STASTICAL METHODOLOGY FOR DEVELOPING TIME STANDARDS

Formulas for Computing Standard Hours (time standards)
There are three generally accepted methods for determining a time standard for a procedure or activity: "average time," "median time," or "actual time."

Average Time (Mean)
This method assumes that a procedure has a single, easily computed value that best represents a group of different times. Therefore, in your facility, a standard hour can be computed using the average of the actual times taken to perform this procedure.

The average time formula can be described in a three-step format:

Step 1: Identify the number of times a procedure is performed in a specific time period.

Step 2: Add all of the actual times recorded for performing the procedure.

Step 3: Find the average time by dividing the sum of the times spent on performing the activity (Step 2) by the number of times the activity was performed (Step 1).

Step 1: To arrive at the average time, you will need to collect a large enough sample of the actual times taken to perform the procedure. The ideal size of this sample depends on the variability of the actual times (noted as the "variance" in statistical terminology). However, it is reasonable to use an unbiased sample size that reflects at least 10% of the total number of times the procedure is performed annually, as long as the size of the sample is at least 20 but preferably 30 or more data points.

Assume, for example, that you wish to compute a standard time for your institution for the procedure "New Procedure." Over a period of time, you have each staff member who performs this procedure record how many times they perform the procedure and the actual amount of time spent performing it on each occasion. Supposing this procedure is performed 37 times in that period, you would record the actual time (as standard hours) required to perform each procedure.

Step 2: The 37 data points collected for all of the "New Procedure" procedures performed during the three-month period are listed in Table 1. By totaling the actual times, you arrive at a sum of 28.22 hours.

Step 3: Calculate the average time by dividing this total time by 37, the number of times the procedure was performed. As shown in Table 1, the average for the procedure "New Procedure" in your institution for this three-month period is 0.76 hours.

TABLE 1 New Procedure (Actual Times)	
#	Actual Time in Hours
1	0.88
2	0.87
3	0.77
4	0.79
5	0.61
6	0.70
7	0.74
8	0.73
9	0.84
10	0.81
11	0.88
12	0.76
13	0.75
14	0.75
15	0.71
16	0.68
17	0.69
18	0.78
19	0.74
20	0.81
21	0.78
22	0.76
23	0.72
24	0.77
25	0.83
26	0.80
27	0.79
28	0.84
29	0.76
30	0.73
31	0.65
32	0.71
33	0.69
34	0.75
35	0.78
36	0.78
37	0.79
Sum	28.22
Average	28.22 ÷ 37 = 0.76

Before finalizing this 0.76 hour figure as your standard hour, it is recommended that you make a histogram of your actual times from your sample. A histogram is a column chart that notes the frequency of occurrence of a particular actual time within a set time boundary. For example, from the data in Table 1 it is clear that the actual times range from 0.61 to 0.88 hours. By setting up time boundaries with increments of 0.04 (0.61 to 0.65, 0.65 to 0.69, etc.), you can then count the frequency that an actual time falls into one of our boundaries. Table 2 notes the regrouping of all of the actual times from Table 1, according to the frequency in each boundary

TABLE 2 Regrouping of Actual Times (According to Frequency)	
Boundaries	Frequency
.61-.65	1
.65-.69	2
.69-.73	6
.73-.77	10
.77-.81	10
.81-.85	6
.85-.89	2
.89-.93	0
Sum	37

From Table 2 you can plot the histogram shown in Figure 1 below. This figure demonstrates that the frequency of your actual times is evenly distributed around the 0.76 hours computed in Table 1. Therefore, you can conclude that 0.76 is a reasonable estimate for the time standard for "New Procedure" in your facility. The further value of a histogram is seen when it does not indicate an even distribution of actual times. Assume that the first actual time recorded by your staff was 1.88, which would make the first data point 1.88 instead of 0.88 in Table 1. If you recalculate the average time, you would now have 0.79 hours, instead of 0.76 hours. Replotting the histogram, as shown in Figure 2, clearly indicates that this 1.88 hour data point is what is called an "outlier," a data point that is significantly different from the other 36 points in Table 1.

Figure 1: Frequency of Actual Times
Average = 0.76 Hours (See Table 1)

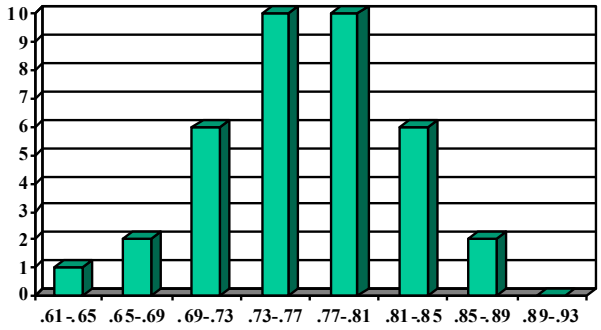
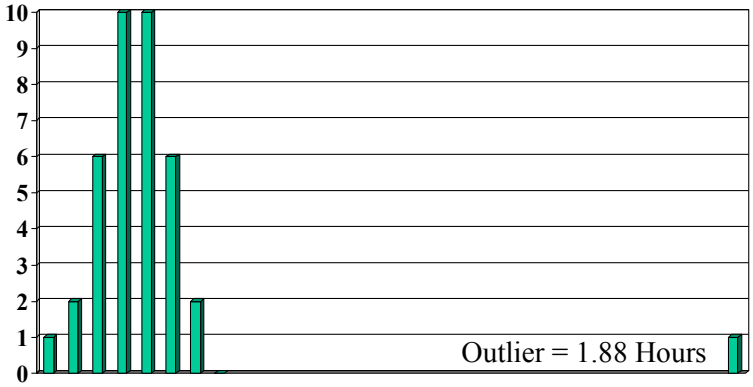


Figure 2: Demonstration of Outlier Actual Time
New Average Including Outlier = 0.79 Hours



Boundaries of Actual Times (Hours)

See Figure 1 for Boundary Widths

The histogram is an excellent way of identifying any outliers in the data — data points that perhaps should be excluded from the computation of your average time. To determine whether this 1.88 hours is an outlier that can be excluded, you must first decide whether you believe that an actual time of 1.88 hours for "New Procedure" is a time that is highly unlikely to recur or is due to a data recording error. If you decide to eliminate this data point as an outlier, you then recalculate the average without this data point by summing the remaining times and dividing this

sum by 36 (the new average becomes 0.76 without the outlier). However, if you believe that 1.88 hours of actual time is a realistic or potentially recurring time, you must include it in your average time calculation.

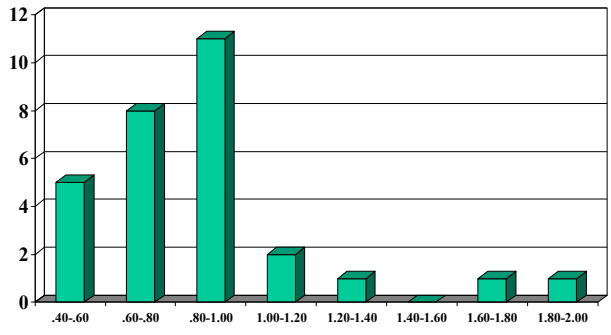
Median Time

The "average time" (mean) method is used to compute time standards when the distribution of data points on the histogram is fairly even around the average value computed. If, however, the histogram shows a large collection of data points to one side of the average computed, these actual times are considered skewed. Under these circumstances, a better single estimate of the standard hour is the median (or the actual time that lies in the exact center of a listing of all actual times from lowest to highest). Suppose that you want to compute a standard time for performing the procedure "Cardiopulmonary Resuscitation" (CPR). In this example, you collect all the actual times spent doing CPR over a six-month period. You record the 29 data points shown in Table 3, regroup the data according to frequency, and plot the histogram in Figure 3. As you can see by the histogram, there are many more data points clustered below the average figure of 0.89 hours computed in Table 3. To find the median, you regroup the data in Table 3 from the lowest to the highest actual time recorded, as shown in Table 4. The median is the actual time that is in position number 15 (the halfway point between 1 and 29). The median time of 0.80 hours is, therefore, a better estimate for the standard hour for your institution than the average time.

TABLE 3
Actual Times for Cardiopulmonary Resuscitation

#	Actual Time in Hours
1	0.99
2	0.89
3	0.75
4	0.55
5	0.66
6	0.80
7	1.15
8	1.19
9	0.50
10	0.70
11	0.90
12	0.95
13	0.80
14	0.66
15	0.75
16	0.41
17	1.35
18	0.88
19	1.75
20	2.00
21	0.89
22	0.90
23	0.75
24	0.58
25	0.50
26	0.78
27	0.79
28	0.98
29	0.95
Sum	25.75
Average	25.75 ÷ 29 = 0.89

Figure 3: Histogram of Cardiopulmonary Resuscitation
Frequency of Actual Times
Average = 0.89 Hours (See Table 3)



Boundaries of Actual Times (Hours)

TABLE 4 Resorted Actual Times for CPR Lowest to Highest Rank	
#	Actual Time in Hours
1	0.41
2	0.50
3	0.50
4	0.55
5	0.58
6	0.66
7	0.66
8	0.70
9	0.75
10	0.75
11	0.75
12	0.78
13	0.79
14	0.80
Median 15	0.80
16	0.88
17	0.89
18	0.89
19	0.90
20	0.90
21	0.95
22	0.95
23	0.98
24	0.99
25	1.15
26	1.19
27	1.35
28	1.75
29	2.00

When reviewing the specific data points developed in your institution, you will need to decide which formula is appropriate in assigning time standards to each procedure.

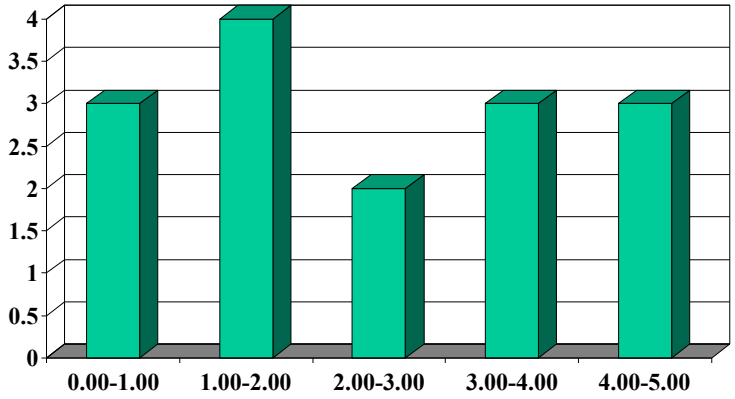
Actual Time

Finally, there are circumstances when neither the average time nor the median is a good estimate of a standard hour for your institution. This may occur when the procedure is so highly variable that the histogram shows no pattern of data clustering. Under these circumstances, it may be best to have your staff record the actual time spent performing the procedure rather than computing a standard hour.

For example, examine the data you might get if you record the actual times spent in transporting a subject via ambulance. During a 12-month period, only 15 transports occur, with the data points listed in Table 5. The histogram made from these data points is shown in Figure 4 and demonstrates no consistency in transport times. Since transporting subjects occurs infrequently (15 times/year in our example) and the time is so highly variable, you should record the actual amount of time spent on such transports, rather than computing a standard hour for the institution.

Table 5 Actual Times for Ambulance Transport	
#	Actual Time in Hours
1	1.50
2	3.87
3	0.50
4	0.67
5	3.90
6	4.50
7	3.70
8	4.75
9	1.90
10	0.85
11	1.75
12	4.25
13	2.50
14	1.85
15	2.66
Sum	39.15
Average	39.15 ÷ 15 = 2.61

Figure 4: Frequency of Actual Times
Average = 2.61 Hours (See Table 5)



Boundaries of Actual Times (Hours)