



## A CASE FOR THE REVISION OF U.S. SIZING STANDARDS

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### ABSTRACT

*Apparel consumers today have difficulties finding clothes that provide appropriate fit. In large part, this can be attributed to the outdated sizing standards based on decades-old anthropometric data used by apparel firms to create patterns. This study determines the inadequacies of ASTM sizing standards at meeting the needs of consumers in three target groups, segmented by age: Juniors, Missy, and Over55. Using Body Shape Analysis Software (FFIT for Apparel<sup>®</sup>), SizeUSA data and ASTM measurement data were analyzed for each of the three age groups. Resulting graphs allowed for comparison between the body shapes that predominate in each age group (based on SizeUSA samples) and the body shapes that are accommodated best by the ASTM standards. Results and implications of these comparisons are included in the article.*

*Keywords: Sizing, Fit, SizeUSA, Body Measurements, FFIT for Apparel<sup>®</sup>*

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### Introduction

Apparel fit ranks high on apparel consumers' lists as an area of intense frustration. A study by Kurt Salmon Associates recently showed that 62% of U.S. consumers are very dissatisfied with the fit of their apparel (Kurt Salmon Associates, 1999). This statistic is particularly telling since comfort and fit are among the highest determinants for apparel purchase in today's markets. A garment that does not fit well, will not sell.

The problem of fit, however, is hard to measure for apparel manufacturers. Often, the only way manufacturers can measure the extent and severity of fit problems is through analysis of the amount of returned merchandise. Sirvart Mellian, an apparel

program manager for the U.S. Navy has said that "quality control people at women's and children's apparel manufacturers report that the highest number of returns retailers get is because of size and fit" (Agin, 1994). However, a focus simply on returns does not give a true indication of the fit problem. It is very hard to quantify losses related to lost sales, brand dissatisfaction, and time wasted in fitting rooms, which are all indicators of the costs of fit problems (DesMarteau, 2000).

The search for the causes of fit problems experienced by so many consumers is a very important one; only by finding the cause may apparel firms start to improve apparel fit. Sizing standards used by the apparel industry to create patterns are one source

that may be examined to determine their adequacy at meeting the fit expectations of consumers. ASTM international committees have directed the establishment of several sizing standards for different groups of the population, three of which will be explored in this study to determine their adequacy at meeting the needs of their target consumers. The standards used in this study are the Junior, Missy, and Over 55 ASTM standards. While it is known that these standards are largely based on outdated, decades-old anthropometric data, the extent to which the standards fit current consumer body shapes is not fully known.

### Research Objectives

This research is a preliminary study of the SizeUSA data that aims to determine the inadequacies of sizing standards used by apparel companies today to target three consumer groups, segmented by age and comprised of women (Junior, Missy, and Over 55).

To frame the main research objectives, three hypotheses were formulated at the outset of the study:

- 1) The Junior Standard, ASTM D6829, is based on body shapes not predominately found in the U.S.
- 2) The Missy Standard, ASTM D5585, is based on body shapes not predominately found in the U.S.
- 3) The Over 55 Standard, ASTM D5586, is based on body shapes not predominately found in the U.S.

### Methodology

To test these hypotheses, body measurements from each of the three standards were first processed using FFIT for Apparel<sup>®</sup> Software developed at NC State's College of Textiles. This software translates body measurements into nine distinct body shape classifications based on bust, waist, hip, high hip, abdomen, and stomach measurements. The software uses measurement input to classify a subject as one of the following nine body shapes: Hourglass, Bottom hourglass, Top

hourglass, Rectangle, Diamond, Oval, Spoon, Triangle, and Inverted triangle (Devarajan, 2003).

In the first part of this study, measurement data from the ASTM standards for Junior, Missy, and Over 55 populations were entered into FFIT for Apparel<sup>®</sup> software to determine the body shapes that these standards best fit. The ASTM standards do not include two of the body measurements that are required for classification of the sample into the nine body shapes. The diamond and oval body shapes were not included in the results because of these missing measurements.

Next, SizeUSA data containing measurements from 6300 women from across the United States were retrieved and sorted by age into three different groups that corresponded with ASTM groups (Junior, Missy, and Over 55). Stomach, bust, hip, high hip and waist measurements from these subjects were extracted and processed using FFIT for Apparel<sup>®</sup> software. Like the ASTM standards, the SizeUSA data was also missing two of the body measurements that would have allowed for further definition of the body shapes into nine body shapes. The diamond and oval body shapes were not included in the results because of these missing measurements. However, the results obtained are a preliminary indication of the body shapes that actually predominate in each of the three age groups in the sample. Also, because the SizeUSA sample is representative of the population distribution of the U.S., the results may be extrapolated to describe the entire U.S. population.

The last part of the study involved the production of graphs showing the body shapes targeted by each ASTM standard, which were then compared to graphs showing the actual body shapes that predominate in each age group. Through this comparison, the effectiveness of each standard at targeting the actual body shapes of the U.S. female population was determined.

## Results and Discussion

The results of the research are best presented through an analysis and comparison of the graphs generated for each of the three age groups: Juniors, Missy, and Over55. Each age group is considered separately, in order to determine the effectiveness of the standard at fitting the body shapes of its respective age group.

### Juniors

After processing ASTM 6829 (Juniors) measurements through the FFIT for Apparel<sup>®</sup> software, Chart 1 was generated.

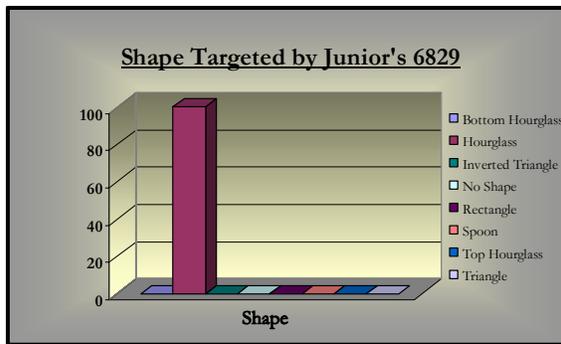


Chart 1

This chart shows that the measurements related to all of the sizes covered in this standard correspond to an hourglass body shape. Thus, patterns made using ASTM 6829 will best fit consumers with an hourglass body shape.

Chart 2 shows the body shapes of the subjects from the SizeUSA sample. From this graph, the body shapes that predominate in the actual U.S. population in this age group can be closely estimated.

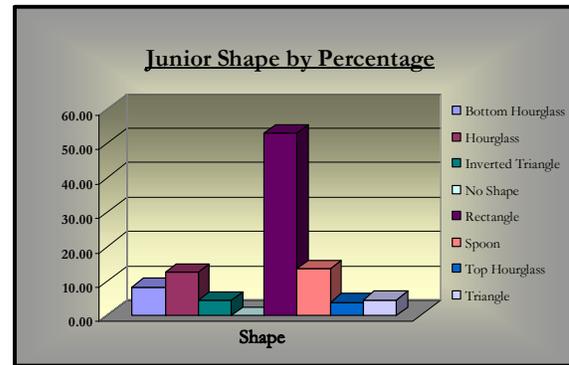


Chart 2

Chart 2 shows that 52.9% of the sample were rectangular in body shape, followed by 13.6% with spoon shapes, and then 12.5% with hourglass shapes. Bottom hourglass, top hourglass, inverted triangle, and triangle shapes were all represented, but to a lesser extent. Based on the data, it is clear that ASTM 6829 does not meet the junior target market. The standard entirely targets an hourglass shape, but over half of the sample population was rectangular in shape.

### Missy

Similar results were found in the analysis of the Missy group. After processing ASTM 5585 (Missy) measurements through the FFIT for Apparel<sup>®</sup> software, Chart 3 was generated, which shows the body shapes best accommodated by the Missy standard.

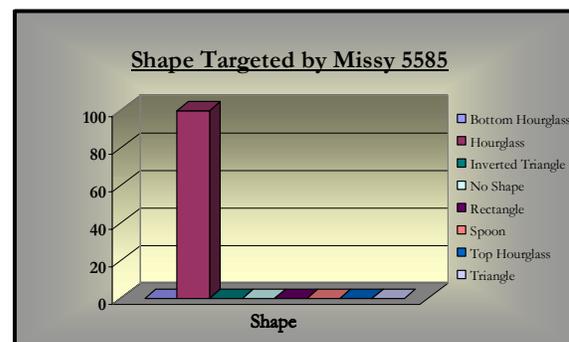


Chart 3

This chart shows that the measurements in ASTM 5585 100% corresponds to the hourglass shape, meaning that apparel produced using these standards will best fit a person who is hourglass in body shape.

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Chart 4 below shows a breakdown of the body shapes that predominated in the SizeUSA sample. Once again, from this graph, the body shapes that predominate in the actual U.S. population in this age group can be closely estimated.

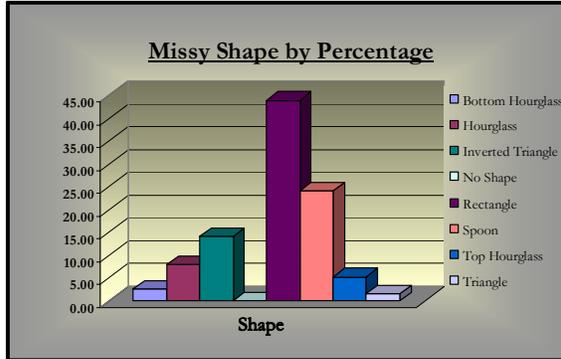


Chart 4

According to this chart, over 80% of the entire sample was composed of people with rectangle, spoon, or inverted triangle body shapes. The shape targeted by the Missy Standard (ASTM 5585), the hourglass shape, only made up 8% of the total sample. A comparison of Charts 3 and 4 clearly show that the ASTM Missy standard being used today does not adequately meet the needs of the Missy consumer.

*Over 55*

ASTM 5586, the Over 55 standard, is actually a family of standards, including seven distinct substandards. This group contains standards for 55+ Missy, Missy Petite, Missy Tall, Women, Halfsizes, Juniors, and Junior Plus. Each of these substandards uses different body measurements for the classifications of sizes, meaning that the same size among different substandards does not correspond to the same body measurements. Thus, garments manufactured according to different standards within the Over 55 standard may not fit the same body shapes. The following graphs (Charts 5 through 11) show the body shapes that each of the substandards fit best.

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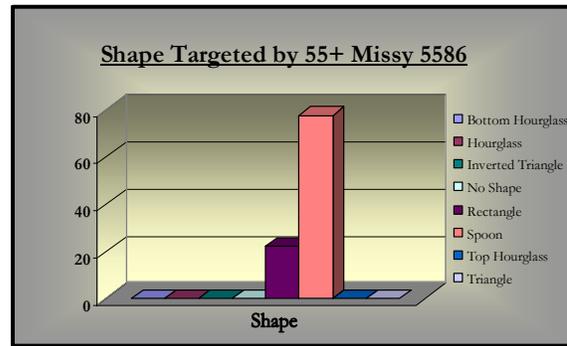


Chart 5

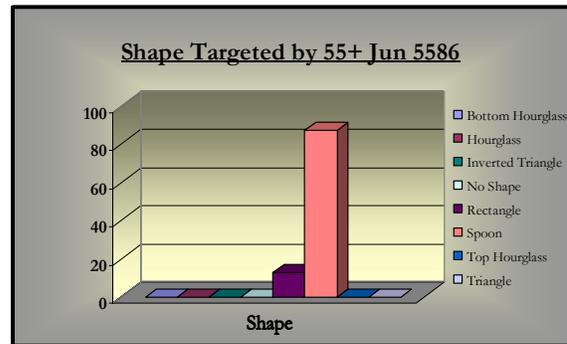


Chart 6

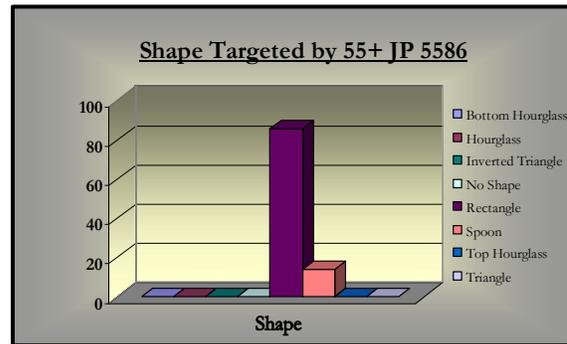


Chart 7

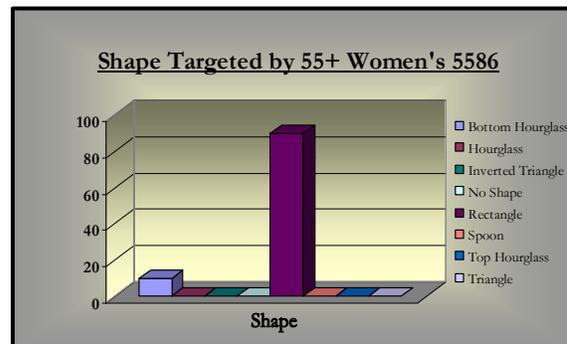


Chart 8

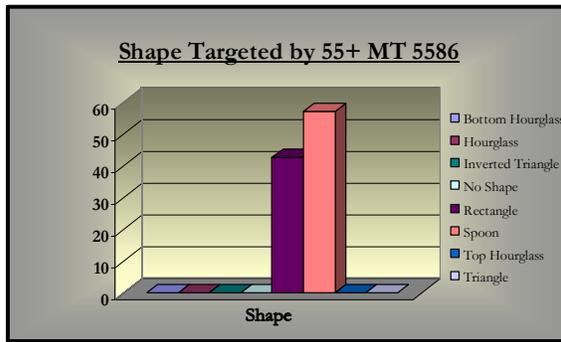


Chart 9

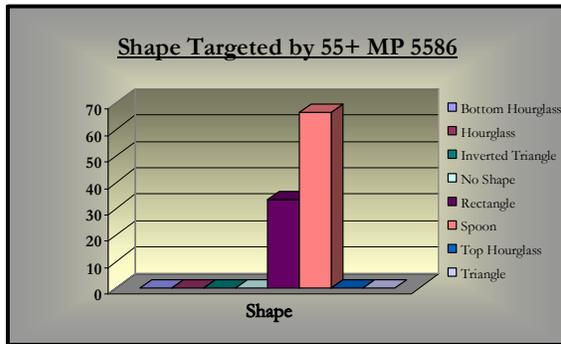


Chart 10

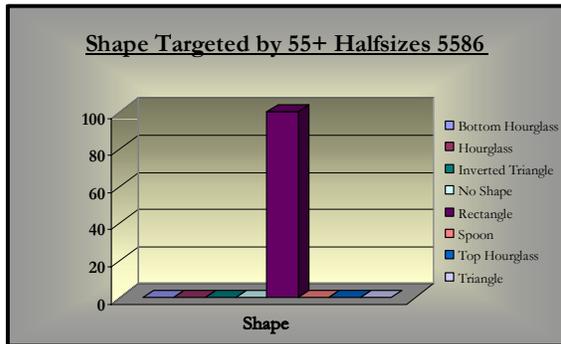


Chart 11

The most obvious point about these graphs is that six of the seven substandards best fit two shapes. For instance, the Missy (Chart 5), Junior (Chart 6), Missy Tall (Chart 9) and Missy Petite (Chart 10) substandards all predominately fit people with spoon body shapes, but some of the sizes within the standard better fit the rectangular body shape. The ideal sizing standard would fit the same body shape across all sizes for consistency.

To add to the inconsistencies in the Over 55 ASTM standard, the Women's substandard (Chart 8) predominately accommodates the rectangle body shape, but a few sizes within

the substandard fit the bottom hourglass shape. Furthermore, the Junior Plus substandard (Chart 7) targets the rectangular body shape predominately, while several of the sizes better accommodate the spoon body shape. Because of these variabilities within the substandards, the Over 55 ASTM standard should be revised to provide more consistency.

The problems already discussed do not consider whether any of the substandards actually fit the body shapes that exist in the Over 55 population. To determine the effectiveness of ASTM 5586 at fitting the body shapes of its target consumer, the body shapes accommodated by the standards can be compared to the body shapes that exist in the Over 55 women in the SizeUSA sample. Chart 12 shows the distribution of the body shapes that exist in the Over 55 group of the SizeUSA sample.

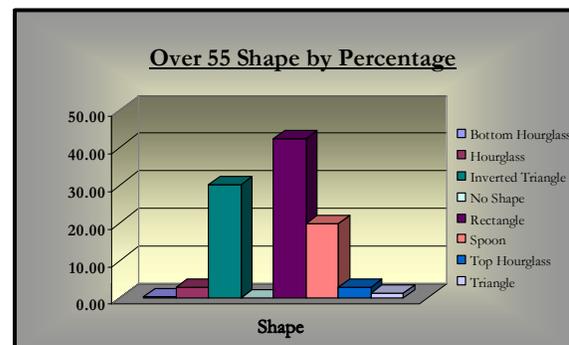


Chart 12

This chart shows a high concentration of people with rectangle, spoon, and inverted triangle body shapes. This result is different from the Missy and Junior samples, which had more of a distribution among the seven types of body shapes.

A comparison of Chart 12 with Charts 5-11 shows that the Over 55 standard does a better job than the Missy and Junior ASTM standards at meeting the body shapes of its target population, because it does primarily target the rectangle and spoon body shapes. However, none of the seven substandards under ASTM 5586 fit the inverted triangle body shape, which is the second most prominent body shape in the Over 55

SizeUSA sample, at 30 percent. Therefore, clothes produced using any of the Over 55 substandards would not fit about one-third of the population, a substantial percentage.

### Implications and Future Research

The results of this research show that the Junior, Missy, and Over 55 standards used by the apparel industry today are inadequate at meeting the needs of their target consumers. The Junior and Missy Standards are not based on the body shapes that dominate in those age groups in the U.S. Furthermore, very high variance exists within substandards of the Over 55 Standard, and even though the standard does seem to better meet the body shapes of the Over 55 group, it ignores certain body shapes that make up this group in the population.

Based on the results of this preliminary study of sizing standards and SizeUSA data, it seems as though the Over 55 standard does the best job at accommodating the body shapes of not only the Over 55 group, but also the Junior and Missy age groups. This is due to the fact that the Over 55 set of standards largely targets the rectangle and spoon body shapes, while the Junior and Missy standards 100% target the hourglass body shape. The rectangle and spoon shapes are much more represented than the hourglass shape in the three age groups considered in this study.

Unfortunately, an attempt to use the Over 55 standard on Junior and Missy age groups would not be effective and only appears to be a fitting solution due to the methodology of this research. In this study, the FFIT for Apparel software classified measurements into body shape categories based on circumferential measurements of the body. These circumferential measurements do not consider the sloping shoulders and flatter posteriors that women over 55 years old experience. Thus, by using this software, it seems as though the Over 55 standard would work the best for Junior, Missy, and Over 55 age groups, when in actuality this standard is

based on body changes that are not apparent in the Junior and Missy age groups.

In light of the problems and inconsistencies found in this research, the poor fit experienced in dressing rooms across the nation today is really no surprise. The inefficiencies in today's standards may be better addressed by understanding and using data from SizeUSA, the most comprehensive and representative sizing study completed on the U.S. population to date. In addition, the use of FFIT for Apparel software to analyze SizeUSA data provides many opportunities for future research. Because of the wide variety of demographic data collected by SizeUSA, areas of future research include (but are not limited to) studies into the body shapes that predominate in specific ethnic groups and other consumer groups. This will allow for a greater understanding of the body shapes of target consumers. Revisions of the ASTM sizing standards based on this SizeUSA data would improve the fit of clothes, improve customer satisfaction, and enhance the business performance of apparel retailers.

### References

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M
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