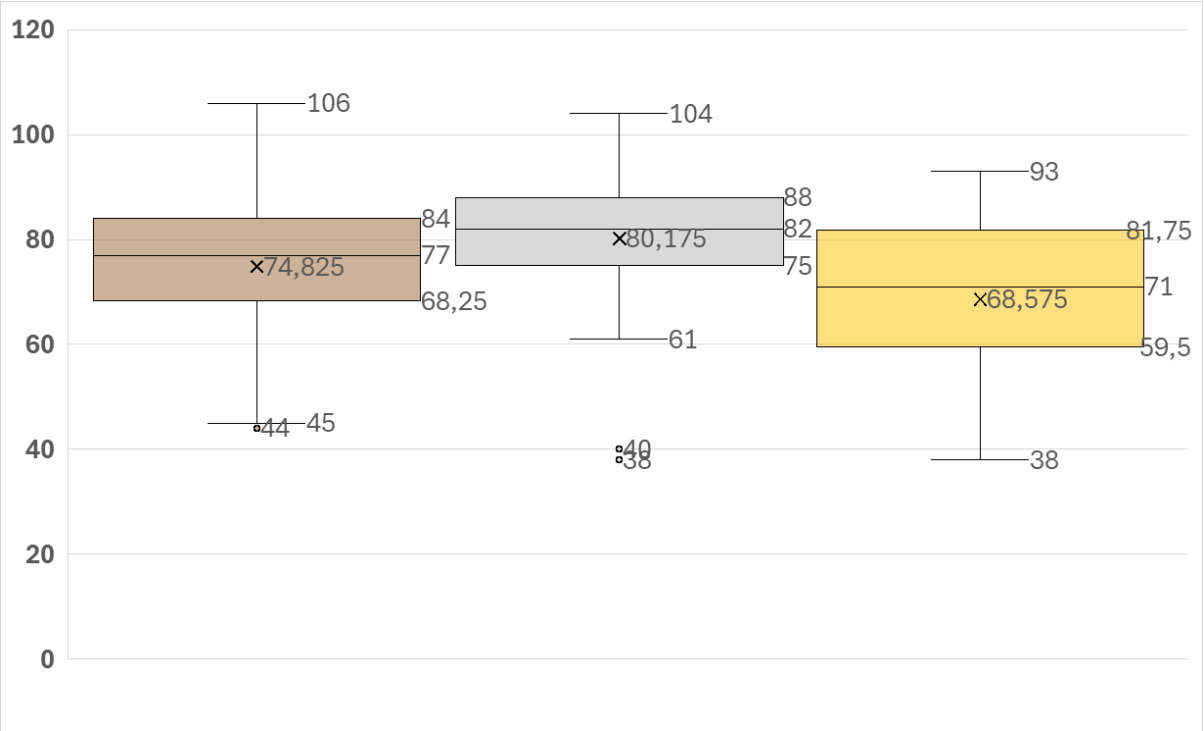

Figure 1. Lifespan of bodybuilders throughout the bronze, silver and golden era.

Box and whisker plot displaying mean and median values, lower (25%) and upper (75%) quartiles, and data distribution of life expectancy generated for bodybuilders from the bronze (brown), silver (grey) and golden (gold) eras.

Era	Bronze	Silver	Golden
Mean	74.8	80.2	68.6
S.D.	13.5	12.9	15.5
T-test	Bronze v Silver	Bronze v Golden	Silver v Golden
P-value	0.4930 (n.s.)	0.0289 *	0.0005 ***

Table 1. Comparison of lifespan of bodybuilders between different eras. The lifespan of bodybuilders between each era (bronze, silver and golden) was compared using a t-test. Significant p-values are indicated (*$p<0.05$*, $p>0.0005$***)*.

Year	World	West	Bronze	Silver	Golden	Ratio (World/Era)	Ratio (West/Era)
OECD 2021							
1860	30	37	75			2.5	2.0
1900	31	48		80		2.6	1.7
1950	49	68			69	1.4	1.0
Dattani et al, 2023							
1860	30	36	75			2.5	2.1
1900	32	46		80		2.5	1.7
1950	46	59			69	1.5	1.2

Table 2. Comparing life expectancy of bodybuilders versus world population. Ratios of life expectancy of western and world population with each corresponding bodybuilding era is shown. Two different online data. sources were used.

Discussion

Our analysis reveals a compelling narrative about the evolution of mortality rates in bodybuilding across the twentieth century. The findings suggest that the practice of bodybuilding, as conducted in the Bronze (1900-1930) and Silver (1930-1960) eras, was associated with increased longevity compared to population averages. However, this protective effect diminished significantly during the Golden era (1960-1990), coinciding with the widespread adoption of performance-enhancing substances and increasingly extreme physique standards.

The most striking finding is the progressive decline in life expectancy from the Silver to the Golden era, with mean lifespans decreasing from 80.2 years to 68.6 years ($p<0.0005$). It

is worth stressing that Bronze and Silver Era athletes lived through world wars and in a less technologically advanced age, and with all these perceived disadvantages, they still had longer lifespans than Golden Era bodybuilders. This 11.6-year reduction in life expectancy coincides with several crucial developments in the sport. First, the introduction and proliferation of anabolic steroids in the late 1950s and early 1960s marked a fundamental shift in how athletes approached muscle development. Second, the creation of physique-only competitions, particularly the Mr. Olympia in 1965, changed competitive standards by emphasizing muscle mass and definition over the more holistic criteria of earlier eras. The relatively high life expectancy observed in Bronze-era athletes (74.8 ±13.5 years) compared to their contemporary population (30-37 years) suggests that early physical culture practices, focused on general health and proportional development, may have offered significant health benefits. This aligns with recent research by Smoliga et al. (2023) suggesting that moderate resistance training and balanced physical development contribute to longevity. The even higher life expectancy in Silver-era athletes (80.2 ±12.9 years) likely reflects advances in nutrition and training methodology while predating the widespread use of performance-enhancing substances.

These historical findings have implications for contemporary bodybuilding and fitness culture. Recent studies have documented concerning mortality rates among modern professional bodybuilders, with multiple studies reporting elevated risks of sudden cardiac death and other health complications (Smoliga et al., 2023; Escalante et. al, 2022). Our historical analysis suggests this is not an inherent risk of the sport itself, but rather a consequence of specific practices that emerged during and after the Golden era (Bateman, 2017). The analysis of bodybuilding's evolution from the Bronze to the Golden era offers critical insights into contemporary practices and their impact on athletes' health. One significant observation is the correlation between the shift from holistic health criteria to an emphasis on extreme muscularity and definition, and decreased longevity among athletes. This trend raises

important questions about the current competitive standards in bodybuilding. It suggests that competition organizers might need to reconsider the criteria used in judging, potentially reintegrating broader health and wellness aspects into the standards to enhance athlete well-being. Furthermore, the decline in life expectancy noted during the Golden Era, which coincides with the widespread introduction and use of performance-enhancing drugs, indicates that the high mortality rates observed among modern professional bodybuilders might be more attributable to long-term drug use patterns rather than the inherent physical demands of the sport. This connection underscores the need for more stringent regulations and awareness programs regarding drug use in the sport to mitigate health risks. Lastly, the analysis reveals that athletes from the Bronze and Silver eras, who typically engaged in more moderate training methodologies, enjoyed superior longevity compared to their successors in the Golden era. This finding suggests that modern training methods, which often prioritize extreme muscle mass and definition, may require reevaluation. By learning from the past and adjusting training practices to focus more on overall health rather than just aesthetic outcomes, the bodybuilding community can potentially improve both the health and longevity of its athletes.

Limitations and Future Directions

Several limitations of our study warrant consideration. First, our sample size of 40 athletes per era, while statistically significant, represents a small portion of all practitioners. Second, our focus on male competitors limits our understanding of how these trends affected female athletes. Future research should examine larger samples and include female athletes to provide a more comprehensive picture. We have deliberately stopped at 1990 only due to the fact that athletes competing in the period 1990 to the present are still alive. A further limitation is that some athletes from the Silver Era are still alive, and could not be used for our data pool. In other cases, very little information was available about some Mr Universe champions and

because it was not possible to not find out if they were dead or alive, these were also ommited We have thus focused on deceased athletes. There is also the issue of bodybuilding champions who won competitions multiple times who skewed the data based upon their victories. A logical and strong counterpoint is that multiple year champions were taken to be the best representation of that generation and were thus oftentimes a standard for others within their era (Fair, 2009).

Additionally, our analysis stops at 1990, predating the emergence of new performance-enhancing substances and training methods. Future studies might extend this analysis to examine more recent trends, particularly given the reported increase in sudden cardiac deaths among bodybuilders in the past decade.

It is important to also state that these observations are not intended to be interpreted as negative or judgemental, and instead, we hope that this can lead to a more open discussion about anabolic steroids and performance-enhancing drugs. Although we have demonstrated a negative association between longevity and the proliferative use of performance-enhancing drugs, understanding that the original intended use of these compounds was for medical reasons, and still serves a purpose as forms of medical treatment should help direct future research into the beneficial use of these compounds (Monaghan, 2009).

Conclusion

This historical analysis demonstrates that bodybuilding, as practiced in its early eras, was associated with increased longevity compared to population averages. The marked decline in life expectancy during the Golden Era, coinciding with the introduction of performance-enhancing substances and more extreme physique standards, suggests that current high mortality rates in bodybuilding are not inevitable but rather the result of specific historical developments. These findings have important implications for contemporary practice,

suggesting that a return to more balanced approaches to physical development might better serve both competitive athletes and recreational practitioners. As bodybuilding and bodybuilding standards continue to evolve, these historical insights offer important perspectives on the relationship between training practices, competitive standards, and long-term health outcomes.

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Appendix

Table of Bronze Era Athletes

Name	Age at Death	Title	Year
Otto Arco (Otto Nowosielsky)	79	Worlds' most perfectly developed man	1913
Edward Aston	89	Professional Middleweight champion of the world, Britains Strongest Man	1909
Charles Atlas	80	"America's Most Handsome Man" in 1921, and "America's Most Perfectly Developed Man" in a 1922	1921, 1922
Anthony Barker	106		
Milo Barus	71	Strongest man in the world	1930
Joe Bonomo	77		
Batta (Charles Estienne)	65		
Paul von Boeckmann	74		
Milo Brinn	89		
Ernest Cadine	84	Olympic gold medallist light heavy weight	1920
Tromp Van Diggelen	82		

Launceston Elliot	56	Olympic Gold medallist 1896, won a physique competition 1898	1896, 1898
James Evans	73	Won first Muscle Control contest 1948, Britain's most versatile strength & physical culturist	1948, 1949
Gustav Fristensky	77	Won many physique championships between 1905-1910	1905-1910
Hermann Görner	65		
John Grün	45		
George Hackenschmidt	89		
George F Jowett	77	Most Perfect Man	1920s
Prof Bill Klein	91		
Sigmund Klein	85	World's best built man/athlete	1925
John Lemm	76		
Earle Liederman	81		
George Lurich	45		
Bernarr MacFadden	87		
Clevio Massimo (Tony Sabatino)	84		

Maxick (Max Sick)	79		
Alan P Mead	78		
William L Murray	64	The Great Competition Winner	1901
Joe Nordquest	68		
Bobby Pandour	44		
Charles Poire	69		
William Albert Pullum	73		
Charles Rigolout	58	Olympic gold medallist	1924
Monte Saldo	70		
Eugen Sandow (Friedrich Muller)	58	World's most perfect man	
Hermann Saxon	79		
Milo Steinborn	95	German championship	1920
Al Treloar	87	Most Perfectly Developed Man 1903, Men's Physical Culture show 1904	1903, 1904
Gustav Wain	70		
Alexander Zass	74		

Table of Silver Era Athletes

Name	Age at Death	Title	Year
Bert Goodrich	84	Mr America	1939
Roland Esmaker	86	Mr America	1939
John Grimek	88	Mr America	1940
John Grimek	88	Mr America	1941
Frank Leight	78	Mr America	1942
Jules Bacon	89	Mr America	1943
Steve Stanko	61	Mr America	1944
Clarence Ross	84	Mr America	1945
Alan Stephan	81	Mr America	1946
Steve Reeves	74	Mr America	1947
George Eiferman	76	Mr America	1948
John Grimek	88	Mr Universe Amateur	1948
Jack Delinger	66	Mr America	1949
John Farbotnik	72	Mr America	1950
Steve Reeves	74	Mr Universe Amateur	1950
Monotosh Roy	87	Mr Universe Pro	1950
Roy Hilligen	85	Mr America	1951
Reg Park	79	Mr Universe Amateur	1951
Manohar Aich	104	Mr Universe Pro	1951

Jim Park	79	Mr America	1952
Juan Ferrero	40	Mr Universe Pro	1952
Bill Pearl	91	Mr America	1953
Bill Pearl	91	Mr Universe Amateur	1953
Arnold Dyson	83	Mr Universe Pro	1953
Dick Dubois	74	Mr America	1954
Jim Park	79	Mr Universe Pro	1954
Steve Klisanin	75	Mr America	1955
Mickey Hargitay	80	Mr Universe Amateur	1955
Leo Robert	95	Mr Universe Pro	1955
Ray Schaefer	85	Mr America	1956
Ray Schaeffer	85	Mr Universe Amateur	1956
Jack Delinger	66	Mr Universe Pro	1956
Ron Lacy	75	Mr America	1957
John Lees	91	Mr Universe Amateur	1957
Arthur Robin	95	Mr Universe Pro	1957
Tom Sansone	38	Mr America	1958
Earl Clark	87	Mr Universe Amateur	1958

Reg Park	79	Mr Universe Pro	1958
Harry Johnson	96	Mr America	1959
Bruce Randall	79	Mr Universe Pro	1959

Table of Golden Era Athletes

Name	Age at Death	Title	Year
Henry Downs	93	Mr Universe Amateur	1960
Paul Wynter	83	Mr Universe Pro	1960
Ray Routledge	77	Mr America	1961
Ray Routledge	77	Mr Universe Amateur	1961
Bill Pearl	91	Mr Universe Pro	1961
Vern Weaver	56	Mr America	1963
Tom Sansone	38	Mr Universe Amateur	1963
Abd El Hamid El Gindi	65	Mr Universe Pro	1963
Abd El Hamid El Gindi	65	Mr Universe Pro	1964
Elmo Santiago	82	Mr Universe Amateur	1965
Reg Park	79	Mr Universe Pro	1965
Larry Scott	75	Mr Olympia	1965
Bob Gajda	81	Mr America	1966
Chester Yorton	80	Mr Universe Amateur	1966
Paul Wynter	83	Mr Universe Pro	1966
Larry Scott	75	Mr Olympia	1966

Dennis Tinerino	64	Mr America	1967
Bill Pearl	91	Mr Universe Pro	1967
Sergio Oliva	71	Mr Olympia	1967
Dennis Tinerino	64	Mr Universe Amateur	1968
Sergio Oliva	71	Mr Olympia	1968
Sergio Oliva	71	Mr Olympia	1969
Chris Dickerson	82	Mr America	1970
Casey Viator	61	Mr America	1971
Bill Pearl	91	Mr Universe Pro	1971
Steve Michalik	63	Mr America	1972
James Morris	80	Mr America	1973
Chris Dickerson	82	Mr Universe Amateur	1973
Ron Thompson	59	Mr America	1974
Chris Dickerson	82	Mr Universe Pro	1974
Steve Michalik	63	Mr Universe Pro	1975
Serge Nubret	72	Mr Universe Pro	1976
Dave Johns	40	Mr America	1977
Dave Johns	40	Mr Universe Amateur	1978
Ray Mentzer	47	Mr America	1979

Rufus Howard	61	Mr America	1982
Edward Kawak	47	Mr Universe Pro	1982
Edward Kawak	47	Mr Universe Pro	1983
Edward Kawak	47	Mr Universe Pro	1984
Edward Kawak	47	Mr Universe Pro	1985