DEMOGRAPHICS, SIDE EFFECT, AND HEALTH CARE BELIEFS OF
PROHORMONE USERS

by

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ABSTRACT

JOSHUA MATTHEW NOONE. Demographics, side effects, and health care beliefs of prohormone users. (Under the direction of DR. YVETE HUET)

Prohormones are a type of nutritional supplement similar to Anabolic-Androgenic Steroids (AAS). As AAS are illegal without a medical prescription prohormones are sometimes used as a legal alternative. It is thoughts that prohormones carry the same types of health risks associated with AAS, but there is little research to support this. The study has focused on identifying a group of prohormone users and asking them about who they are, including demographics, how they use prohormones, what health outcomes they experience, and their perceptions of the health care system. Data acquisition was accomplished via a survey posted to two online forums dedicated to prohormone use and the Facebook[TM] page of a private gym facility. The survey was created and administered in the SurveyShare[TM] platform. Sixty five usable responses were gathered from three months of survey run time, four of which had to be dropped from papers two and three for lack of pertinent information. Demographics were identified including age, gender, and education along with use characteristic such as cycles taken per year. These characteristics were tested to see if there existed differences in those who started use at an earlier age or a later age. Self-reported health outcomes experienced were also identified and explored to assess any differences in outcomes based upon taking more than the recommended dose. Finally health care beliefs were outlined such as belief in the information obtained from a physician and tested based upon being a prohormone users or a user of both prohormones and AAS

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CHAPTER 1: INTRODUCTION

Background

The increase of anabolic hormones in the human body has been the focus of research and controversy for more than fifty years. Illicit use of these hormones is thought to cause severe negative health effects as well as controversies surrounding their use being cheating in sports and currently we classify these drugs as schedule three controlled substances. Several different methods exist to increase anabolic hormone levels depending on the setting. In a medical setting these hormones can be injected or increased via a transdermal patch (1-5). The most common medically used anabolic hormones are synthetic versions of testosterone and the former prohormone turned prescription drug androstenedione. In a non-medical setting anabolic hormones range across dozens of different hormones with similar structures but different development backgrounds. Those substances that come from medical or veterinary backgrounds are frequently known as anabolic-androgenic steroids (AAS) and those with this designation are controlled substances that are illegal to possess without a prescription (1). Hormones developed to increase physical performance and not intended for medical or veterinary use are made without the knowledge of the Food and Drug Administration and are legal. These hormones are commonly referred to as "prohormones" or less commonly as "designer steroids" (6). However, these substances are not identical even though the terms are used interchangeably. These differences will be discussed further under their

named sections, but for the general purposes of this paper the term prohormone will describe both substance types unless otherwise stated. The major overarching differences between AAS and prohormones are their methods of administration and obtainability. As mentioned previously AAS are most commonly administered intravenously or through a transdermal patch. Prohormones are never administered intravenously as this would automatically change them from being nutritional supplements to prescription drugs (6). These substances are usually administered by pill, but also by transdermal cream or sublingual liquid. From an obtainability standpoint AAS are prescription drugs and are usually obtained illegally from another country whereas prohormones are legal and easily purchased online.

The Loop Hole

Prohormones exist because of an opening in the law created by the Controlled Substance Act of 1971 and the Dietary Supplement Act of 1994 (7, 8). The largest loopholes exist because of the Controlled Substance Act, which is primarily concerned with any substance that has the potential for dependence. These substances are then ranked from schedule one to schedule five based upon their medical need versus their potential for abuse. Those with the most potential for abuse and little to no medical need are placed in schedule one with the opposite in schedule five. AAS were added to the schedule in 1991 via the Omnibus Crime Act (9). This was a highly controversial addition as the dependence capability of AAS was openly refuted by medical professionals called to testify in committee meetings on the topic (10). AAS were added to schedule three of the controlled list with some stipulations that create the present day loopholes. Most importantly AAS of any kind are not illegal as they have valid medical and veterinary uses. This makes any drug enforcement involved with these substances

much more difficult as an individual may have a valid reason to possess them. Secondly, any chemical difference no matter how small from a known AAS creates a new substance that must be congressionally reviewed before being added to the list. In effect this means that any manipulation creates a new substance which is by default legal until determined otherwise. This is where the Dietary Supplement Act becomes important. These new substances are then marketed as dietary supplements and via the Dietary Supplement Act are outside the purview of the Food and Drug Administration (FDA). The FDA simply needs to be notified that a new substance exists, they add it to the list of registered nutritional supplements, and it can be sold to the public, though enforcement on how often supplements are checked against FDA registrations is unknown (6). A third piece of legislation was created after this topic received attention in the early 2000's called the Anabolic Steroid Act of 2004. With this new legislation a substance deemed to be an AAS by the head of the Drug Enforcement Agency can be designated as a controlled substance without going through congressional oversight. This has been used on a few occasions since, most notably with the addition of the designer steroid Madol (11). After all of these pieces of legislation what has effectively happened is the creation of an open market for small labs to create new substances, market them, and sell them as nutritional supplements without fear of repercussion.

Prohormones

A prohormone is any hormonal substance that after administration converts into another hormonal substance. This conversion is usually accomplished via the liver where a methyl group is cleaved off the molecular structure of the substance. More specific to this context a prohormone is a substance that breaks down into an anabolic steroid (12). The most famous prohormone in United States history is androstenedione (Andro), which

is a naturally occurring hormone and is the last in a cascade of hormones that result in testosterone production (13). In the late 1990's nutritional supplement companies began marketing Andro as a way to increase testosterone levels without actually supplementing testosterone itself. Retrospectively we now know that while Andro will convert to testosterone, it also commonly converts to estrogen in young men. After being made famous in the early 2000's by baseball player Mark McGwire, Andro became controversial and was eventually added to the list of known AAS making it a controlled substance illegal without a prescription (14). At the same time some other famous prohormones were added to the list as well including Methyl 1-Testosterone and 19 Nor-Andro (7).

Since Andro became a controlled substance other prohormones have become popular as nutritional supplements. These substances also occur naturally in the body and are part of the hormonal cascade mentioned earlier, they are simply higher up the list. Androstenediol, one of the new substance, is the conversion before Androstenedione has been sold as well as Androstone and the "19 Nor" versions of each (2, 15). To be effective each of these prohormones must first break down into Andro. These substances are not perceived as being as effective as the original Andro and are therefore less popular accounting for less and less of the market share over time. This gap in the market is being filled by designer steroids.

Designer Steroids

Designer steroids are new anabolic substances sold as nutritional supplements. These substances are usually very similar to an existing AAS, mainly having one chemical difference between the new substance and the "parent hormone" (See Exhibit 1). In other cases they are entirely new substances such as THG made famous in the Bay

Area Lab Corporation (BALCO) trials involving performance enhancing drug use (PED)

in several elite athletes including Barry Bonds (16). These new substances are usually

created to be highly anabolic while at the same time being entirely undetectable in drug

tests (17). Noted by Diel et al. and Frese et al. these new or slightly different substances,

while chemically similar to other AAS, may have very different outcomes within the

human body (2, 15). As such there is no way to predict how any new substance will act

or what health outcomes could be possible. It is also the case that guidelines such as

appropriate dosages are most often made up or taken from the experiences of a small

experimental group including the chemists themselves and their associates. With no legal

oversight these substances can exist for years undetected as with the BALCO case.

Paper 1 Demographics

Background demographics for prohormone users do not exist. In light of this lack

of information we must substitute demographics for AAS users. Demographics for AAS

users show a distinct split depending on the age of the subject in question. Because of

existing data and the ease of collecting new data while they are gathered together in

school, children and adolescents are the most studied age groups (18, 19). From this

research it is evident that adolescent AAS users commonly participate in sports, are more

likely to have body image concerns, use other illicit drugs, and miss school more than

their non-using peers. Moreover, reports on racial and socioeconomic status influences

on AAS use have not been consistent and therefore cannot be used as a predictive factor

at present. (19-23).

The demographics of adult AAS users contrast those of adolescent's. Of the few

large studies investigating adult AAS users they tend to be well educated, employed, but

not participants of sports activities (24, 25). Some studies have shown that adult AAS

users suffer continued body image concerns and most studies agree that illicit drug use other than AAS is much higher than non-using peers, but whether this is a continued illicit drug use or is just a leftover artifact in the data from when they were adolescent is unclear (26). With this seeming demographic divide depending on the age of the participants being studied this paper will assess any demographic differences between those who initiated prohormone use before the age of 30 versus those began use after the age of 30 years.

Paper 2 Side Effects

Adverse health outcomes have been the focus of most PED research since nonprescription use began. A limited amount of research has been conducted specifically to investigate prohormones. In two case studies the prohormone Methasteron (Superdrol) was linked to advanced liver damage. One of the two studies detailed a college student's hospitalization after a little more than a month on the substance (27, 28).

AAS adverse health outcomes have been theorized and debated for decades, but some AAS adverse health outcomes are well accepted. These include, but are not limited to, acne, hair loss, increased blood pressure, hyperlipidemia, increased feelings of anger, liver damage (oral AAS), elevated prostate specific antigen (PSA) levels (in dehydrotestosterone related AAS) and erectile dysfunction are all known as potential short term side effects meaning that they would likely return to normal within approximately six months of cessation (1, 3, 4, 13, 29-33). The percentage of individuals who experience these outcomes is unclear and with more than one hundred different AAS products available, the combination of adverse health outcomes may be specific to the AAS used.

Longer term outcomes are more challenging to measure and evidence for specific long-term health outcomes in association with AAS use is lacking, except for gynecomastia, which is known to occur with testosterone AAS (29). Other potential long term effects with AAS use include: heart disease, cancer, stroke and permanent prostate damage (32, 34-37). While little research is associated with the effects of different dosage, pharmacological principles suggest that adverse events would increase with increased dosages. Lack of research on this topic may have to do with the extreme doses that most AAS users use, when an individual uses 100 times the medical dose degrees of change in outcomes associated with each dosage potentially get lost (24). This study will look at the association of prohormone use with all of the short term and as many of the long-term effects health outcomes as possible. Prohormone related health outcomes will then be compared between those taking the manufacturer recommended dose and those taking higher doses.

Paper 3 Health Care Beliefs

Patient beliefs about information coming from physicians have been studied for many years as it is an integral part of health care delivery. Of the many studies in existence and measurement scales there appear to be differences in how a patient interacts with a health care provider based upon gender, race, age, and the physician's physical appearance. Pope et al found little difference in beliefs about health care provider credibility between AAS users and their non-using, weightlifting peers (38). The authors inquired about general health, illicit drug use, smoking, and many others with no differences found except for beliefs about nutritional supplements and AAS. The AAS users believed less of a physician's advice about AAS than their non-using peers and placed more credibility on information from "underground publications" dealing with

AAS use. This disbelief is not unexpected as Yeselis and others have observed that adolescent do not believe the information they receive about AAS in school (23, 39) (40). Pope et al also reported that a large number of AAS users never discuss their use with their physicians, making it difficult to correctly diagnose and treat a set of symptoms(38). If a similar scenario exists in prohormone users, the implications for the medical community may include incorrect diagnosis of symptoms and harmful treatment.

Significance

The obvious question to this topic is why anyone should care. The answer is the potential outcomes associated with prohormone use. There are no current estimates of prohormone use prevalence in the United States, but with online forums dedicated to discussing prohormones exceeding 50,000 members, prohormone use may include a significant sector of the population, emphasizing the urgency for further investigation.

Currently, the demographics of prohormone users and the type or dosage of prohormone use are not known. Therefore, initial characterization of prohormone use and users is essential for future study as without this we will not know how to reach the individuals or, if deemed necessary, what methods of outreach would be prudent. Clinical health outcomes are difficult to measure because giving high doses of AAS or any dose of a prohormone to human beings in a lab setting would be unethical. Therefore, the present study will query individuals who are already taking prohormones, about their:

- Health outcomes
- Comfort in speaking to a physician about prohormones
- Belief in the information a physician is giving about prohormones

If these users are seeking help for health outcomes, but do not feel comfortable speaking with a physician about prohormone use the physician may be unable to effectively treat the patient.

Theoretical Framework

The Theory of Planned Behavior

The Theory of Planned Behavior (See Exhibit 2) was created by Icek Azjen as an extension to the Theory of Reasoned Action (41). The Theory of Reasoned Action states that an individual is more likely to perform an action if he believes the consequences of that action will be positive and if he believes that those who are socially important to him also believe the action is positive. The Theory of Planned Behavior takes this one step further in identifying "control beliefs", or the individual's beliefs about their actual ability to perform a given task, as the third key in predicting if an individual is likely to perform that task.

Behavioral Beliefs:

If a given individual believes that the consequences of taking prohormones are positive than he/she is more likely to actually take them. In this case the individual may take into account the negative health outcomes theorized to accompany prohormone use and compare that against the perceived positives of increased musculature or improved performance. If the positives outweigh the negatives then a positive "attitude toward the behavior" will prevail.

Normative Beliefs:

For an individual to use prohormones he/she may think about what other members of society, or more specifically his/her social circle will think about the behavior. If they think members of their social group will be pleased about taking these drugs then the

normative beliefs would be positive. Each individual's beliefs and the ranking of how important it is for the subject to comply with those beliefs create the "subjective norm." This is really just the cumulative beliefs of all those the subject feels are important and whether they are positive or negative.

Control Beliefs:

Control beliefs convey the individual's beliefs about whether he or she is actually able to complete the task and what factors may help or hinder that ability. The most obvious of these is whether an individual believes there is enough money to purchase the prohormones or if there is access to a gym. Either of these could bolster the subject's intentions or lower them and greatly impact the likelihood of performing the action. The overall belief about both impeding and facilitating factors creates individuals "perceived behavioral control".

Actual Control:

While not discussed as part of the decision making process, the subject does need to have the actual physical ability or skills to perform the task. In this case if all prohormones were made illegal and destroyed the subject would not be able to actually obtain them next week regardless of their planned behavior.

It is important to remember that these factors do not act alone but in combination with each other. The normative beliefs of a culture could certainly impact the behavioral beliefs of an individual just as much as the behavioral beliefs could influence individual perception of normative beliefs and the same is true for control beliefs. This model is not so much a progression of steps but an accumulation of factors that can then predict individual behavior.

Methods

The Survey

The survey instrument was designed to fit the research questions of the study. Several focus areas exist within the survey including: demographics, experienced health outcomes, details about prohormone use, and beliefs of users about the health care system. Each question was reviewed and discussed by the dissertation committee ending with a total of thirty-seven questions being formulated. After committee review the survey was submitted and approved by the Institutional Review Board (IRB) of UNC Charlotte and built using SuveyShare TM. The survey was posted to two prohormone discussion forums dedicated to those who use prohormones and posts were placed informing the community of what the survey was, what the intentions are, and the duration ending on September 8, 2013. After initial posting the survey was monitored and posts made to keep the survey at the top of the discussion forum comments to maximize survey visibility to potential participants.

Proposed methods for each portion of the study

Paper 1 Methods

Paper one will used means and frequencies to determine common characteristics among prohormone users. As discussed in the background section there was potential for age to impact background characteristics so chi square analysis was used with categorical variables. T-tests were used for continuous variables and chi-square tests for categorical variables to identify differences between users who began before the age of thirty and those who began after that age. To gain a more defined picture of how the age of first use impacts prohormone use characteristics logistic regression analysis was performed. The

logit model predicted the odds of each characteristic based upon beginning use before the age of twenty five.

Paper 2 Methods

Adverse events are hypothesized to be common among prohormone users. Basic frequencies and counts were used to find and order outcomes from the most common to the least. All outcomes given were included in a table with the number of users who experienced the given outcome. Means were used to describe the average number of outcomes per user, cycles per year and cycles in a lifetime. All outcomes with two or more occurrences were used for further analysis.

T-tests and chi square analysis were used to assess differences in health outcomes between users who use the recommended dosage versus those who use more than recommended. Finally independent multivariate logistic regression were used to estimate odds of each outcome while controlling for age and education. Sensitivity analysis was done using a MANOVA including all outcomes simultaneously. Further analysis were included such as the clustering of factors and outcomes associated with those clusters.

Paper 3 Methods

The number of users who interact with the health care system and how they interact with it will be detailed using how many see a primary care physician, frequency of office visits, and averages of beliefs. These results will then be analyzed by comparing users of only prohormones versus those who use both prohormones and AAS in t-test and chi-square analysis. Multinomial logistic regression will be used for scalar variables and binary for those with only two levels to compare the same two groups while controlling for age and education.

CHAPTER 2: DEMOGRAPHICS OF PROHORMONE USERS

Background

Prohormones are a group of substances chemically similar to anabolic steroids that are sold as legal nutritional supplements in the United States. These substances are either anabolic steroids that were created in the mid 1900's and never released as pharmaceuticals or are entirely new substances created from illegal anabolic steroids (2). In either case these substances are not covered under the Drug Enforcement Agencies schedule three listing and are therefore legal to be sold as nutritional supplements. Anabolic steroids are known to cause health problems in those who abuse them including hyperlipidemia, hypertension, acne, and gynecomastia, as well as possible links to heart disease, cancer, and diabetes (4, 30, 42).

To date, there have been no reports published on the demographics of prohormone users despite the associated health concerns. Therefore, assumptions are made about prohormone users that derive from the better known demographics of AAS users. Demographics for AAS users show a distinct demographic split depending on the age of the subject in question (21, 43). Because of existing data and the ease of new data collection in a school setting, children and adolescents are the most studied age groups (18, 19). From this research it is evident that adolescent AAS users commonly participate in sports, are more likely to have body image concerns, use other illicit drugs, and miss school more than their non-AAS using

peers (Yesalis, Barsukiewicz et al. 1997, Stilger and Yesalis 1999, Yesalis and Bahrke 2000, Bachman, O'Malley et al. 2011, Denham 2011). Studies have reported disparate findings in terms of racial prevalence and prevalence within socioeconomic classes. As a result of these disparate findings these indicators cannot reliably be used as a predictive factor at present (44).

The demographics of adult AAS users contrast those of adolescent's. Of the few large studies investigating adult AAS users they tend to be well educated, employed, but do not participants of sports activities (24, 25, 43). Some studies have shown that adult AAS users suffer continued body image concerns and most studies agree that illicit drug use other than AAS is much higher than non-AAS using peers, but whether these data indicate continued illicit drug use or if this is just a leftover artifact in the data from when the individuals were of adolescent age is unclear (26). It remains largely unclear with little longitudinal data whether the individuals who use AAS when they are children remain as low academic and social achievers and are entirely separate from what is known about adult users or end up eventually becoming the high achievers we see in studies of adults.

The goal of this study was to describe a prohormone using population in terms of their background characteristics and their prohormone use patterns. With a seeming demographic divide depending on the age of the participants being studied this paper assessed any demographic differences between those who initiated prohormone use before the age of twenty five versus those began use after that age.

Methods

Data

The data used in this study was gathered using an online survey. The survey was created by the authors including candidate and committee, approved by the institutional review board, and uploaded to the Internet using the SurveyShare^{TM} survey tool. The survey link was posted to two online forums dedicated to prohormone use. These forums are portals for users to discuss a wide range of topics, including personal experiences, related to prohormone use. After initial posting, the survey was promoted on the forums for a total of two months. The survey link was then posted to Facebook^{TM} on pages for private gyms catering to weightlifting, powerlifting, and fitness. The total convenience sample netted sixty one responses to the survey that were used for this analysis.

Variables

Background

Background variables measured in the study include current age, gender, and education. Current age was measured as a categorical variable with categories including 18-19, 20-24, 25-29, 30-39, 40-49, along with 50 and above. Education was also measured as a categorical variable with levels of high school only, being currently in college, having a vocational degree, associate's degree, bachelor's degree, and master's degree or higher. Gender was collected as a binary variable with male and female.

Prohormone Use Characteristics

Measured prohormone use characteristics include age at first use, number of prohormone cycles ever used, prohormone cycles per year, dosage taken during the last cycle, number of substances used in the last cycle, and reasons for using. Age at first use and number of substances taken in the last cycle were both measured as continuous variables. Number of prohormone cycles ever used and use per year were both measured as categorical variables including levels of one, two, three, four, and more than four. Dosage taken was measured as a categorical variable of less than recommended, exactly recommended, and more than recommended. Reasons for initiating use include weight lifting sport, non-weight lifting sport, to look better, to be stronger, and to help in my job.

Study

Means and frequencies were used to determine common characteristics among prohormone users. As discussed in the background section there is potential for age to impact background characteristic. T-tests were used for continuous variables and chi-square tests for categorical variables to identify differences between users who began before the age of twenty five and those who began after that age. Categorical variables were collapsed into groups when cell sizes were too small to allow for meaningful analysis. Missing data was largely censored out of the study with only four values being imputed with averages for the relevant age and use characteristics of the user.

To describe the demographics of how age and education levels impact prohormone use patterns, multinomial and binomial logistic regression were used to

assess the effect of having initiated used before the age of twenty five of several use patterns. Results were expressed in odds ratios with confidence intervals and p-values.

Results

Current age at time of the survey ranged from eighteen to more than fifty years old with a median age category of twenty-four to twenty-nine years old. Education also varied but is far above what is considered average with more than forty-six percent holding a bachelor's degree or higher (Table 1)(45). Prohormone use patterns are further described in Table 2. Average age of first use, otherwise known as a cycle, was 26.4 years of age, but with a broad standard deviation at 7.07 years. The average number of cycles per year is 1.93 (SD) with lifetime usage ranging between once and 4 or more times. The most common duration of cycles was six weeks with an average of 1.85 (SD) prohormones taken in an average cycle. The most frequently reported reason for prohormone use was to 'look better' (49.18% ± SD), but improving strength and performance in weight lifting related sports also make up a large portion of the reported reasons for prohormone use (22.95% ± SD and 24.59% ± SD respectively).

Assessing differences between older and younger prohormone users revealed differences in the averages shown in tables one and two (see Table 3). After dividing the population into those who began using prohormones before 25 years of age and those who began after 25 years of age, understandably created significant differences in current age, but also created a significant difference in age at first use ($p = <0.01$; Table 3). Additional significant differences between age groups included reasons for

initiating use (p=<0.01, Table 3) and the number of prohormone cycles used per year

(p=<0.01, Table 3). Older individuals were more likely to use prohormones to

enhance physical appearance while the younger users reported more interest in

strength gains, as well as improved performance in weightlifting related sports (e.g.

bodybuilding). Younger respondents were more likely to use prohormones in two

cycles per year, while older users are more likely to only use one cycle per year.

Planning to use prohormones again was also significant (p= 0.02), but as only two

individuals in the entire sample responded that they were not planning to use

prohormones again the variable had to be dropped from further analysis. All other

variables included in chi-square analysis were not significant.

In multivariate analysis the two factors that were significant in univariate

analysis, those being cycles taken per year and the reasons for use, remained so while

controlling for the education of the individual (Table 4). Individuals who started

using prohormones at an earlier age are 5.04 times (p = 0.01, CI = 1.44-17.68) more

likely to complete two prohormone cycles a year and 8.96 times (p = 0.01, CI = 1.69-

47.51) more likely to complete three or more cycles per year compared to their older

counterparts. The reported reasons for using prohormones also differed with younger

initiators being less likely to use prohormones to improve perceived physical

appearance compared to older respondents (OR = 0.24, CI = 0.06-0.87).

Discussion

This is the first study to report demographic information about prohormone

use patterns and characteristics of prohormone users. As an emerging group of

performance enhancing drug users there are a couple of reasons that society should

take note. First, this group has the potential to experience all of the negative health consequences that are currently associated with AAS. Compounding this is the absence of information about the population prevalence of this group. With current forum enrollment seen at approximately fifty five thousand individuals and no estimate as to the number of forums in existence the population has the potential to be large. Any large group of individuals with serious health implications could have a negative impact on the health care system. Secondly our understanding of this group can help us to learn the actual health impacts associated with these substances and positively focus any health interventions necessary. Of note is the reluctance of performance enhancing drug users to talk about how they use substances. The building of a background profile of a sample of prohormone users can set the groundwork for future studies.

The results of this study suggest that younger prohormone users complete more cycles per year and reported a greater interest in sports performance and perceived physical appearance. This difference between older and younger prohormone users shows a contrast within the population that could be explained by two primary factors. First, known prohormone availability began in the early 1990's and some users may have started using these substances prior to this if they had been available. Moreover, it is possible that when current older users were younger, they may have used prohormones for similar reasons as those reported by current younger users (e.g. physical performance) had these substances been available. This second point is merely speculation, as the data does not exist for the prohormone population or an older anabolic steroid using population.

Factors that were not statistically significant may still help to improve understanding of prohormone user demographics. Overall, the respondents in this study had achieved an above average level of education with 47.55% of the sample with a bachelor's degree or higher, well above the 31.4% considered average for males over the age of twenty five in the United States population (45). Ninety percent of users were between the ages of twenty and forty completed at least one prohormone cycle per year with an average of two substances per cycle. Currently we have no idea of the cumulative effect of taking more than one prohormone at the same time. Even in the AAS population it is known to be common but our understanding is lacking. As a testosterone related substance polypharmacy is considered to be a negative health implication. Fifty nine percent of users had also taken anabolic steroids within the last calendar year. This implies that either prohormones are substances taken by anabolic steroid users while not on steroid cycle, taken by anabolic steroid users while on cycle possibly to improve the effects of a cycle, or are themselves a gateway into anabolic steroid use. All three options are plausible and may occur simultaneously within different segments of a prohormone using population.

The limitations of this study are mainly present within the study design. As a population that is difficult to study, the forum based convenience sample was the only plausible option to reach a larger population. The sample cannot therefore be used to make assumptions about the population in general. Another limitation of this study was the low statistical power and as stated previously, post hoc power analysis indicated that this study could only detect differences greater than thirty percent as

significant. While this was enough power to detect differences when the sample was very evenly distributed as with age at first use, other differences that were more skewed such as recommending prohormones to a friend may require larger sample sizes before effective assessments can be made.

The strength of this study is the population investigated. Very little data exists pertaining to prohormone users and the data that does exist is usually limited to individual cases (27). This study has described a prohormone using population on a larger scale than previously reported. The information provided by this study facilitates decision-making with regard to future hypotheses and study design. For example utilizing online forums to elicit information from prohormone users is an effective method. Furthermore there is some evidence of a divide within older and younger users for reasons of use and how prohormones are used that needs further exploration.

This was a pilot study that investigated a research area with a paucity of data. While it presents important information about the demographics of prohormone users, who may experience significant health risks associated with their use of these substances, larger sample size studies are now required to describe these individuals and the potential implications of prohormone use.

Table 1: The profile of the prohormone user (n=61)

	Frequency/Mean	Percent/SD
Gender	Male	100
Age		
18-19	1	1.64
20-24	17	27.87%
25-29	21	34.43%
30-39	17	27.87%
40-49	4	6.56%
50+	1	1.64%
Education		
High School or less	2	3.28%
Vocational	5	8.20%
Associates	12	19.67%
Currently in College	13	21.31%
4 Year College	20	32.79%
Masters or higher	9	14.76%

Table 2: Prohormone use characteristics

	Frequency/ Mean	Percent/ SD
Age at first cycle	26.40	7.07
Cycles per year	1.93	1.06
Cycle duration		
Four weeks or less	15	24.59%
Six weeks	36	59.02%
Two Months or more	10	16.39%
Number of prohormones taken in last cycle	1.85	0.66
Cycles completed in lifetime		
1	16	26.23%
2	7	11.48%
3	12	19.67%
4	15	24.59%
More than four	11	18.03%
Reason for initiating use	2.93	1.64
Weight lifting sport (powerlifting, bodybuilding)	15	24.59%
To look better	30	49.18%
To be stronger	14	22.95%
Help me in my job	1	1.64%
Any other sport	1	1.64%

Table 3: Differences between older and younger users (began <25, began >=25)

	<25	>25	P
Age of first use	21.03 (1.97)	32.00 (6.22)	.00
Current Age			.00
18-19	1	0	
20-24	16	1	
25-29	12	9	
30-39	1	16	
40-49	0	4	
50+	0	1	
Education			0.28
High School	10	5	
Vocational/Associates	8	9	
College Graduate or more	12	17	
Cycles per Year			0.01
1	6	18	
2	16	10	
More than two	8	3	
Cycle duration			0.98
Four weeks or less	7	8	
Six weeks	18	18	
More than six weeks	5	5	
Dosage			0.90
Recommended or less	15	16	
More than recommended	15	15	
Cycles completed in lifetime			0.48
1	6	10	
2	5	2	
3	5	7	
4	7	8	
More than four	7	4	
Number of prohormones taken in the last cycle			0.95
1	9	9	
2	17	17	
More than two	4	5	
Reason for initiating use			0.04
Look better	10	20	
Improve strength	8	6	
Other	12	5	
Also taken AAS in the past year			0.88
Yes	12	13	
No	18	18	
Going to use prohormones again			0.02
Yes	30	29	
No	0	2	
Recommend prohormones to a friend			0.25
Yes	28	26	
No	2	5	

Table 4: Prohormone use factors based on age starting before twenty five and controlling for education

	OR*	CI**	P-value
Cycles Per Year[1]			
2	5.04	1.44-17.68	0.01
Three or more	8.96	1.69-47.51	0.01
Cycle Duration[2]			
Six weeks	1.15	0.34-3.93	0.82
More than six weeks	0.80	0.15-4.38	0.79
Cycles Completed in lifetime[3]			
2	4.81	0.65-35.71	0.12
3	1.49	0.30-7.44	0.62
4	2.12	0.45-9.95	0.34
Five or more	4.33	0.78-24.02	0.09
Number of PH taken in the last cycle[4]			
2	1.01	0.31-3.23	0.99
Three or more	0.96	0.18-4.96	0.96
Reason for using[5]			
To look better	0.24	0.06-0.87	0.03
Other	0.56	0.13-2.53	0.45
Recommend prohormones to a friend	3.75	0.60-23.42	0.16
Taking more than the recommended dose	1.11	0.39-3.09	0.84
Also taken AAS in the last year	0.806	0.28-2.32	0.69

*OR= Odds Ratio, **CI= Confidence Intervals, [1]= referent category one cycle per year, [2]= referent category cycle duration of four weeks or less, [3]= referent category one cycle in lifetime, [4]= referent category one PH in last cycle, [5]= referent category wants to be stronge

CHAPTER 3: SIDE EFFECTS OF PROHORMONE USE

Background

Adverse side effects resulting from performance enhancing drug use has been
the primary focus of research on this topic since nonprescription use began.
Investigating the health effects of using a performance enhancing substance improves
understanding of the negative consequences associated with it. A limited amount of
research has been conducted specifically to investigate prohormone use. In two case
studies the prohormone Methasteron (Superdrol) was linked to advanced liver
damage (27, 46). One of the two studies detailed a college student's hospitalization
after a little more than a month of using the substance (27). To compensate for the
paucity of information regarding side effects of prohormone use, similar studies on
the health effects of anabolic steroids (AAS) are helpful as they are chemically
closely related.

The scope of adverse side effects associated with AAS has been controversial
for decades, but some AAS adverse side effects are well accepted. These established
adverse side effects include, but are not limited to, acne, hair loss, increased blood
pressure, and hyperlipidemia, increased feelings of anger, liver damage, elevated
prostate specific antigen (PSA) levels and erectile dysfunction(1, 3, 4, 13, 29-33).
These outcomes are considered short-term side effects meaning they would likely
return to normal within approximately six months to a year after cessation(1). The
percentage of individuals who experience adverse side effects is unclear and with

more than one hundred different AAS products available, the combination of adverse side effects may be specific to the AAS used. This substance specific potential for outcome may also be associated with prohormones, but this is currently not studied.

Longer-term outcomes are more challenging to measure and evidence for specific long-term health outcomes in association with AAS use is lacking. The exception to this rule is gynecomastia, breast growth in men, which is known to occur with AAS use in some individuals (29). Other potential long-term effects associated with AAS use include: heart disease, cancer, stroke and permanent prostate damage (32, 34-37). While little research associates the effects of different dosage, pharmacological principles suggest that adverse effects would increase with increased dosages also known as a "dose response" (47). Lack of research regarding outcomes found at each dose may have to do with the doses that most AAS users take which far exceed pharmacologic doses and are highly variable between users (24).   The association of these principles and prohormones can only be guessed at with no research on the topic. The purpose of this study was to assess associations between prohormone use and short-term and as many of the long-term health outcomes as possible. Prohormone related health outcomes will then compare those taking the manufacturer recommended dose and those taking higher doses. Finally, adverse side effect risk will be compared between those who are seen to have multiple risk factors versus just one.

Methods

Survey instrument

      The instrument used to collect data for this study was an online survey focused on prohormone users. The survey included questions about prohormone use, demographics, outcomes, health care beliefs, and post cycle therapies. Two online forums that focus on prohormone use were selected. The survey was posted to these for a period of two months with continual updates by the research team to ensure visibility within the forum. For an additional month the survey was posted to the Facebook[TM] page of a privately owned fitness company whose owners are involved in the bodybuilding and powerlifting communities. After a total period of three months data collection ceased, the results were downloaded for analysis.

Data analysis

      An overall description of the population included gender, age, and educational status of the prohormone users who responded to the survey. Adverse side effects are hypothesized to be common among prohormone users. Basic frequencies and counts were used to find and order outcomes from the most common to the least. All side effects reported with at least two occurrences were included in a table with the number of users who experienced the effect and the percentage of the population involved. Means and standard deviations were used to describe the average number of effects per user, cycles per year, number of substances taken in the last cycle, and cycles in a lifetime.

      Prohormone users were divided between those who took the recommended dose or less and then who took above the recommended dose. Independent

multivariate logistic regressions were used to estimate odds of each effect occurring as a result of increased dose while controlling for age and education. The association of side effects experienced on beliefs about the commonality of effects in general will be tested using Pearson correlation tests. The population will be divided into those who experienced a number of effects above the average, experienced the average, and then those who experienced none. These will be correlated with answers to a survey questions asking on average how common are side effects within the population.

Finally, the impact of being at multiple risks of increased side effects simultaneously was assessed. Other than dose, risk factors included the number of prohormones taken in a given cycle, the number of cycles per year, cycle duration, and having taken AAS in the last year. To be considered at risk for the number of prohormones taken in a cycle only those who took above the average number of substances were used. Similarly, those who completed more than the average number of cycles per year will be considered at risk and the same was used for duration. If the individual indicated that they had taken AAS in the last year they were automatically considered at risk. A Pearson correlation test was used on the risk factors to test for collinearity. The above four risk factors were combined with dosage to create a pool of individuals experiencing multiple risks. These individuals then were compared to their single risk peers, associating risk with the chance of experiencing more than the average number of side effects.

Results

Sixty-five observations were used for overall analysis. Population characteristics show the responders were 100% male, with an age range of eighteen to

the lower fifties with a concentration of individuals in their twenties (64.62%, Table one). The individuals are well educated with 46.16% having received a bachelor's degree or more and all individuals having at least a high school diploma. Prohormone use characteristics show an average of 1.84 prohormones taken per cycle with a standard deviation (SD) of 0.67 and 1.80 cycles per year (SD=0.75). Of the users, 49.23% (n=32) consumed more than the manufacturer recommended dosage and 40.00% (n=26) percent have also taken anabolic steroids within the last year.

Side effects experienced by two or more users included eighteen different effects along with eight individuals who have never experienced a side effect (Table two). The most common reported side effect was "Feeling sluggish" with 53.85% (n=35) of users admitting they had experienced this side effects. Acne and increased aggression were equally the second most common with twenty-four individuals or 36.93% of the population reported experiencing one or the other. Headaches, cholesterol issue, and hair loss were the next three most common effects with 33.85%, 18.46%, and 15.38% respectively. All other side effects were experienced by less than ten percent of the population and night sweats were the least common side effect experienced (only two individuals or 3.08%) and were not included in further analyses.

There was a significant, positive correlation between experiencing objective adverse effects and beliefs about the frequency of side effects experienced (R=0.26, p=0.04, Table three). There was not a significant impact of using more than the recommended dosage on the chances of experiencing a given side effect (Table four). The test of collinearity indicated that AAS use and cycle duration were highly

correlated with the number of substances per stack and therefore they were dropped

from analysis. Multiple risk analysis did show an association between experiencing

multiple risks and experiencing an above average number of side effects. (OR= 8.45,

CI= 1.53-46.99)(Table five). When broken down into combinations of dosage and

other risks individually no significant difference was seen. .

Discussion

This study has established a range of side effects experienced by prohormone

users. Overall the effects are negative and included sluggishness, acne, and

aggression as the most common. If studies on anabolic steroids can be used as an

example of duration of the effects listed above, they are likely short-term and resolve

within six months of cessation of prohormone use, with the exception of

gynecomastia which was uncommon in the sample(4). However, it is important to

note that not every side effect is negative since three individuals stated an increased

sense of "wellbeing." Because of the limited research done on prohormones users,

we are the first to report this positive effect, which may be specific to prohormone

use. Positive effects found in AAS research are rare and most studies have involved

qualitative research, interviewing users (39).

The correlation analysis adds information about the mindset of users based on

their own experiences. Previous anabolic steroid research has reported that adolescent

users do not believe the information they receive in school about the side effects of

use (40). This is further confirmed with similar lack of belief present in adult AAS

users (39). This sample indicates the impact of experiencing overt side effects

affected user's beliefs about the commonality of side effects. Those individuals who

had never experienced a side effect believed that they were uncommon in the

prohormone using population (R=0.26, p=0.04). Those who experienced more than

the average number of side effects were not significantly correlated with the belief

that they are common (R=0.17, P=0.16). These new findings are in line with

previous research on AAS users as individuals who had experienced more than the

average number of side effects still disbelieved that side effects were common among

prohormone users in general(39).

     Dose-response relationships between dose taken and effects, both positive and

negative, are expected among anabolic hormone supplementation (48). In this

analysis dose-response effects were not found in association with side effects. This

finding may be explained by two factors. First, as previously stated this is a pilot

study and therefore had a lack of statistical power. For example, the effect of hair

loss was reported less in those who used more than the recommended dose (OR=

0.19, p=0.06), this effect with a p-value close to significance may have been

improved with a larger sample. Second, it is unclear how the recommended doses

were originally established. For many of these substances drug trials regarding

substance effectiveness and safety have not been conducted. It is possible that

recommended doses are sufficiently high to elicit the effects reported here and there

are no additional effects experienced when more than recommended is taken. It is

also important to note that the desired effect of increased muscle mass was not

questioned and that there is no data regarding doses required for muscular outcomes.

The multiple risk analysis provided several important pieces of information. First,

those individuals who use prohormones in a manner that they experience multiple

simultaneous risk factors are at increased odds for experiencing more than the average number of side effects (Table 5). Second, those individuals who also use AAS are significantly correlated with other high risk factors including more substances per cycle and more cycles per year. These two pieces information provide an important point for future research into this population indicating a special need to focus on AAS-prohormone dual users.

The primary limitation of this study was the lack of statistical power. With so many effects being experienced and some with small numbers of individuals experiencing them, comprehensive analysis of the sample was challenging. As a pilot study into a new area of research, the design of this study is a convenience sample and therefore no generalizations about prohormone users were possible. This design limitation only allowed for descriptive analysis of the observed population subset.

The strengths of this study are that it provides a framework for future research. In previous research it has been cited that users of performance enhancing drugs are difficult to study. These individuals tend to be secretive and reluctant to discuss any detail regarding their drug use, therefore any information gained is helpful. The list of effects reported here will help facilitate future research focusing on degrees of severity within effects as opposed to establishing that they exist. Most importantly is the implication for further research on the population experiencing multiple risk factors simultaneously as these individuals may be more susceptible to adverse side effects.

Prohormones remain an understudied and little understood form of nutritional supplement, but their use may lead to significant adverse health outcomes. This study

was a pilot that investigated side effects experienced by prohormone users and

associations with potential risk factors, such as taking more than the recommended

dose. Clearly more research is needed to understand the population in more detail.

Table 5: Descriptive

	Frequency/ Mean	Percent/SD*
Gender		
Male	65	100%
Age		
18-19	1	1.54%
20-24	20	30.77%
25-29	22	33.85%
30-39	17	26.15%
40-49	4	6.15%
50-54	1	1.54%
Education		
High School or less	2	3.08%
Vocational	5	7.69%
Associates	13	20.00%
Currently in College	15	23.08%
Bachelors	21	32.31%
Masters or higher	9	13.85%
Average number of Prohormones taken in a cycle	1.84	0.67*
Dosage above recommended	32	49.23%
Average number of cycles per year	1.80	0.75*
How common are side effects		
Very common	14	22.22%
Somewhat common	35	55.56%
Not common	14	22.22%
Also an AAS user	26	40.00%

*SD-Standard Deviation

Table 6: Side Effects Observed

	Number observed	Percent of users reporting this outcome/ SD*
Total Population	65	
Self-evaluated outcomes		
Hair loss	10	15.38%
Acne	24	36.92%
Feeling "sluggish"	35	53.85%
Cholesterol issues	12	18.46%
High blood pressure	6	9.23%
Chest pain	4	6.15%
More Aggression	24	36.92%
Gynecomastia	4	6.15%
Chest tenderness	9	13.85%
Back Pain	4	6.15%
Headaches	22	33.85%
Decreased libido	3	4.62%
Night sweats**	2	3.08%
Overall sense of "wellbeing"	3	4.62%
Never experienced a side effect	8	12.31%
Average number of side effects	2.49	1.61*
Diagnosed conditions since prohormone use began		
Diagnosed with high blood pressure	8	12.31%
Diagnosed with high cholesterol	4	6.15%

*Standard Deviation

**Too small for further analysis

Table 7: Correlations of Beliefs and Experienced Side Effects

	Correlation	P-value
Experiencing an above average number of side effects and believing side effects are very common	0.17	0.16
Having never experienced a side effect and believing side effects are not common	0.26	0.04

Table 8: Odds of experiencing side effects based on above recommended dosage[1]

	OR *	P-value	CI**
Self-evaluated outcomes			
Hair loss	0.19	0.06	0.03-1.04
Acne	0.47	0.07	0.17-1.35
Feeling "sluggish"	0.93	0.88	0.35-2.47
Cholesterol issues	0.45	0.24	0.12-1.70
High blood pressure	2.52	0.34	0.40-15.85
Chest pain	1.02	0.99	0.13-7.84
More Aggression	0.72	0.56	0.24-2.16
Gynecomastia	1.13	0.91	0.14-8.87
Chest tenderness	2.30	0.28	0.51-10.44
Headaches	1.88	0.24	0.66-5.39
Reduced libido	0.46	0.54	0.04-5.70
Back Pain	1.04	0.97	0.13-8.11
Overall sense of "wellbeing"	2.40	0.50	0.19-30.21
Never experienced a side effect	1.06	0.94	0.24-4.71
Diagnosed:			
High blood pressure	0.99	0.99	0.19-5.07
High cholesterol	3.12	0.35	0.29-33.04

[1] Controlled for age and education

*OR- Odds Ratio

**CI-Confidence Interval

Table 9: Multiple risk factor analysis of experiencing a higher than average number (≥3) of self-evaluated outcomes

	OR	P-value	CI
Above recommended Dose	1.59	0.37	0.58-4.34
Any risk combined with above recommended dose	8.45	0.02	1.52-46.99
Combined with Three or more prohormones per stack	1.90	0.44	0.38-9.67
Three or more cycles per year	4.57	0.09	0.78-26.80

CHAPTER 4: HEALTH CARE BELIEFS OF PROHORMONE USERS

Background

Patient beliefs about the credibility of information provided by physicians

have been studied for many years, as it is an integral part of health care delivery (49,

50). Of the many studies and measurement scales in existence to assess patient-

provider interactions there appear to be differences in patient and health care provider

interactions based upon the gender, race, age, and the physical appearance of the

physician (51). There are also differences based upon the race, gender, and age

demographics of the patient (52). Some evidence suggests that there are also

differences based upon the health behaviors of the patient such as drug use and that

will be the focus of this study (53).

Prohormones are substances chemically similar to anabolic-androgenic

steroids (AAS) or are legal substances that break down into anabolic steroids (2). In

the United States these substances are considered nutritional supplements, although

some have made the transition to being legally considered AAS such as

androstenedione (7). Currently there is little information about these substances in

terms of the people who use them, their pharmacokinetics and pharmacodynamics,

how many types are available, and the experiences of those who use them.

Since prohormones are similar to AAS, it is possible that users experience

similar negative side effects. If so, prohormone users may need medical attention as a

result of their prohormone use (1, 11, 34). Currently, interactions between prohormone users and physicians, and what their perceptions are of the physician's knowledge with regard to prohormones have not been described.

Pope et al (2004) found little difference in beliefs about health care provider credibility between AAS users and their non-using, weightlifting peers (38). The authors inquired about general health, illicit drug use, smoking, and many others with no differences found except for beliefs about nutritional supplements and AAS. The AAS users believed less of a physician's advice about AAS than their non-using peers and placed more credibility on information from "underground publications" dealing with AAS use. This lack of acceptance regarding physician provided information was not unexpected as previous reports have observed that adolescents who use AAS do not believe the information they receive about the drugs in school (23, 39) (40). Pope et al also reported that a large number of AAS users do not discuss their use with their physicians, making it difficult to correctly diagnose and treat a set of symptoms (38). If a similar scenario exists in prohormone users, the implications for the medical community may include incorrect diagnosis of symptoms and potentially harmful unnecessary treatment to the patient. This study assed if prohormone users interact with the health care system, frequency of doing so, their perceptions about the knowledge of physicians, and whether they believe physician provided accurate information.

Methods

Survey

To obtain information about this population, a convenience sample survey was created. Questions within the survey inquired about basic demographics, use patterns, health care beliefs, and health outcomes. The survey was posted to two online forums dedicated to prohormone use for a period of two months and the Facebook page of a privately owned gym for one month. Data was then downloaded via excel spreadsheets and stored for further analysis.

Data

All statistical analysis was completed using SAS 9.3 (Cary, NC). Basic demographics were tabulated into table. Two more tables divide beliefs about physicians in general and beliefs about physicians the users actually interact with. Table 2 outlines the beliefs of prohormone users about physicians at large, meaning not their own physician. Table 3 asks the same questions about how knowledgeable and accurate the information is, but restricted to the physician that the individual actually interacts with. All data is presented as frequencies with corresponding percentages.

Univariate statistical analysis was used to test the differences in beliefs based on being a prohormones user only and being a prohormone user who also uses AAS. As all variables tested are categorical in nature chi-square tests will be used for all. In some cases categories are collapsed to allow for meaningful analysis. Finally, multivariate statistical analysis is done using logistic regression to control for age and education along with giving meaningful effect measures in the form of odds ratios.

Results

  A total of sixty-one responses were used for analysis. 67.22% of the population held at least an associate's degree (Table 1). Ages of individuals are widely spread with the youngest being in the eighteen to nineteen age group and the oldest in the fifty plus age group. The vast majority of individuals (90.17%) are currently between twenty and forty years of age. Forty-eight of the users have been to see a physician in relation to prohormone use (78.69%) and twenty five (40.98%) have also used AAS in the last year.

  Beliefs about physicians in general are reported in table 2. 65.57% of the sample had gone to see a physician at least once a year with an additional 24.59% who say they only go when they are sick. The remainder of the group goes every other year or less (6.56%) or never (3.28%). A majority of those sampled (40.98%) are not comfortable speaking to a physician in general about a prohormones, 36.07% indicate that they are comfortable and 22.95% say they are somewhat comfortable. When asked about the knowledge of physicians with regards to prohormones, only one individual stated that physicians are very knowledgeable. The other individuals are exactly divided with twenty stating physicians know a little, twenty stating they know nothing, and the last twenty stating they, the respondents, did not know how knowledgeable physicians are. Finally, beliefs about the accuracy of information that physicians give in regards to prohormones were collected. No individuals believed that physicians gave very accurate information and only fourteen (22.95%) believe that physicians give somewhat accurate information. Sixteen (26.23%) individuals

believed that physicians give false information about prohormones and the other

thirty-one (50.82%) state that the physicians give no information.

Prohormone user's beliefs about private physicians contrasted that of

physicians in general with four respondents (6.56%) indicating that their physician is

very knowledgeable about prohormones and an additional ten (16.39%) respondents

stating their physician knows a little about prohormones (Table 3). Thirteen

individuals (21.31%) stated their physician knows nothing about prohormones and

thirty-two more (52.46%) stated they do not know how knowledgeable their

physician is. This leaves the final two individuals (3.28%) who stated they do not

have a physician. In regards to the accuracy of the information given by the user's

physician the responses were again different from physicians in general. Four

individuals (6.56%) stated their physicians give very accurate information, nine

(14.75%) stated their physicians gave somewhat accurate information, and four

(6.56%) more indicate their physicians gave false information. Forty-two (68.85%)

individuals stated their physicians gave no information and the final two individuals

(3.28%) that do not have physicians.

After separating observations into those who only use prohormones and those

who use prohormones in combination with anabolic steroids, chi-square analysis

revealed one significant difference. Our data suggest that in this sample prohormone

only users think differently about the accuracy of information physicians in general

provide, since they are significantly more likely to state that physicians give no

information about prohormones (P = 0.05; Table 4). Significance was not maintained

after multivariate logistic regression, controlling for age and education, but only

slightly with p-value of 0.06 (OR=2.93, CI=0.96-9.07, Table 5). No other differences

between prohormone only and prohormone-AAS combination users were significant

with either chi-square or logistic regression analysis.

Discussion

The purpose of this study was to determine the characteristics and beliefs of

prohormone users with regards to health care and the picture painted by the data is

bleak. Of the total population, 78.69% claimed to have interacted with a physician in

relation to their prohormone use, but only 22.95% of individuals believed the

information physicians give about prohormones is at least somewhat true. More

startling is that no respondents believed physicians in general give very accurate

information and an additional 26.23% believe physicians give false information.

Interestingly, there were differences between beliefs about physicians in general and

those about the physicians that the users actually saw. A possible explanation for this

difference is the relationship developed between the physician and the user.

Somehow amidst these interactions, particular physicians have conveyed topic

understanding with regard to prohormones.

An overall lack of difference between those who use exclusively prohormones

and those who use both prohormones and AAS is also noteworthy. With 40.98% of

prohormone users in the sample also taking AAS there is some overlap between the

two classes of substances. Prohormone users may be less likely to interact with

physician and when they do interact were less likely to accept the information given.

As there was no difference in the mean age of the two groups, it is possible there is

another explanatory factor unmeasured.   Perhaps prohormone use leads to AAS use

or prohormone users are simply unwilling to risk breaking the law and so use a legal alternative. Further studies are warranted to explore these potentially important characteristics of the two groups.

The apparent belief system of prohormone users investigated in this study may lead to complications for physicians and the health care system. Previous work on AAS use suggests significant side effects result and we can speculate that similar outcomes are associated with prohormones. If such a high percentage of individuals are interacting with physicians in response to prohormone use and only 36.07% are actually comfortable speaking to a physician about their use, a physician may be presented with a set of symptoms and not enough information to properly diagnose the condition. This lack of open communication could lead to costly, unnecessary tests and procedures as a physician attempts to identify causation of the presented symptoms.

The data seen here suggests that health care professionals need to communicate their knowledge about this topic better to their patients. This would require a certain amount of patient profiling on the part of the physician, but there are certain side effects associated with AAS and potentially prohormones that are uncommon with other conditions, such as gynecomastia and abrupt hair loss (4). Being able to identify these potential indicators of AAS and/or prohormone use may require further education on the physician's part, especially since some physicians feel uncomfortable dealing with illicit drug use (54). From a public health perspective there is a need to better understand these substances and then communicate current knowledge about these substances.

The limitations of this study are in its exploratory nature, sample size, and generalizability. As previously stated this is a pilot study and one of the first in an understudied area. Not having a great deal of background data to inform the survey questions means that helpful indicators were seen retrospectively but not measured such as why some individuals do not use AAS while others do. Moreover, sixty-one usable responses were gathered for this study and when this was further divided into categories there is a lack of statistical power. This means that actual differences may have gone unmeasured. A lack of generalizability is due to the convenience sample design. Other designs such as including a component of randomization were not deemed practical for a pilot study, but may be used in further research.

The strength of this study is in the base information gained. This group of individuals has thus far remained unstudied and this project has identified important characteristics about them along with how they interact with physicians. Trust and open communication between a patient and their physician is a critical part of successful health interventions. This study has identified that, with this sample, trust regarding physician knowledge and accuracy is limited. If in further studies it is seen that this lack of trust is widespread throughout the prohormone using population, then educational interventions may be needed for both the public and physicians.

Prohormones are a class of nutritional supplements, the use of which may lead to similar health problems as AAS and this has been largely overlooked. This study was the first to assess the beliefs of these individuals by describing a subset of the population. Further large-scale analyses need to be done to fully understand this population, their experiences, and how they interact with the health care system.

Table 10: Demographics

	Frequency	Percent
Total population	61	100.00%
Education		
High School or GED	2	3.28%
Vocational School	5	8.20%
Associates Degree	12	19.67%
In College	13	21.31%
Bachelor's degree	20	32.79%
Master's degree or higher	9	14.76%
Age		
18-19	1	1.64%
20-24	17	27.87%
25-29	21	34.43%
30-39	17	27.87%
40-49	4	6.56%
50+	1	1.64%
Also an anabolic steroid users		
Yes	25	40.98%
No	36	59.02%
Have been to a physician in response to prohormone use		
Yes	48	78.69%
No	5	8.20%
Did not answer	8	13.11%

Table 11: Beliefs of this prohormone using population about physicians in general

	Frequency	Percent
Going to the physician		
More than once a year	26	42.62%
Once a year	14	22.95%
Every other year or less	2	3.28%
Less than every other year	2	3.28%
Only when I am sick	15	24.59%
Never	2	3.28%
Comfortable speaking to a physician about PH		
Yes	22	36.07%
Somewhat	14	22.95%
No	25	40.98%
How much do doctors in general know about PH		
Very knowledgeable	1	1.64%
Know a little	20	32.79%
Know nothing	20	32.79%
I do not know	20	32.79%
How accurate or true is the information doctors in general give about PH		
Very accurate	0	0.00%
Somewhat accurate	14	22.95%
Gives false information	16	26.23%
Gives no information	31	50.82%

Table 12: Beliefs about personal physicians

	Frequency	Percent
How knowledgeable is my personal physician about prohormones		
Very knowledgeable	4	6.56%
Knows a little	10	16.39%
Knows nothing	13	21.31%
I don't know	32	52.46%
I do not have a physician	2	3.28%
How accurate or true is the information my physician gives about prohormones		
Very accurate	4	6.56%
Somewhat accurate	9	14.75%
Gives false information	4	6.56%
Gives no information	42	68.85%
I do not have a physician	2	3.28%

Table 13: Chi-square comparing prohormone to combination AAS users

	Prohormone only	Prohormone plus AAS	P-value
Age			0.53
18-19	1	0	
20-24	9	8	
25-29	10	11	
30-39	12	5	
40-49	3	1	
50+	1	0	
Physician use			0.36
More than once per year	12	14	
Once a year	10	4	
Every other year or less	4	2	
Only when I am sick	10	5	
Comfortable speaking to a physician about prohormone use			0.37
Yes	14	8	
Somewhat	6	8	
No	16	9	
My physician:			
Knowledgeable about prohormones			0.73
A little or more	7	7	
Knows nothing	8	5	
I do not know	21	13	
Accuracy of information given			0.20
Somewhat or more	5	8	
False information	2	2	
No information	29	15	
Physician in general:			
Knowledgeable about prohormones			0.43
A little or more	12	9	
Knows nothing	10	10	
I don't know	14	6	
Accuracy of information given:			0.05
Very	0	0	
Somewhat	6	8	
False information	7	9	
No information	23	8	

Table 14: Odds based on being a prohormone only user

	OR	P-value	CI
Going to the physician yearly or more	0.44	0.18	0.13-1.46
My physician:			
At least somewhat accurate information	0.44	0.24	0.11-1.75
Doctor knows at least a little about prohormones	0.32	0.11	0.07-1.30
Physicians in general:			
At least somewhat comfortable speaking to a physician about PH	0.52	0.25	0.17-1.60
Give no information	2.93	0.06	0.96-9.07
Doctors know at least a little about prohormones	0.84	0.77	0.26-2.63

CHAPTER 5: FUTURE RESEARCH

General Remarks

This study has been an exploration into an area of nutritional supplements that has hitherto gone largely unnoticed. It is clear from this research that we have captured a group of prohormone users that are diverse in several ways. Age ranges from twenties to more than fifty and use characteristics change with that age. What we do not know is if the older individuals who use because they want to look better would have had other reasons if we asked them earlier in life. The individuals seen here are experiencing a number of side effects. Most of those seen to be relatively mild but some, such as gynecomastia, are permanent. Also seen was a positive side effect of an increase in well-being and this may have potential for helping explain why individuals take prohormones. Finally, we have seen a group that interacts with the health care system often. They see physicians regularly, but are limited in how much they believe a physician's information regarding the substances that they take. This fact has implications for how a physician would treat a set of symptoms that seemingly have no explanation leading to unnecessary and potentially costly waste. As a pilot study there are several ways in which this study could be improved upon which leads to the discussion of the future direction of this research.

Direction

 After completion of this dissertation several points have come to light that impact

my future research. First is the refocusing and expanding of the study seen here. The

survey conducted gave insight into several factors that may improve the repeat survey

including questions into perceived weight gain, perceived increases in strength, the

impact of these substances on health, and a situational question asking into whether an

individual would still use these substances if it was known that a severely negative side

effect existed such as diabetes. To achieve better results from the survey the research

team will be pursuing grant opportunities to enable us to pay the research subjects and

increase the number of participants. Second is another area of similar research into

prescription anabolic steroids. Prescription testosterone use is also controversial and I

will look into the outcomes of this use to see if there are negative outcomes associated

with the substances and also if there are negative outcomes experienced by those who are

testosterone deficient whom do not take prescription testosterone.

Power

 Much has been said in this dissertation about the lack of power due to sample

size. To help instruct the future implementation of this research I have done a sample

size analysis. To detect a 10 percent difference between two groups, given a two tail test,

the survey needs at least 134 respondents in each group or 268 total. To be safe the

future study will aim to recruit approximately 300 respondents.

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