IPF POINTS - PROPOSED REPLACEMENT FOR WILKS COEFFICIENTS.

By Joe Marksteiner

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Executive Summary

This paper proposes IPF Points as a replacement for the Wilks points for relative lifter ranking or determining "Best Lifters" in IPF powerlifting competitions. There are many critiques of the Wilks coefficients of formula with the primary complaint being that using Wilks points unfairly favors certain weight classes in the Best Lifter rankings. The evidence supporting this complaint is that weight classes that make up a relatively small percentage of the lifter population are a much larger percentage of the Best Lifters. The reasons for this apparent bias include: changing lifter population, rapidly evolving improvements in supportive gear, rapid growth of classic lifting and application of 3-lift coefficients to bench only competition. This paper quantitatively demonstrates the bias in the Best Lifter rankings calculated using Wilks points and shows the proposed IPF Points provides a more equitable and fair representation of all weight classes in the Best Lifter rankings. IPF Points are based on analysis of a much larger and current data set than the Wilks calculations. IPF Points provide a more accurate and easier to understand ranking system than the Wilks points. The analysis methodology does not rely on special software or individual expertise and should be updated on a regular basis as IPF powerlifting evolves and grows.

Why Replace the Wilks Formula?

The Wilks Coefficients are Biased.

In a 2008 interview Dr. Wilks stated, "The Schwarz formulae clearly greatly favoured lighters e.g. according to Schwarz 21 out of 50 (42%) of the World's greatest performances had been achieved by lifters in the 52 an 56kg classes, where only 7% of lifters existed." http://www.club150kg-dc.fr/php/blog2/BlogClub150.php?id=1&qd=200806&annee=2008 The Wilks coefficients were adopted to correct that disproportionate representation of lighter classes among the best lifters – see Appendix 1 - Historical Development of the Wilks Coefficients .

Today, a similar disproportionate representation of weight classes among the best lifter ranks exists.

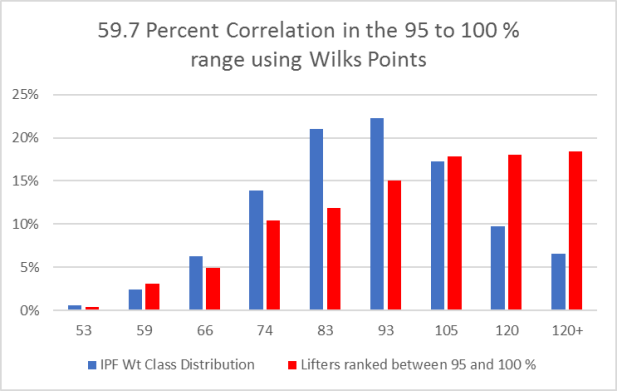


Figure 1. Distribution of Best Lifters compared to Distribution of weight classes

The red bars on the chart in Figure 1 shows the percentage of lifters within each weight class in the overall lifting population and the blue bars show the percentage of each weight class in the top 10% of lifters using the Wilks formula. Athletes in the 120 and 120+ classes are approximately 15% of the total population but more than 36% of the best lifters – they are more than twice as likely to be selected as best lifters than athletes in the 59, 66 and 74 kg classes.

The Wilks Coefficients are Outdated

- In one database there are more than 1200 men heavier than 120kg. For the Wilks calculations, there were less than 200.
- Wilks assumed the maximum weight in the men's SHW class would be 145kg. The average weight of lifters in that class in now approximately 140kg.
- Wilks coefficients are the same for all men heavier than 205kg and for women heavier than 150kg. Currently, there are men and women heavier than those limits competing today.
- Analysis of contemporary data shows the average body weight for men and women to be 10-15kg heavier than when the Wilks calculations were performed.

Analysis

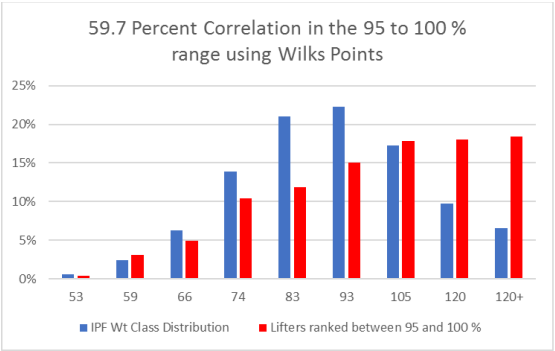
- This analysis method was presented to the IPF at the 2017 General Assembly in Pilsen and used data from the IPF web page (http://www.powerlifting-ipf.com/championships/ranking.html). This update to the analysis uses the largest available database – nearly 30,000 lifters. See Appendix 2 - Links to Data Sets Used in the Analysis. It comes closest to representing the entire IPF. It is unlikely that any relative ranking system will be accurate and fair for all lifters if their data is not included in the analysis.

- When small elite lifter data sets (results from World championships or world record holders) are used, a single outstanding performance can change rankings dramatically from year to year. Repeat performances by the same lifters in world championships means that the performance of a small number elite lifters is used to evaluate the relative performance of a much larger and more diverse population of athletes.
- Separate sets of coefficients are needed for men & women, classic & equipped, 3-lift and bench press. Coefficients developed for equipped lifting are not accurate for classic competition. The increased performance due to the use of equipment varies with gender and body weight and is not the same for bench press as it is for 3-Lift. See Appendix 3 - Effect of Equipment on 3-Lift and Bench Press Performance.
- This data analysis method also provides the necessary information to evaluate the need for and determination of new weight classes.

IPF Points Proposal

The proposed IPF Points system proportionately represents the lifter population among the Best Lifters and is fair to the athletes in all weight classes.

The charts in Figure 2 compare the percentage of Best Lifters to the percentage of lifters in each weight class. The blue bars in both charts show the percentage of the men's lifting population in each of the weight classes. The red bars in the chart on the left show the portion of lifters from each weight class in the top 5% of the Wilks rankings. The green bars in the chart on the right show the portion of lifters from each weight class in the top 5% of the proposed IPF Points rankings. The chart on the right clearly shows the proposed IPF Points ranking produces a more proportionate and fair distribution of Best lifters across all weight classes. The **Percent Correlation** in the heading of each chart is a standard statistical method that compares how well the best lifter distribution matches the distribution of all lifters across the weight classes. The Correlation calculation is described in detail in Appendix 4.



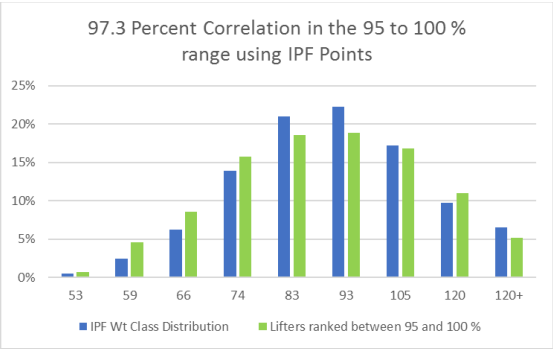
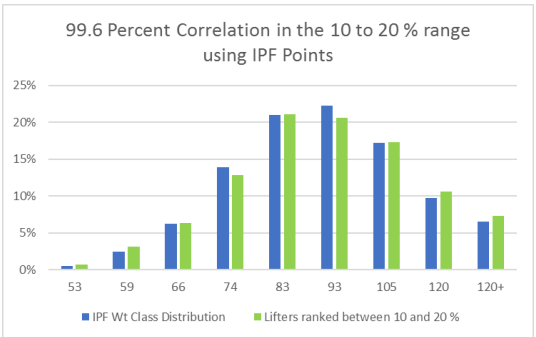


Figure 2. Best Lifter (95-100%) distributions using Wilks and IPF Points

The replacement for the Wilks Coefficients will be used by lifters at all levels not just for Best Lifters at World championships. The distribution of lifters in any range of performance should closely match the distribution of lifters in the overall population. The charts in Figure 3 show very high Correlations for novice lifters in the 10-20% range of overall performance and average lifters in the 50-60% performance range.



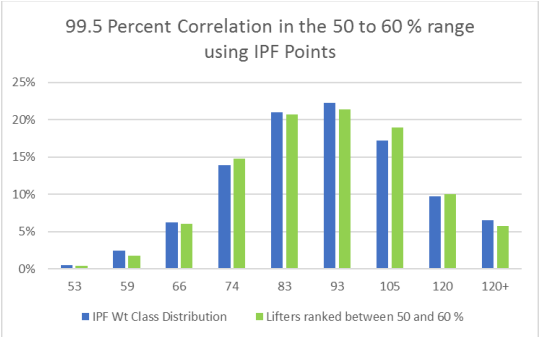


Figure 3. IPF Points correlation to novice (10-20%) and average (50-60%) lifter distributions.

How it works

<u>Mathematically</u>

Two factors are computed for each lifter – the first represents the average performance at the lifters bodyweight and the second represents the range of performance (for mathematicians and statisticians those factors are mean & standard deviation). Figure 4 shows Men's Classic Bench press performance for approximately 20,000 lifters – body weight is plotted along the horizontal axis and Bench Press is plotted along the vertical axis. Average Performance and Range of Performance is shown for a 105kg lifter. Detailed analysis of the data is in Appendix 5 - Understanding the Current Lifter Population.

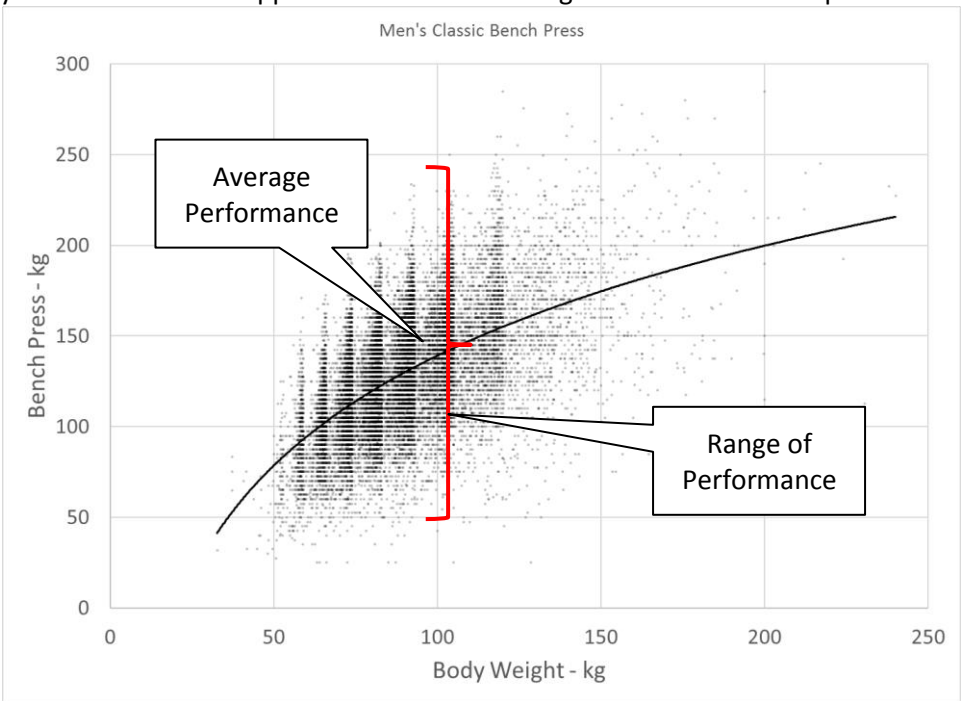


Figure 4. Average and Range of Performance illustration

The 2-factor methodology provides greater accuracy than the Wilks coefficients that only compared lifter performance to the average. Details of the calculation method are in Appendix 6.

<u>In competition</u>

The 2 factors (mean and standard deviation) for a 105 kg lifter are:

- Mean = 143.29kg
- Standard Deviation = 28.69kg

Figure 5 shows those values in an online GoodLift competition spreadsheet. **W.Coef**. has been replaced with **IPF Coef** and the mean and standard deviation using the lifter's bodyweight are listed under **IPF Coef**. Those changes are in the red boxes.

Lifters				
Pl.	Name	Team	BY/BW/Lot/AD	IPF Coef
Open				
-105kg				
1	IPF Lifter	International Team	95/105.00/2/J	143.29/28.69

Figure 5. GoodLift competition sheet with IPF Points

Mean and Standard along with a lifter's actual performance are used to calculate IPF Points:

- IPF Points = 500 + 100*(Bench Press – Mean)/Standard Deviation

If the 105kg on the spreadsheet in Figure 5 completes a 175kg bench press, his
IPF Points = 500 + 100*(175 – 143.29)/28.69 = 610.523

IPF points is a precise method for determining best lifters in a competition but it is an arbitrary number and it is difficult for a lifter to estimate how they compare to other lifters without knowing or calculating the points earned by everybody else. The proposed IPF Points methodology can accurately describe relative lifter performance as a percentile rank that is easy to interpret. Figure 6 shows the same data as depicted in Figure 4 with bench press performance separated into bands that are 10% wide. The position of a 105kg lifter who bench pressed 175kg falls in the light gray 80-90% band for all lifters. His precise percentile rank is 86.547% - so his performance is better than 86.547% of all lifters.

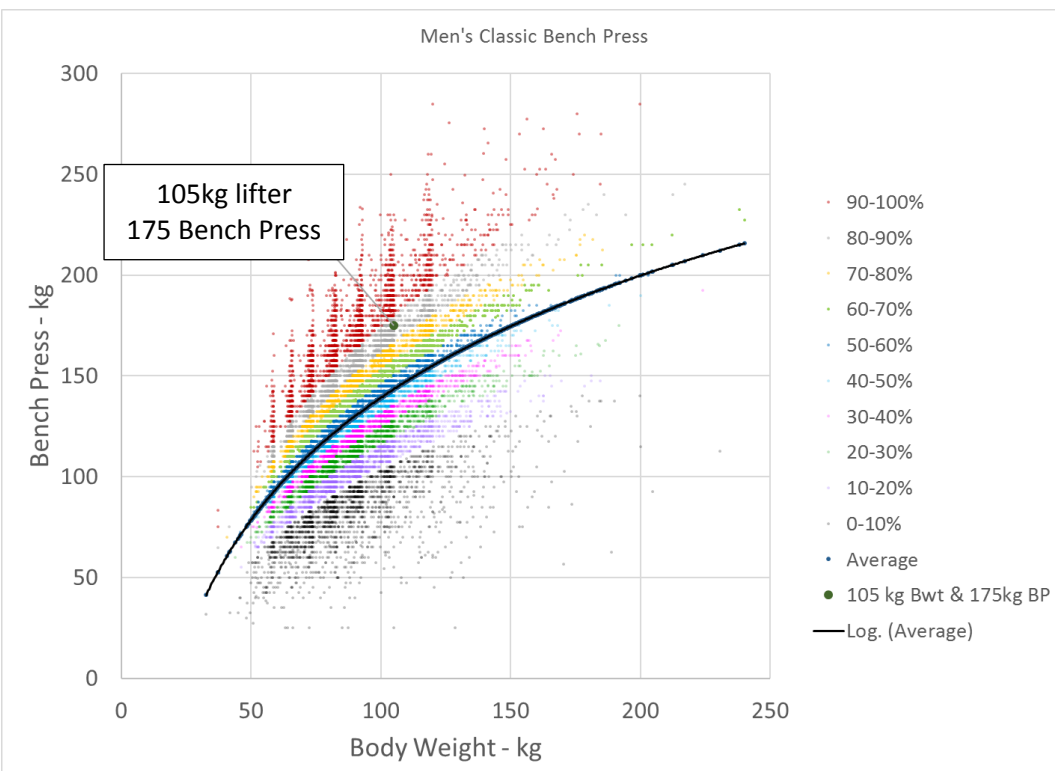


Figure 6. Bench Press performance ranges.

Spreadsheet calculations or a simple app shown in Figure 7 can tell a lifter exactly how his or her performance compares to the overall lifting population.

Table 1, below, compares the Best Lifter Rankings for 2017 World Open Men's Championships in Pilsen using Wilks Points and IPF Points

Best Lifters of Open Using Wilks Points											
Rnk	Lifter	Nation		B.Weight		WF		Total		W.Points	C.Rnk.
1	Fedosienko Sergey	Russia		55.49		0.9186		732.5		672.87	1
2	Olech Jaroslaw	Poland		73.05		0.726		908		659.21	1
3	Semenenko Dmytro	Ukraine		104.98		0.5976		1090.5		651.68	1
Best Lifters of Open Using IPF Points											
Rnk	Lifter	Nation		B.Weight		IPF Coefficients		Total		IPF Points	C.Rnk.
1	Olech Jaroslaw	POL		73.05		540.53/123.516		908.0 -w		797.51	1
2	Fedosienko Sergey	RUS		55.49		434.055/101.347		732.5		794.48	1
3	Rubets Oleksandr	UKR		100.28		663.224/149.062		1070.5 -wj		773.23	2

Table 1 – Best Lifters Wilks Points vs IPF Points 2017 IPF Open World Championship

Appendix 7 shows the complete 2017 IPF Open Worlds Results using IPF Points to determine Best Lifters.

Type of Competition	Lifter Bwt (kg)	Best Benchpress (kg)	Percentile	IPF Points
Men Classic Benchpress	105	175	86.547%	610.523

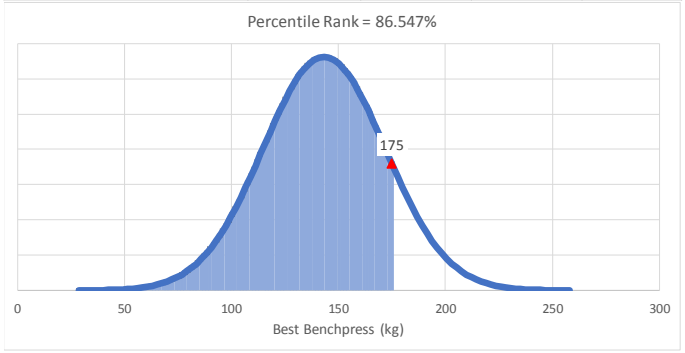


Figure 7. Percentile and IPF Points App. https://1drv.ms/x/s!ApWUKh6DXuZYpRxjePYyr_J1nlzG

For competitions where athletes are competing for Best Lifter honors or using IPF Points to determine placing (like the World Games), a simple online or phone app can be used to quickly calculate what a lifter needs to lift to move ahead of his or her competition. Those calculations can even be built into the competition spreadsheet.

Comparison to Wilks Points

To determine how well a methodology works and to provide fair comparisons to other methodologies an objective measure of performance must be used. Also, for any evaluation of competing best lifter methodologies, the methodologies should all be compared with the same data set and the same objective measurement tools.

The Correlation Coefficient was chosen as an objective method to compare the Wilks and IPF Points methodologies. It is a widely used and accepted method for comparing sets of data. Values closer to 1 represent better correlation.

For Men's Classic Bench Press Table 2 shows the correlation between the distribution of lifters in each range of performance and the distribution of the overall lifting population. In all ranges of performance, IPF Points showed a better correlation with the overall population than Wilks points. Additionally, best lifters in open National, International and World championships are most likely to be in the highest performance range (95-100%) where IPF points at 97.3% are much better than Wilks points at 59.7%. IPF Points have a far better correlation and therefore much fairer distribution of best lifter performance across all the men's weight classes. Full comparisons in Appendix 8.

Mens Classic Bench Press		
	Wilks	IPF Pts
0-10%	93.0%	96.9%
10-20%	97.7%	99.6%
20-30%	97.9%	99.1%
30-40%	98.8%	99.5%
40-50%	99.2%	99.6%
50-60%	99.0%	99.5%
60-70%	98.9%	99.5%
70-80%	99.2%	99.6%
80-90%	97.1%	99.4%
90-100%	78.9%	98.8%
95-100%	59.7%	97.3%

Table 2. Correlation comparison Wilks vs IPF Points

Advantages of this Methodology

- It represents the entire IPF lifting population not just elite lifters or World Record holders.
- It doesn't require any arbitrary filtering of "outliers".
- Percentile rankings are easy to understand without needing to know the scores for other lifters.
- Lifters can be compared across weight classes and even across genders because the performance metric is a measure of how well a lifter does compared to the entire lifting population: a light weight female better than 90% of her competition is comparable to heavyweight male better than 90% of his competition. It is even possible to compare classic and equipped lifters.
- The IPF will own the formula/process.
- The calculations can be accomplished with most spreadsheet programs – no special software or expertise is required. Anybody familiar with basic spreadsheets can be trained to perform the calculations. The process is not dependent on any single person with special knowledge or skill.
- Because the development process for the computations was relatively easy and repeatable, it can and should be recomputed every few years.
- IPF points can easily be developed for special competitions (like Arnold Deadlift) that use points to determine prize winners.
- A valuable byproduct of this analysis method is that it provides the data necessary to assess the need for new or different weight classes and how they can be determined.

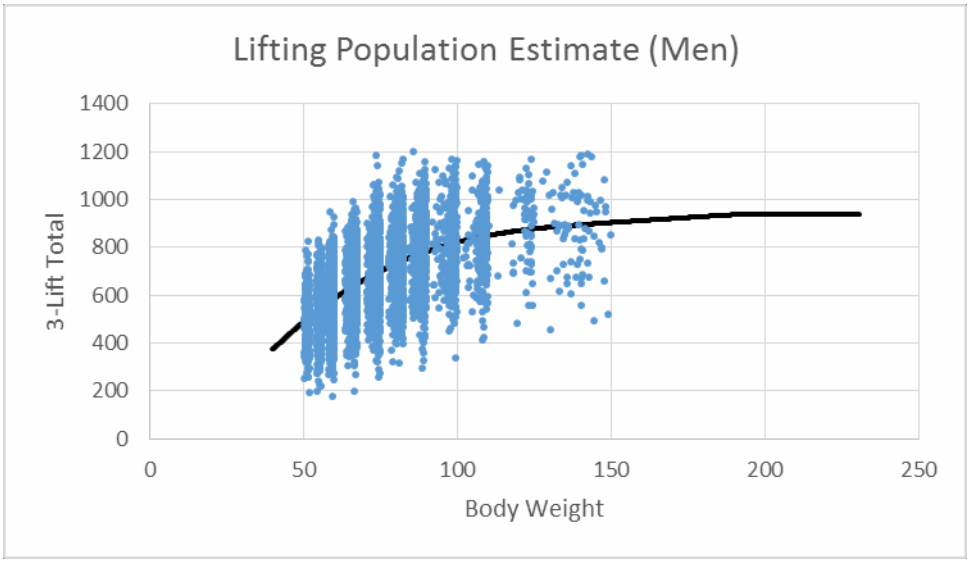
Appendix 1 - Historical Development of the Wilks Coefficients.

This paper proposes a methodology as a replacement for the Wilks Coefficients, so it is probably instructional to explain the development of the Wilks Coefficients. Wilks Coefficients were developed from a regression analysis of about 10,000 lifters from the national ranking lists from 15 or so IPF nations with a pool of about 10,000 lifters. Initial calculations were completed in 1984 and repeated in 1995 with no difference in the curve for total. Polynomial equations that best fit the average performance for male and female lifters were fit to each gender's data set. This analysis used full populations and differs from some previous work that used only world records or lifters in world championships.

(http://www.club150kg-dc.fr/php/blog2/BlogClub150.php?id=1&qd=200806&annee=2008)

The actual data set used to develop the Wilks estimates is not publicly available, but the data probably looked a lot like the diagram in Figure 3, below – plotting bodyweight along the horizontal axis and total lifted on the vertical axis. There are noticeable clusters of lifters near the near the upper weight limit for each class except for the heaviest class. With the table of Wilks Coefficients, the average data line can be reconstructed and is shown by the black line in the diagram in Figure 8, below. Wilks calculations showed that 3-Lift Total generally increased with increasing bodyweight.

Figure 8. IPF Equipped Men - Performance Estimate



500 Wilks points was chosen to represent the average equivalent performance for both men and women lifters. To bring the entire range of average performance to 500, a set of coefficients was computed that could be multiplied by the average lifter's total at any bodyweight that to correct that average value to 500 points – see the illustration in Figure 9.

Dr. Wilks stated in his interview, "I established series of equivalent performance points at 52, 56, 60kg and so on up to 145kg (the assumed "limit" for the SHW class, being the average bodyweight of those competitors at World Championships) and similar for women. That "curve" of performance points I then had spliced into a series of coefficients via a quadratic equation. Those coefficients were what was adopted by the IPF Congress."

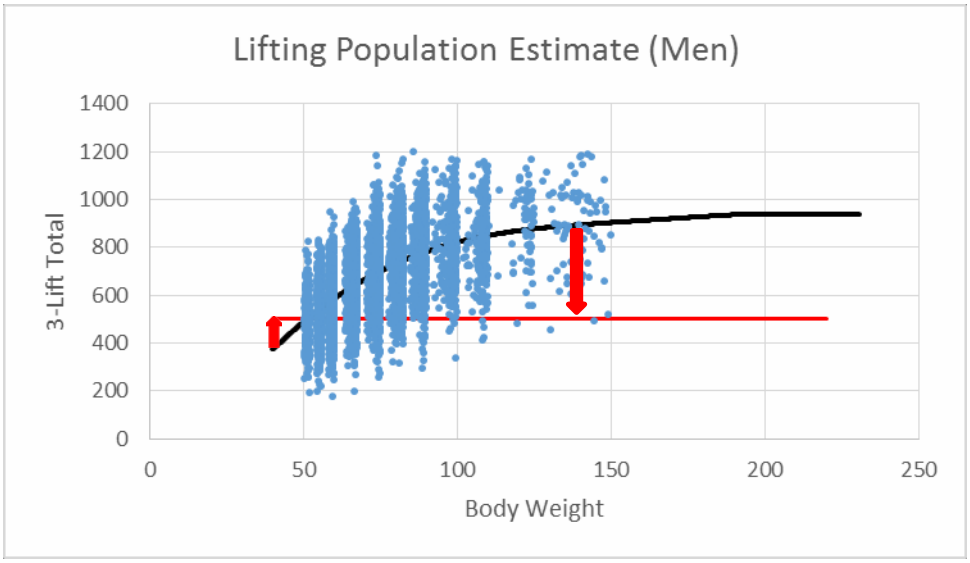


Figure 9 – Coefficient correction from polynomial data fit to 500 Wilks points.

To summarize, the Wilks Coefficients were developed to mathematically adjust average lifter performance at any bodyweight to a value of 500 Wilks points. The Wilks Coefficients were adopted as a table of numbers to 4 decimal places, not as the equations that calculated those numbers.

In the more than 20 years since the calculations were completed, there have been significant changes in powerlifting throughout the IPF: a significant portion of the population participates in classic lifting, lifters of both genders who are heavier than those considered in the Wilks data set are now competing at the national and international level, and equipment changes (especially for bench press) have dramatically affected lifter totals.

Appendix 2 – Links to Data Sets Used in the Analysis

Data from Open Powerlifting (http://www.openpowerlifting.org/data.html) was used for this analysis. The data was filtered to show only IPF affiliate competitions and the current IPF weight classes (adopted in 2011). The starting point for the calculation process is to filter the data set so that only the best result is used for an athlete who has appeared several times in competitions over the time under consideration.

It is important to note that analysis used the most complete lifter population available – men & women, equipped & classic, novice to elite, all nations, and local contests to World Championships. Links to the filtered data sets are provided here:

Women Equipped Powerlifting
https://docs.google.com/spreadsheets/d/1jkc1a49drPr5iCgr2PsZess_GFaTv-NvSlENCPIF5YA/edit?usp=sharing

Women Equipped Bench Press
https://docs.google.com/spreadsheets/d/1Zwu0hEOSrU7qv8SbQSBhaurqZ_vHx2nrWJhYqol3_P0/edit?usp=sharing

Women Classic Powerlifting
https://docs.google.com/spreadsheets/d/1N0G7QKowGIB63vnPVM0U2ZOlJxaqdbywG0DusM-nh34/edit?usp=sharing

Women Classic Bench Press
https://docs.google.com/spreadsheets/d/1qvVpgf6wSAw2hJO4GhtJDCAn4NZu_V9fJOyP5lBvmq8/edit?usp=sharing

Men Equipped Powerlifting
https://docs.google.com/spreadsheets/d/1Jue8QQptU6_lh-5HdWPFASsYWbOlsZn-h4Hhl0tYI-s/edit?usp=sharing

Men Equipped Bench Press
https://docs.google.com/spreadsheets/d/1RKpW7QsnSeVYTkR6tH759rssZ_vlwQQDhdVR8ZG7CRQ/edit?usp=sharing

Men Classic Powerlifting
https://docs.google.com/spreadsheets/d/1I9ScostJh3S8xmu_g3EA4NUri5Q6-opJI31e0K8BOqs/edit?usp=sharing

Men Classic Bench Press
https://docs.google.com/spreadsheets/d/1QQOKE8q3kAlRnVZKVs0neGg0AURErK00AXJQxUvm6i0/edit?usp=sharing

Appendix 3 – Effect of Equipment on 3-Lift and Bench Press Performance.

The following table shows the performance increase due to supportive shirts suits and wraps (Equipped lifting compared to Classic lifting). For each weight class, the average 3-Lift Total or Bench press for Classic lifters is compared to the average value for Equipped lifters – the Equipped performance is divided by the Classic performance to calculate the factors in the yellow columns. For example: The average Equipped Bench Press in the Men's 120+ weight class is 1.31 times the average Classic Bench Press. The equipped performance factors vary with, gender, weight class and 3-Lift or Bench Press.

	Men CL 3-Lift	Men EQ 3-Lift	3-Lift EQ Factor	Men CL BP	Men EQ BP	BP EQ Factor
Wt Class	**Average Total**	**Average Total**	**EQ Total/CL Total**	**Average BP**	**Average BP**	**EQ BP/CL BP**
53	375.67	416.28	1.11	84.17	90.32	1.07
59	408.98	457.81	1.12	93.45	104.68	1.12
66	443.82	501.23	1.13	103.14	119.70	1.16
74	479.36	545.53	1.14	113.04	135.02	1.19
83	515.02	589.98	1.15	122.96	150.39	1.22
93	550.36	634.04	1.15	132.80	165.63	1.25
105	588.06	681.04	1.16	143.29	181.89	1.27
120	629.55	732.75	1.16	154.84	199.77	1.29
120+	677.44	792.45	1.17	168.17	220.42	1.31

	Wmn Cl 3-Lift	Wmn EQ 3_lift	3-Lift EQ Factor	Wmn CL BP	Wmn EQ BP	BP EQ Factor
Wt Class	**Average Total**	**Average Total**	**EQ Total/CL Total**	**Average BP**	**Average BP**	**EQ BP/CL BP**
43	242.66	290.84	1.20	50.36	60.49	1.20
47	253.79	306.54	1.21	52.59	64.86	1.23
52	266.44	324.40	1.22	55.12	69.82	1.27
57	277.93	340.61	1.23	57.42	74.33	1.29
63	290.46	358.28	1.23	59.93	79.24	1.32
72	307.17	381.86	1.24	63.28	85.80	1.36
84	326.46	409.08	1.25	67.14	93.37	1.39
84+	348.28	439.87	1.26	71.50	101.93	1.43

Table 3 – Equipment Performance Factors.

Appendix 4 - Best Lifter Criteria & Correlation Coefficient

For years powerlifters have looked for a way to find the "best lifter" across all weight classes for total as well as individual lifts, sometimes across genders and even comparing classic or "raw" lifting to equipped lifting. All the methods developed to date have involved multiplying lifters' scores by coefficients (based on body mass and gender) to obtain a score that was representative of how each lifter compared to the entire population not just other lifters in the same weight class.

Before attempting to show any system for determining "best lifters" is better than another, some objective criteria must be agreed upon. The following objective measure is proposed:

Within each range of performance, lifters from each weight class should appear in similar proportions to the distribution of those weight classes in the overall lifting population. Well populated weight classes like men's 83kg that comprise about 18% of the male lifters population should be about 18% of the lifters in any given range of performance. And, small percentage weight classes like 59kg and 120+kg that comprise less than 10% of the population should be a smaller percentage of the lifters. Wilks coefficients were developed specifically because lighter weight lifters were disproportionally represented in the best lifter rankings. While the weight class distributions are not expected to be a perfect match, they should have similar shapes so that all the weight classes are more proportionately and fairly represented in the Best Lifter rankings. Standard statistical tests (correlation between overall lifter population and representation in the lifter rankings) can be used to objectively evaluate how well the two distributions match.

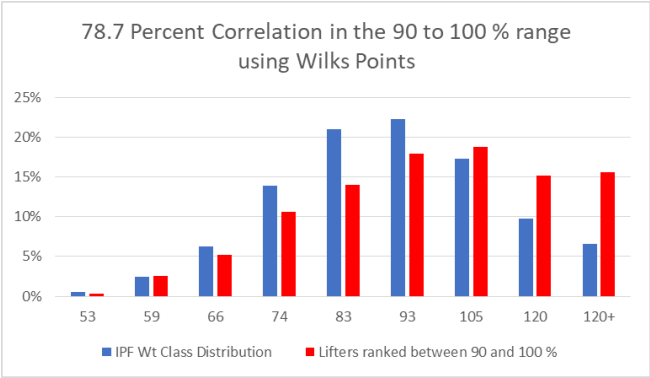


Figure 10 – Weight class distribution in the overall lifter population compared to distribution in the top 10%.

In Figure 10, the blue bars show the percentage of lifters in each weight class in the population under analysis. The red bars show how each weight class is represented among the top 10% of all lifters in the same population.

In statistics, the Pearson correlation coefficient (PCC, pronounced /ˈpɪərsən/), also referred to as the Pearson's r, Pearson product-moment correlation coefficient (PPMCC) or bivariate correlation, is a measure of the linear correlation between two variables X and Y. It has a value between +1 and −1, where 1 is total positive linear correlation, 0 is no linear correlation, and −1 is total negative linear correlation. It is widely used in the sciences. It was developed by Karl Pearson from a related idea introduced by Francis Galton in the 1880s. https://en.wikipedia.org/wiki/Correlation_coefficient

Appendix 5 - Understanding the Current Lifter Population

The Wilks powerlifting formula was evaluated in 1999 and the study concluded, "As used currently (BP and TOT only), the Wilks formula appears to be a valid method to adjust powerlifting scores by body mass." https://www.ncbi.nlm.nih.gov/pubmed/10613442

However, analysis of contemporary data bases indicates that the lifter population has changed significantly since the original calculations. In a 2004 IPF TC newsletter, Dr. Wilks listed the percentage of the lifting population that was in each of the men's and women's weight classes. Table 4 shows the percentage of lifters that would be in each of those weight classes today.

Men				Women		
WtCls	2004	Today		WtCls	2004	Today
52	2%	0.5%		44	6%	2.3%
56	6%	0.8%		48	10%	3.3%
60	10%	1.7%		52	17%	5.7%
67.5	17%	6.7%		56	19%	8.2%
75	18%	12.2%		60	19%	10.2%
82.5	16%	16.2%		67.5	14%	21.2%
90	12%	17.0%		75	10%	19.0%
100	10%	19.1%		82.5	4%	13.6%
110	5%	12.7%		90	2%	8.2%
125	3%	9.1%		90+	1%	8.3%
125+	1%	3.9%				

Table 4 - 2004 IPF Weight Class distribution compared to Today.

The distribution of lifters in the various weight classes was assessed with statistical software. (http://www.reliasoft.com/products.htm?_ga=2.147866231.1503980409.1509936496-227513124.1509936496). The Pearson correlation coefficient indicated the bodyweight distributions observed by Wilks are well described by lognormal distributions.

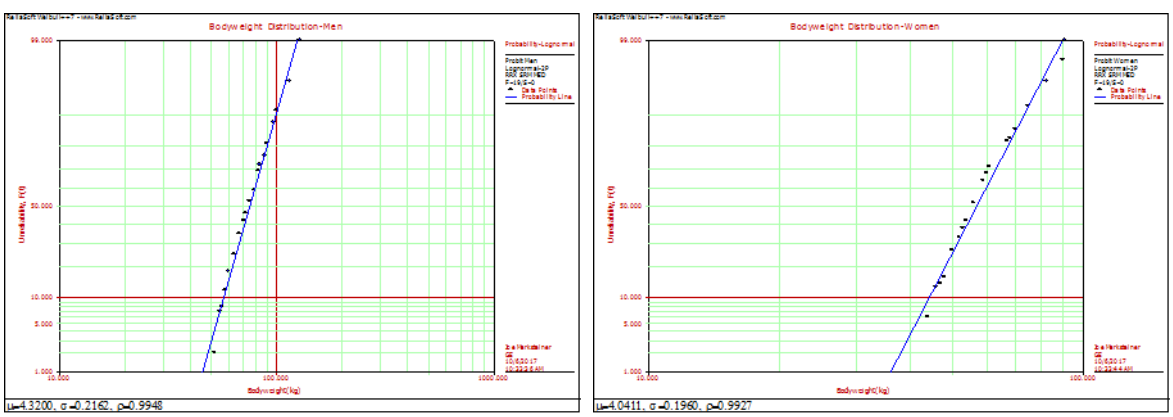


Figure 11 – Lognormal evaluation of the Wilks distributions for men's and women's weight classes.

The coefficients (ρ values) in the above charts were 0.9948 for men and 0.9927 for women. Values close to 1.0 indicate a very strong correlation.

Additionally, four other contemporary populations were also analyzed:

- http://www.openpowerlifting.org/data.html - this database is comprised of more than 300,000 entries from multiple lifting organizations. The data was filtered to show only IPF affiliate competitions, the current IPF weight classes (adopted in 2011), and classic competition (first IPF World cup in 2012). The data was further filtered to so there was only one data entry per lifter. The final data set contained more than 30,000 entries.

- http://usapl.liftingdatabase.com/rankings - the 2017 USA Powerlifting Ranking database provided more than 6,200 data entries for evaluation. The data was filtered to show the current IPF weight classes (adopted in 2012 by USA Powerlifting), classic competition and only one data entry per lifter.

- http://www.powerlifting-ipf.com/championships/ranking.html - classic and equipped rankings from 2013 through 2017 were compiled and filtered for one data entry per lifter and provided more than 2500 data entries.

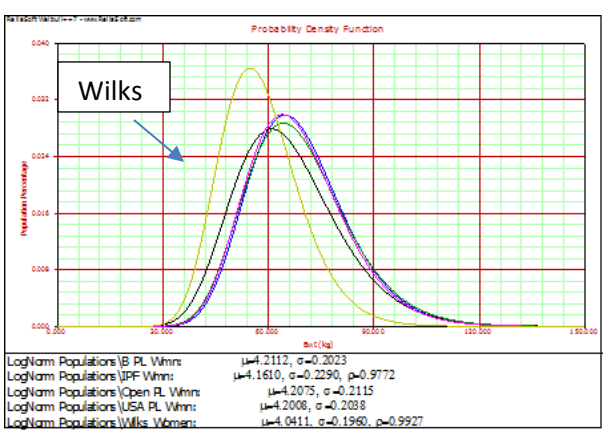
- Data provided by the Great Britain Powerlifting federation was also analyzed.

Tabulated Comparison to Lognormal distributions

Lognormal Corrrelation Coefficient		
	Men	Women
Open Powerlifting	0.996564	0.986062
USA Powerlifting	0.99826	0.98945
IPF Rankings	0.992357	0.978402
Great Britain PL	0.994238	0.986064

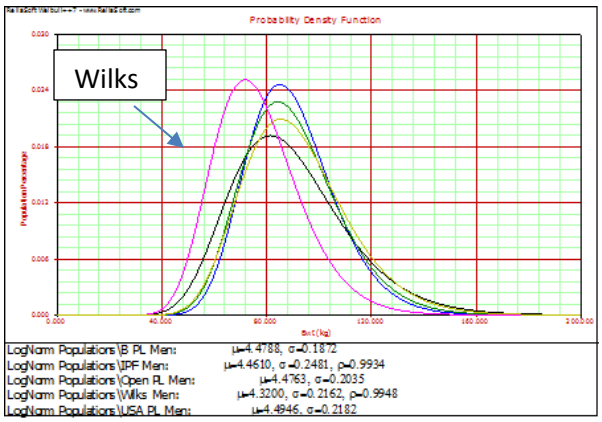
Table 5 – Lognormal bodyweight distribution comparison for lifting populations

One notable observation: When compared to the Wilks population estimates, the contemporary databases all show a significant shift in the in mean bodyweight of all the lifting populations. The women's mean showed an increase of 8-10 kilograms while the men's gained 11-14 kilograms.



	ln(mean)	women
Wilks	4.0411	56.8888
Open Powerlifting	4.2075	67.1904
USA Powerlifting	4.1610	64.1355
IPF Rankings	4.2008	66.7369
Great Britain PL	4.2112	67.4378

Figure 12 – Women's Mean body weight – Wilks vs Contemporary Data



	ln(mean)	Men
Wilks	4.3200	75.1900
Open Powerlifting	4.4763	87.9097
USA Powerlifting	4.4610	86.5757
IPF Rankings	4.4946	89.5335
Great Britain PL	4.4788	88.1255

Figure 13 – Men's Mean body weight – Wilks vs Contemporary Data

Analysis of the contemporary data sets also showed that normal lifter performance within each weight class could be modeled as a normal distribution. Goodness of fit to a normal distribution was evaluated for all current IPF weight classes for all 8 of the best lifter scenarios (Men/Women, Classic/Equipped, Powerlifting/Bench Press). Shown below is a tabulation of that evaluation for Equipped Men in Powerlifting.

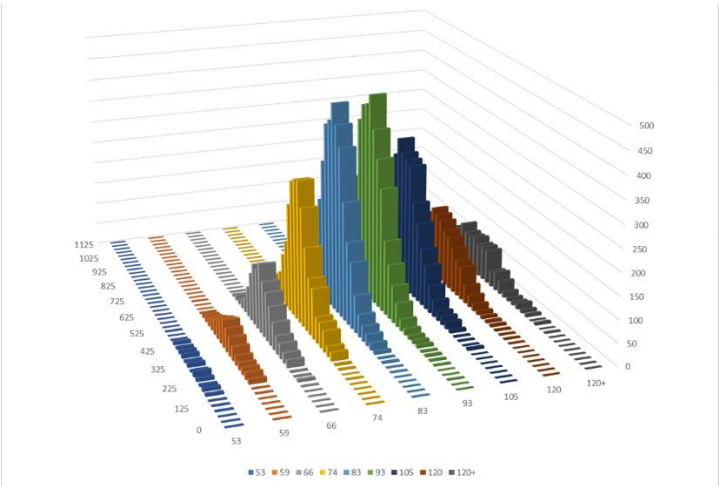
Distribution	# Lifters	Mean	Std Dev	Rho	median
EQ Men PL 53	40	432.3250	79.2374	0.9641	445
EQ Men PL 59	133	475.6504	126.8816	0.9896	472.5
EQ Men PL 66	197	543.5051	112.8267	0.9980	540
EQ Men PL 74	299	595.4348	126.6045	0.9942	610
EQ Men PL 83	321	641.8614	125.8096	0.9965	642.5
EQ Men PL 93	324	690.1466	139.5567	0.9965	695
EQ Men PL 105	302	734.9752	147.1554	0.9914	747.5
EQ Men PL 120	229	781.9127	168.2686	0.9907	790
EQ Men PL 120+	189	805.6270	180.2313	0.9963	810
EQ Men BP 53	61	105.7049	27.7950	0.9943	105
EQ Men BP 59	198	122.5934	37.2296	0.9964	125
EQ Men BP 66	313	139.3435	38.6829	0.9963	135
EQ Men BP 74	447	156.7919	41.0559	0.9985	157.5
EQ Men BP 83	493	171.8722	44.8646	0.9984	170
EQ Men BP 93	494	188.4939	48.0483	0.9982	185
EQ Men BP 105	487	204.2834	52.4796	0.9987	205
EQ Men BP 120	388	221.9265	57.7100	0.9970	220
EQ Men BP 120+	304	233.4276	65.7836	0.9990	235
CL Men PL 53	23	380.9130	71.2126	0.9717	382.5
CL Men PL 59	149	427.1980	76.9890	0.9973	427.5
CL Men PL 66	250	484.3920	82.9168	0.9951	490
CL Men PL 74	360	535.4569	85.9822	0.9953	537.5
CL Men PL 83	394	577.8084	88.5837	0.9960	582.5
CL Men PL 93	397	614.1071	93.8613	0.9959	615
CL Men PL 105	342	663.5234	93.2438	0.9922	667.5
CL Men PL 120	236	689.1081	116.9747	0.9927	705
CL Men PL 120+	196	723.4260	137.7539	0.9806	740
CL Men BP 53	36	83.4722	19.3348	0.9888	80
CL Men BP 59	198	100.8864	24.4147	0.9950	98
CL Men BP 66	301	114.0648	25.0702	0.9968	115
CL Men BP 74	459	127.1144	24.9656	0.9953	127.5
CL Men BP 83	484	138.8120	25.4240	0.9985	140
CL Men BP 93	488	149.1445	27.8093	0.9986	150
CL Men BP 105	422	161.1339	30.0123	0.9960	160
CL Men BP 120	297	169.8754	34.8567	0.9951	170
CL Men BP 120+	252	183.2024	39.3737	0.9965	185

Distribution	# Lifters	Mean	Std Dev	Rho	median
EQ Wmn PL 43	29	269.1552	55.9015	0.9732	280
EQ Wmn PL 47	87	323.8218	73.3353	0.9983	315.5
EQ Wmn PL 52	145	340.8241	81.4100	0.9943	350
EQ Wmn PL 57	160	379.7313	75.3900	0.9972	377.5
EQ Wmn PL 63	184	395.1766	90.1911	0.9935	387.5
EQ Wmn PL 72	172	418.5756	96.5239	0.9924	422.5
EQ Wmn PL 84	124	444.0887	105.5546	0.9952	437.5
EQ Wmn PL 84+	87	463.4368	143.6904	0.9918	470
EQ Wmn BP 43	37	55.0676	12.5769	0.9813	55
EQ Wmn BP 47	124	71.1815	21.7235	0.9929	70
EQ Wmn BP 52	187	79.1043	23.5312	0.9960	75
EQ Wmn BP 57	226	87.0354	23.9906	0.9937	87.5
EQ Wmn BP 63	267	90.5524	27.9294	0.9828	85
EQ Wmn BP 72	243	99.6872	30.3997	0.9969	100
EQ Wmn BP 84	181	106.1906	33.2361	0.9951	102.5
EQ Wmn BP 84+	141	118.4681	44.7677	0.9950	115.5
CL Wmn PL 43	20	228.9000	40.4070	0.9735	235
CL Wmn PL 47	101	268.7475	47.7329	0.9938	270
CL Wmn PL 52	150	293.4700	52.3053	0.9983	295
CL Wmn PL 57	208	311.4063	53.4261	0.9985	315
CL Wmn PL 63	246	329.0508	55.3621	0.9990	327.5
CL Wmn PL 72	237	345.0063	63.9280	0.9958	345
CL Wmn PL 84	164	370.4665	66.5626	0.9950	370
CL Wmn PL 84+	117	411.1325	84.2150	0.9961	405
CL Wmn BP 43	21	47.9762	12.8561	0.9893	45
CL Wmn BP 47	107	56.8505	13.1446	0.9910	55
CL Wmn BP 52	175	61.7400	14.8772	0.9898	60
CL Wmn BP 57	231	65.0844	15.0261	0.9923	65
CL Wmn BP 63	275	69.9327	15.8230	0.9866	70
CL Wmn BP 72	274	71.5693	17.5383	0.9869	70
CL Wmn BP 84	177	76.6977	18.3606	0.9919	75
CL Wmn BP 84+	134	86.9888	23.6284	0.9970	87.5

Table 6 - Average Goodness of fit statistic (Rho) for all the weight classes and scenarios is 0.9929.

Appendix 6 - Calculation of IPF Points

Given the two previous observations (lognormal distribution of bodyweight for the overall population and normal distribution of performance within weight classes), it is possible to visualize and model the range of lifter performance within the entire lifting population as a series of normal distributions.



	lifters	mean	std dev
53	85	299.9776	93.46727
59	461	382.9232	87.66974
66	1161	435.0071	84.67091
74	2473	475.0526	86.91762
83	3723	512.8492	87.02288
93	3952	549.8534	90.64786
105	3061	583.387	98.30561
120	1661	610.5213	110.5883
120+	1081	642.9165	129.0031

Figure 14 – Lifter performance visualization for Men's Classic 3-Lift.

Notably, when the new weight classes were adopted, Dr. Wilks data indicated that only about 2-3% of lifters were in the 84+kg for women and 120+kg weight classes for men. While, the data used here shows closer to 10% of the lifters appear in those weight classes. Larger and more complete data sets will provide more accuracy, future evaluations should include the national databases from all IPF member nations.

Microsoft Excel is used for all the following process calculations, charts, tables, and diagrams.

1. The starting point for the calculation process is to filter the data set so that only the best result is used for an athlete who has appeared several times in competitions over the time under consideration. It is important to note that this process uses the most complete lifter population available – all ranges of skill, all nations, local contests to World championships. It is applicable to novice as well as elite lifters. In small elite lifter data sets, a single outstanding performance can dramatically change rankings from year to year. Repeat performances by the same lifters in World championships means the performance of a very small group of elite lifters is used to evaluate a lifter population that may be a thousand times larger.
2. When the filtering is complete, the total vs body weight data is plotted on an X-Y chart as shown in Figure 15.

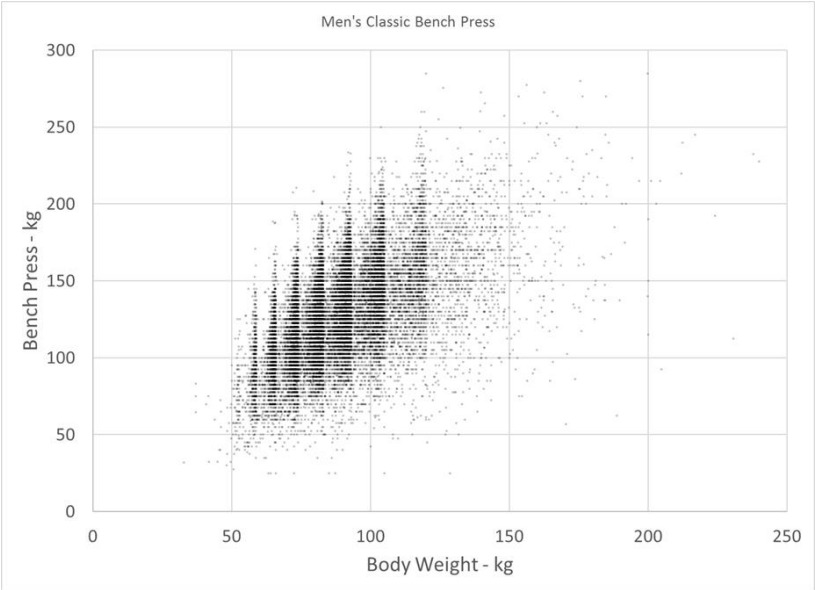


Figure 15 – Total vs Bodyweight for Men's Classic Bench Press.

There are noticeable clusters of lifters near the near the upper weight limit for each class except for the 120+kg class where bodyweights range from just heavier than 120kg to more than 200kg. The average weight of lifters in the 120+kg class is 140.8kg.

3. Following the observation that lifter bodyweight can be described as a function of the natural log of lifter bodyweight, a lognormal trendline is added to the chart (Figure 16) to separate the population into 2 approximately equal-sized subpopulations. This line shows a generally increasing total with increasing bodyweight with the rate of change gradually decreasing as bodyweight increases.

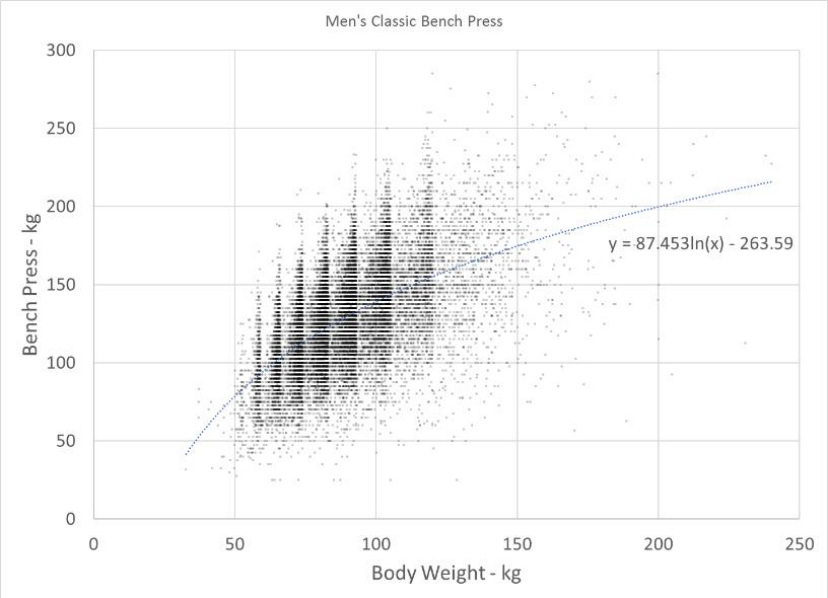


Figure 16 - Performance distribution with average performance line.

4. Figure 17 shows the population separated into 2 truncated normal distributions or subpopulations with approximately 50% in each. A lognormal curve was fit to the Top 50%. The line through the red subpopulation divides the top 50% of the lifters into 2 subpopulations.

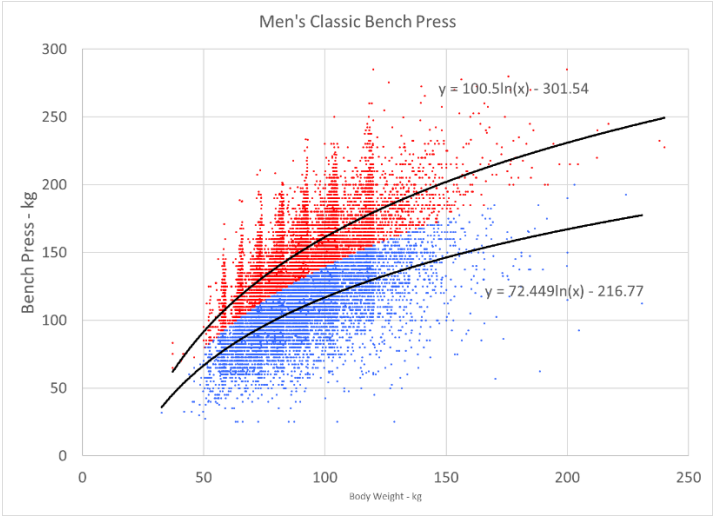


Figure 17 – Lognormal trendlines fit to Men's Classic Bench Press vs Bodyweight

5. The average of the two equations in Figure 10 is an equation for the average or mean performance at any weight in the population under consideration
6. For Truncated normal populations, the difference between top and bottom lines is 1.596 standard deviations. The difference between the two equations divided by 1.596, yields an equation that computes standard deviation. After completing the mathematical computations using the trendline equations on the chart in Figure 17, the equations that characterize performance for the Men's Classic Bench Press are:
   - Mean Performance = 86.475 x ln(bodyweight) – 259.155
   - Standard Deviation = 17.576 x ln(bodyweight) -53.114

   These 2 equations estimate the range of lifter performance at all body weights for the Men's Classic Bench Press.

7. For every lifter, 2 factors (mean and standard deviation) are computed using their body weight. These 2 factors when combined with the lifter's performance generate IPF Points and can also be used to create a percentile rank. Percentile rank tells a lifter exactly how they compare to all the other lifters in the population.

IPF points = 500 + (total - Mean)/Standard Deviation

- An average lifter will score 500 points
- Elite lifters may score more than 800 points
- Both methods (IPF Points or Percentile) are easily incorporated into computer systems.

With Mean and Standard Deviation, a lifter's percentile score can be easily calculated. This provide an easy to understand ranking for lifters. For example, a lifter with a 75% score is better than 75% of all lifters.

Appendix 7 – 2017 IPF Open Worlds Using IPF Points Instead of Wilks Points

The scorsheets below shows how the Men's Best Lifter Awards would change using IPF Points instead of Wilks Points at the 2017 World Open Men's Championships.

Best Lifters of Open Using Wilks Points												
Rnk	Lifter	Nation		B.Weight		WF		Total		W.Points		C.Rnk.
1	Fedosienko Sergey	Russia		55.49		0.9186		732.5		672.87		1
2	Olech Jaroslaw	Poland		73.05		0.726		908		659.21		1
3	Semenenko Dmytro	Ukraine		104.98		0.5976		1090.5		651.68		1
Best Lifters of Open Using IPF Points												
Rnk	Lifter	Nation		B.Weight		IPF Coefficients		Total		IPF Points		C.Rnk.
1	Olech Jaroslaw	POL		73.05		540.53/123.516		908.0 -w		797.51		1
2	Fedosienko Sergey	RUS		55.49		434.055/101.347		732.5		794.48		1
3	Rubets Oleksandr	UKR		100.28		663.224/149.062		1070.5 -wj		773.23		2

The table on the next page shows IPF points applied to the entire 2017 World Open Men's Championships.

INTERNATIONAL POWERLIFTING FEDERATION
World Open Men's Championships. Pilsen (Czechia). 13-18.11.2017
DETAILED SCORESHEET

PL.	Lifters	BY	Team	Weight	IPF Coefficients	Lot	All Squat			All Bench Press				All Deadlift				TOTAL	IPF pts.	Pts.
-59kg																				
1	Fedosienko Sergey	1982	RUS	55.49	434.055/101.347	1	270	285	285	1	180	180	190	1	240	255	267.5	1	732.5	794.4798	12
2	Lin Yi-Chun	1994	TPE	58.56	454.909/105.689	5	250	260	265	3	160	165	172.5	3	240	255	265.0-wj	2	695	727.1687	9
3	Leon Franklin	1983	ECU	58.65	455.503/105.812	9	265	275	275	2	165	165	165	4	225	235	247.5	6	675	707.4395	8
4	Wszola Dariusz	1978	POL	58.62	455.305/105.771	3	235	245	255	4	165	172.5	177.5	2	200	210	215	7	647.5	681.7082	7
5	Satake Yusuke	1996	JPN	58.67	455.635/105.84	4	245	252.5	252.5	5	155	155	170	5	225	240	240	5	640	674.192	6
6	Kupperstein Eric	1966	USA	58.76	456.229/105.963	6	232.5-w2	245	245	6	85	92.5	95	7	227.5	242.5	245	4	572.5	609.7274	5
—	Wang Chun-Lin	1990	TPE	58.74	456.097/105.936	8	245	245	245	—	145	150	152.5	6	235	242.5	245	3	DSQ		—
-66kg																				
1	Gladkikh Sergey	1989	RUS	65.68	499.344/114.941	10	290	300	310	1	195	202.5	210	3	265	275	285	4	805	765.925	12
2	El Belghiti Hassan	1975	FRA	65.78	499.934/115.063	13	280	285	290	2	162.5	167.5	170	9	297.5	310	312.5	1	772.5	736.8841	9
3	Savolainen Antti	1978	FIN	65.68	499.344/114.941	20	260	270	277.5	6	190	197.5	202.5	4	275	290	297.5	3	770	735.4744	8
4	Grotkowski Mariusz	1989	POL	65.46	498.045/114.67	16	275	285	290	3	207.5	207.5	215	1	250	260	270	8	760	728.4424	7
5	Aryanto Viki	1994	INA	65.18	496.385/114.324	12	280	300	300	4	180	200	210	5	270	280	290	6	750	721.8381	6
6	Oishi Eric	1979	BRA	65.68	499.344/114.941	17	265	277.5	282.5	5	175	185	190	6	252.5	262.5	270	7	730	700.6738	5
7	Kiuchi Yosuke	1996	JPN	65.64	499.109/114.891	18	260	267.5	275	8	165	175	182.5	8	260	272.5	277.5	5	720	692.2611	4
8	Vang James	1992	USA	65.85	500.345/115.149	11	260	272.5	280	7	182.5	182.5	190	7	255	255	255	9	710	682.0724	3
9	Hafenbrack Michael	1984	USA	65.6	498.872/114.842	22	245	255	260	9	157.5	162.5	165	10	240	250	260	10	667.5	646.8341	2
10	More Jan	1993	CZE	65.13	496.088/114.262	15	220	220	235	10	140	147.5	147.5	12	220	235	235	11	580	573.4381	1
11	Byambasuren Lkhagvakhuu	1994	MGL	65.42	497.808/114.621	19	210	225	225	11	155	155	155	11	200	210	210	12	575	567.3453	1
—	Hsieh Tsung-Ting	1982	TPE	64.82	494.24/113.878	21	270	270	270	—	205	205	210	2	270	282.5	290	2	DSQ		—
-74kg																				
1	Olech Jaroslaw	1974	POL	73.05	540.53/123.516	12	345	360	368	1	210	215	220	3	295	310	328.0-w	1	908.0 -w	797.5086	12
2	Gaishinetc Sergei	1986	RUS	73.15	541.06/123.626	4	320	337.5	345	2	205	205	205	7	310	322.5	325	3	865	762.0323	9
3	Meiyanto Doni	1989	INA	73	540.265/123.461	13	310	310	330	3	180	185	185	9	300	315	322.5	2	837.5	740.7532	8
4	Barannik Mykola	1989	UKR	73.8	544.486/124.339	2	310	322.5	327.5	4	220	227.5	232.5	1	270	282.5	290	5	832.5	731.6356	7
5	Ochoa Alex	1990	ECU	72.37	536.908/122.762	15	280	290	300	6	190	200	205	6	255	265	275	6	780	698.0194	6
6	Mastrolorenzo Antoni	1982	FRA	73.56	543.224/124.077	10	295	302.5	307.5	5	205	210	215	5	255	262.5	267.5	8	780	690.8301	5
7	Hamada Nobuyuki	1969	JPN	73.25	541.589/123.736	3	290	300	300	8	215	220	220	4	260	270	280	7	775	688.6361	4
8	Jimenez Diego Antonio	1989	ARG	73.47	542.75/123.978	17	285	285	305	9	200	200	200	8	250	270	270	11	735	655.0677	3
9	Seifriedsberger Mario	1988	AUT	73.14	541.007/123.615	5	265	265	280	10	185	192.5	192.5	10	230	250	257.5	9	707.5	634.6869	2
10	Lkhamjav Ganbaatar	1990	MGL	72.39	537.015/122.784	8	235	245	250	11	225	225	230	2	220	235	245	12	705	636.8134	1
11	Kuan Yi-Hsin	1982	TPE	72.02	535.031/122.371	7	200	210	220	14	140	145	X	13	285	300	300	4	650	593.9516	1
12	Lin Ming-Hui	1983	TPE	73.12	540.901/123.593	1	300	320	322.5	7	65	X	X	15	225	250	270	10	615	559.9542	1
13	Stiglbauer Michael	1988	AUT	71.71	533.36/122.023	16	220	220	235	13	160	170	180	11	210	225	225	15	610	562.8077	1
14	Dano Milan	1983	CZE	68.58	516.077/118.424	6	230	250	250	12	155	162.5	170	12	200	215	217.5	14	607.5	577.1997	1
15	Brito Marius	1994	POL	73.5	542.908/124.011	18	100	X	X	15	100	X	X	14	200	230	262.5	13	430	408.953	1
—	Prokopenko Andrey	1988	KAZ	73.59	543.382/124.11	11	320	330	337.5	—	230	240	245.5	—	295	305	312.5	—	DD		—
-83kg																				
1	Naniev Andriy	1984	UKR	82.65	588.346/133.472	11	330	342.5	352.5	2	260	267.5	275.5	1	300	307.5	312.5	6	932.5	757.8484	12
2	Anuar Ulan	1993	KAZ	82.31	586.749/133.139	5	330	340	340	4	230	237.5	242.5	4	320	342.5	345.5	1	915	746.5471	9
3	Roelvaag Kim-Raino	1986	NOR	80.63	578.763/131.476	19	315	315	325	7	245	252.5	255	2	275	282.5	290	9	870	721.5126	8
4	Lochschmidt Max	1983	GER	82.49	587.595/133.315	7	315	325	330	5	212.5	220	225	6	292.5	302.5	310	7	860	704.3312	7
5	Spychala Jacek	1978	POL	82.56	587.924/133.384	4	310	325	332.5	3	200	207.5	212.5	8	300	315	327.5	5	860	703.9801	6
6	Kobayakawa Wataru	1975	JPN	82.67	588.44/133.491	17	307.5	317.5	327.5	6	210	215	220	7	272.5	285	290	10	837.5	686.5747	5
7	Yusup Muhammad	1986	INA	81.92	584.91/132.756	3	260	280	300	14	185	195	202.5	12	330	340	340	2	815	673.3177	4
8	Carniel Simone	1990	ITA	82.39	587.126/133.217	13	305	315	320	8	190	197.5	205	11	280	300	300	11	805	663.5479	3
9	Guaquin Adrian	1990	ARG	78.53	568.543/129.348	18	290	305	305	11	210	222.5	227.5	9	250	265	270	13	770	655.7473	2
10	Tulegenov Abdukarim	1986	KAZ	81.27	581.825/132.114	2	290	300	310	9	160	170	175	16	300	310	310	8	770	642.4339	1
11	Sanchez Marcos	1974	ECU	82.83	589.188/133.647	6	290	300	307.5	10	200	207.5	215	10	245	255	262.5	14	770	635.2906	1
12	Stiglbauer Andreas	1990	AUT	81.17	581.348/132.015	16	280	290	290	12	210	217.5	222.5	5	240	250	260	15	762.5	637.221	1
13	Jhang You-Si	1994	TPE	82.84	589.235/133.657	10	225	240	252.5	17	165	175	180	15	295	325	345	3	757.5	625.8934	1
14	Vasilev Todor	1978	BUL	82.73	588.72/133.55	15	290	305	305	13	190	200	200	13	275	285	X	12	755	624.5078	1
15	Morris Marc	1987	CAN	82.48	587.548/133.305	9	247.5	260	265	15	175	182.5	187.5	14	235	245	255	16	697.5	582.4809	1
16	Batsukh Gansukh	1988	MGL	81.21	581.539/132.054	14	225	240	250	18	237.5	237.5	242.5	3	200	220	220	18	692.5	584.0268	1
17	Jayadeep Krishna P C	1992	IND	82.01	585.335/132.845	12	235	250	260	16	135	145	150	17	210	240	250	17	645	544.9131	1
—	Sorokin Alexey	1985	RUS	82.68	588.486/133.501	1	355	370	377.5	1	230	235	235	—	302.5	317.5	327.5	4	DSQ		—
-93kg																				
1	Inzarkin Dmitry	1987	RUS	92.81	633.245/142.82	10	355	370	380	1	275	285	295	2	330	345	345	3	995	753.2943	12
2	Coimbra David	1983	BRA	91.94	629.598/142.061	6	335	350	360	4	230	245	250	6	332.5	332.5	357.5	1	952.5	727.2989	9
3	Stendebach Sascha	1991	GER	92.13	630.397/142.227	12	330	340	340	6	255	265	272.5	4	332.5	340	347.5	2	952.5	726.4708	8
4	Huber Alexander	1990	AUT	91.35	627.105/141.541	11	330	330	330	7	250	255	262.5	5	280	290	297.5	5	882.5	680.4385	7
5	Myagmarsuren Galsaikhan	1988	MGL	92.01	629.893/142.122	7	345	345	357.5	5	225	235	242.5	7	300	300	305	4	880	675.9809	6
6	Nielsen Nicki Lentz	1992	DEN	91.7	628.586/141.85	5	340	355	370	2	217.5	225	225	9	275	290	290	6	870	670.1902	5
7	Arakawa Takayuki	1978	JPN	89.05	617.229/139.485	9	277.5	297.5	307.5	8	217.5	225	225	10	270	280	280	9	795	627.4476	4
8	Ziffle Aaron	1981	CAN	92.77	633.078/142.785	4	295	295	307.5	9	217.5	225	230	8	250	250	272.5	10	787.5	608.1497	3
9	Turakhanov Davranbek	1974	KAZ	85.38	600.931/136.092	1	275	300	325	10	200	210	210	11	275	300	300	8	785	635.2537	2
10	Kitsui Masahito	1978	HKG	92.13	630.397/142.227	8	220	X	X	13	265	270	275	3	200	230	245	12	725	566.5153	1
11	Watson Matt	1991	GBR	90.27	622.499/140.583	13	252.5	265	272.5	11	187.5	195	195	12	220	232.5	237.5	11	705	558.6852	1
12	Leider Denis	1989	LUX	91.49	627.698/141.665	3	255	262.5	267.5	12	157.5	162.5	162.5	13	272.5	280	285	7	700	551.0375	1
—	Wegiera Jan	1965	POL	92.85	633.412/142.855	2	330	345	355	3	290	290	290	1	280	280	280	—	DSQ		—
-105kg																				
1	Semenenko Dmytro	1988	UKR	104.98	680.962/152.755	13	420	440.5	445.5-w	1	280	292.5	302.5	3	332.5	342.5	352.5	9	1090.5 -w	768.1008	12
2	Rubets Oleksandr	1996	UKR	100.28	663.224/149.062	10	410	433.0-w	441	2	275	285	290.0-cj	7	330	347.5	367.5	7	1070.5 -wj	773.226	9
3	Kuvambayev Zalim	1986	KAZ	104.65	679.743/152.501	16	395	410	420	3	260	270	277.5	12	332.5	340	345	10	1037.5	734.5928	8
4	Mashintcov Sergey	1987	RUS	100.85	665.419/149.519	26	375	385	395	6	270	277.5	280	10	335	355	362.5	4	1030	743.836	7
5	Yang Sen	1994	TPE	104.6	679.558/152.463	24	400	410	415	4	280	300.0-wj	317.5	5	300	312.5	312.5	14	1027.5	728.2145	6
6	Belkesir Sofiane	1984	FRA	104.84	680.445/152.648	22	380	390	392.5	7	270	275	275	14	340	352.5	360	6	1020	722.4435	5
7	Lebedko Konstantin	1981	RUS	104.34	678.594/152.262	4	380	395	400	5	280	280	292.5	11	320	332.5	340	11	1012.5	719.2969	4
8	Eikeland Kristoffer	1989	NOR	104.57	679.447/152.44	14	352.5	360	365	13	287.5	295	300	4	335	345	350	8	1010	716.8421	3
9	Krawczyk Bryce	1987	CAN	104.75	680.113/152.578	15	332.5	355	372.5	9	160	225	225	19	365	388.0-w	391	1	985.5	700.1511	2
10	Van den Hoek Pjotr	1972	NED	104.82	680.372/152.632	8	355	370	375	8	292.5	292.5	297.5	6	310	322.5	322.5	16	977.5	694.6696	1
11	Barbosa Vanderlei	1987	BRA	102.56	671.93/150.875	25	340	347.5	350	18	300	300	310	2	305	315	320	13	965	694.247	1
12	Khuder Enkhbold	1985	MGL	102.84	672.986/151.094	12	340	355	365	11	310	317.5	317.5	1	260	277.5	282.5	22	965	693.2656	1
13	Gunhamn Erik	1992	SWE	103.25	674.527/151.415	11	345	357.5	365	12	230	237.5	242.5	16	340	357.5	372.5	3	965	691.8385	1
14	Bailey Garrett	1992	USA	103.9	676.957/151.921	18	350	360	367.5	10	225	230	230	18	352.5	365	365	5	950	679.7262	1
15	Walgermo Stian	1988	NOR	104.46	679.039/152.355	19	360	370	X	14	285	300	300	8	225	257.5	300	17	945	674.5668	1
16	Johnson Gregory	1990	USA	104.21	678.111/152.162	17	350	350	350	16	220	220	225	20	350	365	372.5	2	942.5	673.7553	1
17	Grenier Allan	1990	FRA	104.69	679.891/152.532	1	345	355	355	17	285	307.5	307.5	9	275	290	300	18	930	663.9714	1
18	Maslov Ilya	1989	KAZ	101.77	668.936/150.251	20	320	320	340	20	260	260	275	13	290	300	310	15	905	657.113	1
19	Akutsu Takahito	1982	JPN	100.49	664.034/149.231	21	327.5	342.5	352.5	15	260	260	260	15	270	287.5	302.5	21	900	658.1216	1
20	Bowring Dean	1974	GBR	104.37	678.705/152.285	23	310	320	325	19	235	242.5	252.5	17	295	315	327.5	12	895	642.0325	1
21	Locke Adrian	1990	CAN	103.95	677.144/151.96	9	285	305	317.5	22	192.5	205	210	21	275	295	307.5	19	822.5	595.6542	1
22	Gengler Jean	1986	LUX	103.26	674.565/151.423	2	265	265	270	23	160	165	167.5	22	275	282.5	290	20	722.5	531.6566	1
—	Shuurai Chanrav	1989	MGL	103.79	676.547/151.836	5	300	310	320	21	310	310	310	—	200	X	X	23	DSQ		—
-120kg																				
1	Bychkov Oleksiy	1985	UKR	119.18	730.093/162.985	2	400	415	425	1	310	330	337.5	1	350	365	367.5	1	1127.5 -w	743.8313	12
2	Sarik Tomas	1975	CZE	119.55	731.293/163.235	13	360	372.5	380	5	265	275	282.5	9	330	345	355	3	1000	664.6141	9
3	Meyer Quintin	1991	USA	118.94	729.312/162.822	14	365	365	370	8	297.5	302.5	302.5	3	315	325	337.5	7	987.5	658.5707	8
4	Dobbins Scott	1992	USA	119.37	730.709/163.113	8	392.5	392.5	405	3	282.5	287.5	287.5	7	295	307.5	320	11	987.5	657.431	7
5	Pahl Dominik	1992	GER	118.49	727.844/162.516	16	380	380	390	4	280	290	290	5	300	315	330	9	985	658.2339	6
6	Tilyeubyerd Saifolla	1987	MGL	118.55	728.04/162.557	1	375	392.5	392.5	6	272.5	272.5	290	10	305	325	345	6	972.5	650.3839	5
7	Lange Martin	1987	GER	112.49	707.72/158.326	9	360	367.5	375	7	260	267.5	272.5	11	315	330	340	4	965	662.4997	4
8	Kasparek Gernot	1975	AUT	119.85	732.264/163.437	7	335	350	350	9	275	290	290	6	275	290	302.5	12	942.5	628.6348	3
9	Johnson Jack	1998	GBR	119.27	730.385/163.045	6	315	332.5	332.5	12	265	275	285	8	285	305	317.5	8	935	625.4957	2
10	Martin Shane	1988	CAN	111.68	704.921/157.744	15	315	330	340	10	265	280	302.5	2	245	265	277.5	14	920	636.3469	1
11	Campos Murillo Carlos Ma	1979	CRC	118.61	728.236/162.598	3	335	335	345	11	235	247.5	252.5	12	330	340	345	5	912.5	613.3249	1
12	Cook Jack	1989	GBR	107.49	690.112/154.66	10	310	322.5	322.5	13	215	222.5	230	13	295	315	315	13	827.5	588.8318	1
13	Tesaki Katsuo	1977	JPN	113.06	709.677/158.734	11	305	315	315	14	210	215	215	14	270	287.5	287.5	15	785	547.4521	1
—	Samuelsson Viktor	1993	ISL	119.27	730.385/163.045	12	375	375	375	—	295	312.5	312.5	4	305	315	315	10	DSQ		—
—	Rokochiy Oleksiy	1981	UKR	119.82	732.167/163.416	4	400	415	422.5	2	280	280	280	—	320	345	357.5	2	DSQ		—
120+kg																				
1	Lupac David	1991	CZE	145.13	806.382/178.869	9	405	405	425	3	325	335	340	4	335	352.5	362.5	2	1127.5	679.5272	12
2	Svistunov Volodymyr	1987	UKR	167.02	860.786/190.196	5	430	430	432.5	1	350	350	360	2	320	335	345	4	1127.5	640.2308	9
3	Johannsson Julian J.K.	1993	ISL	165.99	858.391/189.698	3	390	390	405	4	300	310	310	7	340	370	400	1	1060	606.2794	8
4	Snijders Jordy	1986	NED	125.99	751.612/167.465	15	365	380	387.5	7	315	325	325	6	310	320	325	6	1025	663.2507	7
5	Soukal Jaroslav	1972	CZE	170.25	868.204/191.741	2	365	365	387.5	5	325	325	332.5	5	280	300	307.5	10	1020	579.1673	6
6	Stinn Ryan	1981	CAN	144.05	803.489/178.266	13	385	385	385	6	285	295	295	8	285	305	325	8	985	601.8199	5
7	Zinserling Tobias	1978	GER	151.52	823.068/182.343	12	360	365	375	8	240	270	270	10	340	355	355	3	960	575.0957	4
8	Ito Eita	1995	JPN	153.24	827.44/183.253	11	310	310	325	9	220	230	235	11	280	292.5	295	11	855	515.0396	3
9	Fong Chai Chi	1982	HKG	137.58	785.692/174.561	6	265	285	302.5	10	245	245	245	9	200	230	245	12	760	485.2817	2
10	Sandvik Kenneth	1975	FIN	141.65	796.983/176.912	10	175	X	X	11	345	352.5	360.0-w1	1	175	X	X	13	710	450.8327	1
—	Sahota Ranbir	1983	GBR	130.13	764.133/170.072	8	350	350	350	—	220	227.5	235	12	300	320	320	9	DSQ		—
—	Konovalov Andrey	1986	RUS	157.2	837.32/185.31	1	470	470	470	—	355	355	355	—	X	X	X	—	DSQ		—
—	Baartvedt Hans Magne	1983	NOR	169.06	865.488/191.175	14	395	395	395	—	340	347.5	355	3	322.5	342.5	357.5	5	DSQ		—
—	Cappellino Joseph	1988	USA	169.43	866.334/191.351	4	432.5	432.5	442.5	2	340	340	340	—	320	342.5	342.5	7	DSQ		—

Best Lifters of Open

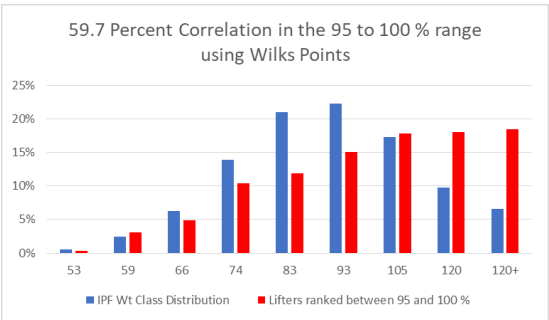
Rnk	Lifter	Nation	B.Weight	IPF Coefficients	Total	IPF Points	C.Rnk.
1	Olech Jaroslaw	POL	73.05	540.53/123.516	908.0 -w	797.5	1
2	Fedosienko Sergey	RUS	55.49	434.055/101.347	732.5	794.5	1
3	Rubets Oleksandr	UKR	100.28	663.224/149.062	1070.5 -wj	773.2	1

Appendix 8 - Wilks Points and IPF Points Scoring Comparisons

The specific criteria laid out at the start of this proposal will be used to compare the IPF Points and Wilks Points best lifter methodologies for each of the 8 scoring variations.

Top ranked lifters from each weight class should appear in similar proportions to the distribution of those weight classes in the lifting population. While the proportions are not expected to be a perfect match, they should have similar shape for the distributions so that all weight classes are fairly and proportionately represented.

The distribution of lifters in the top 5% of Wilks Points scoring was compared to the distribution of lifters in the lifting population with Pearson Correlation Coefficient (CCOEF). In similar fashion, the distribution of lifters in the top 5% of IPF Points scoring was compared to the distribution of lifters in the lifting population with Pearson Correlation Coefficient (CCOEF). The charts below compare the WP and IPF Points correlations for Men's Classic Powerlifting and show the CCOEF for the IPF Points is greater than the WP coefficient (a value of 1.0 indicates perfect correlation).



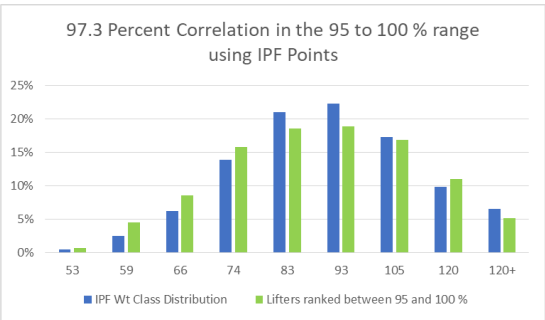


Figure 18 - WP and IPF Points correlations for Men's Classic Powerlifting

Table 7 summarize the distribution comparison for Wilks and IPF Points correlations for performance ranging from the bottom 10% (0-10%) to the top the for top 5% (95-100%) of lifters. Darker red means a lower correlation between the lifter population and the percentage of lifters from each weight class in the range of performance.

Women								
	Classic 3-Lift		Equipped 3-Lift		Classic Bench		Equipped Bench	
	Wilks	IPF Pts	WP	MP	Wilks	IPF Pts	Wilks	IPF Pts
0-10%	77.3%	94.7%	74.4%	83.0%	81.1%	94.2%	81.7%	77.9%
10-20%	92.1%	99.2%	89.5%	89.7%	92.8%	97.8%	92.5%	93.6%
20-30%	97.3%	99.0%	96.1%	97.6%	96.6%	99.4%	96.9%	96.0%
30-40%	98.8%	99.0%	92.0%	96.5%	98.9%	98.2%	97.0%	96.7%
40-50%	99.5%	99.5%	94.4%	95.1%	99.3%	97.7%	93.3%	92.4%
50-60%	98.9%	99.2%	96.5%	84.7%	98.2%	99.1%	90.2%	90.5%
60-70%	99.0%	99.5%	96.3%	94.7%	97.6%	99.6%	93.1%	94.2%
70-80%	97.3%	99.6%	96.8%	95.8%	96.2%	98.2%	94.9%	92.9%
80-90%	88.2%	97.9%	87.4%	98.7%	91.5%	98.7%	93.4%	93.6%
90-100%	76.5%	98.3%	81.4%	93.8%	84.9%	98.9%	97.4%	96.2%
95-100%	62.9%	97.9%	69.8%	87.6%	70.6%	99.7%	97.6%	96.0%

Men								
	Classic 3-Lift		Equipped 3-Lift		Classic Bench		Equipped Bench	
	Wilks	IPF Pts	Wilks	IPF Pts	Wilks	IPF Pts	Wilks	IPF Pts
0-10%	94.7%	97.2%	97.4%	95.9%	93.0%	96.9%	79.7%	95.9%
10-20%	95.8%	94.5%	99.9%	98.7%	97.7%	99.6%	85.6%	95.4%
20-30%	96.7%	96.7%	99.8%	99.6%	97.9%	99.1%	91.4%	96.8%
30-40%	97.3%	97.0%	99.5%	99.7%	98.8%	99.5%	96.3%	97.8%
40-50%	97.8%	98.6%	99.5%	99.3%	99.2%	99.6%	96.2%	98.0%
50-60%	99.0%	98.1%	99.7%	99.8%	99.0%	99.5%	97.3%	99.7%
60-70%	96.1%	92.9%	99.5%	99.5%	98.9%	99.5%	96.1%	92.4%
70-80%	99.0%	97.2%	99.2%	99.7%	99.2%	99.6%	85.8%	95.0%
80-90%	88.1%	97.2%	95.5%	99.5%	97.1%	99.4%	61.3%	92.4%
90-100%	79.7%	85.8%	98.9%	99.1%	78.9%	98.8%	87.8%	95.9%
95-100%	65.8%	78.2%	91.9%	99.1%	59.7%	97.3%	50.7%	84.1%

Table 7 – Correlation Comparison Summary, All 8 Best Lifter Scenarios.

The IPF Points calculation method would replace the existing Wilks coefficients with a set of equations that need a computer, or some means of electronic calculation. While this is a departure from the simple multiplication of Total x Coefficient, computer scoring has become the standard at nearly every contest. This is acknowledged by the fact that the tables of Wilks coefficients are no longer on the IPF website or in the rule book. Even a hand scored contest would require little more than a simple phone App or access to an internet calculator. Here is a link to a google sheet that performs the required calculations:

https://docs.google.com/spreadsheets/d/19IEIi5y6FP561UZla0soi7dwpYRlFBCaZNysGfvWDc8/edit?usp=sharing

As powerlifting grows and evolves, it is important to periodically update the “best lifter” methodology. It is recommended that the IPF Points (or any other methodology) be updated on a 4 - year basis, like Olympic Lifting. Because the IPF Points method does not rely on a table of coefficients, only the factors in Table 8 would need to be updated and republished – no updates to long data tables or rewrites of computer code would be necessary.

	Mean		Standard Deviation	
	Parameter 1	**Parameter 2**	**Parameter 3**	**Parameter 4**
Men Classic 3-Lift	310.6700	857.7850	53.2160	147.0835
Men Classic Squat	123.1000	363.0850	25.1667	75.4311
Men Classic Benchpress	86.4745	259.1550	17.5785	53.1220
Men Classic Deadlift	103.5355	244.7650	15.3714	31.5022
Men Equipped 3-Lift	387.2650	1121.2800	80.6324	222.4896
Men Equipped Squat	150.4850	446.4450	36.5155	103.7061
Men Equipped Benchpress	133.9400	441.4650	35.3938	113.0057
Men Equipped Deadlift	110.1350	263.6600	14.9960	23.0110
Women Classic 3-Lift	125.1435	228.0300	34.5246	86.8301
Women Classic Squat	50.4790	105.6320	19.1846	56.2215
Women Classic Benchpress	25.0485	43.8480	6.7172	13.9520
Women Classic Deadlift	47.1360	67.3490	9.1555	13.6700
Women Equipped 3-Lift	176.5800	373.3150	48.4534	110.0103
Women Equipped Squat	74.6855	171.5850	21.9475	52.2948
Women Equipped Benchpress	49.1060	124.2090	23.1990	67.4926
Women Equipped Deadlift	51.0020	69.8265	8.5802	5.7258

Table 8 – Mean and Standard Deviation parameters for each Competition Category