

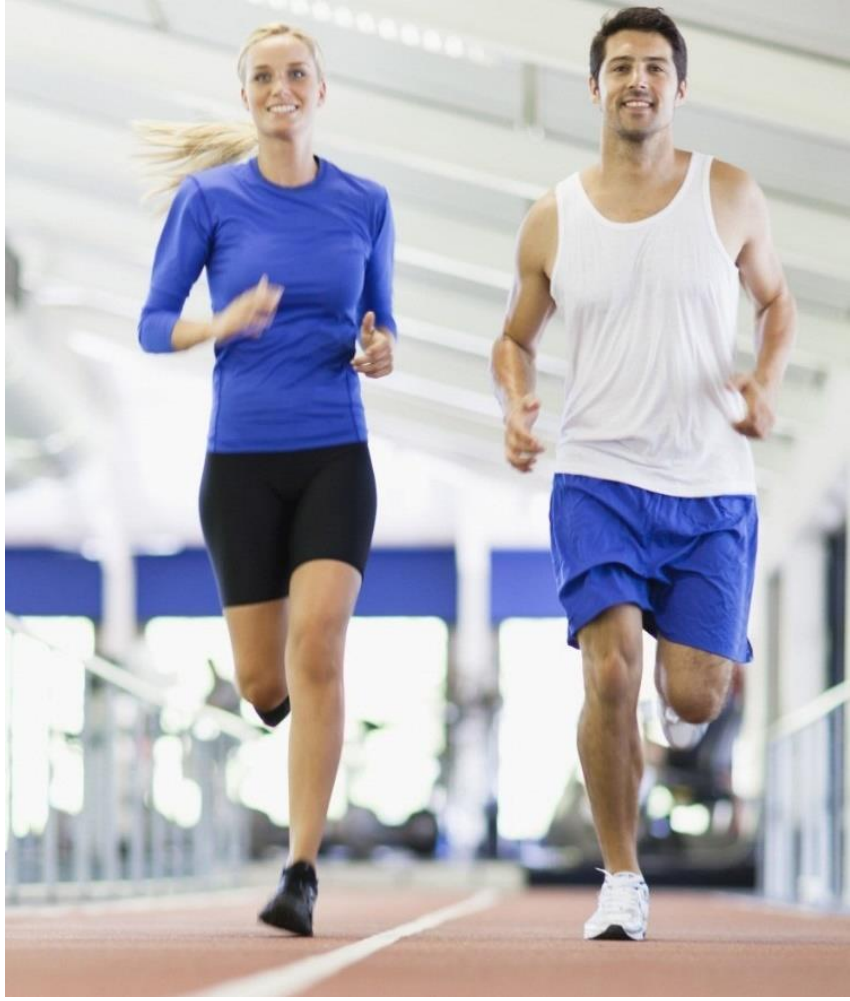

EFFECT OF FITNESS TESTS ON MEMBERSHIP SALES

A MUSCLEHUB A/B TEST

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A/B TEST DESCRIPTION

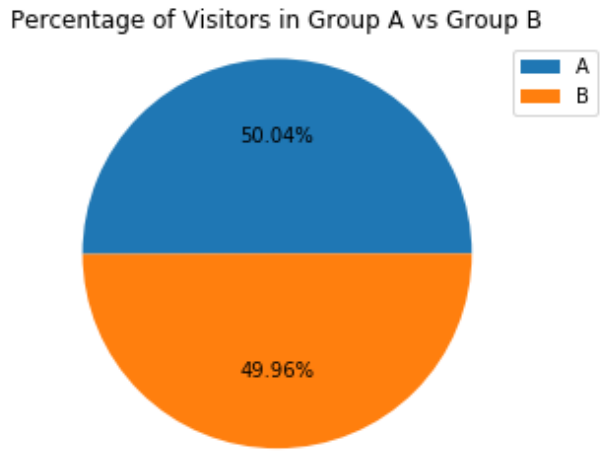
- Originally, MuscleHub Manager Janet hypothesized that the required fitness test has decreased our potential membership base.
- The A/B test was created to test Janet's hypothesis by looking into the effect of requiring new visitors to take a fitness test on the new visitor membership purchase rate. The data corresponding to the potential visitors was separated into two groups, Group A and Group B. Group A was the control group, each subject required to take a fitness test; while Group B was the experimental group, each subject having not taken a fitness test.
- Data was collected on MuscleHub members and potential customers and input into an SQL Database. This data was then analyzed using SQL and Python
- Based on the test, it was determined to most probably be the case that getting rid of the fitness test requirement for prospective members will attract more membership purchases. This can be explained by there being a statistically significant greater number of prospective members in Group B than Group A filling out applications; while the difference in percentage of applicants in the two respective groups who purchased memberships was statistically insignificant.

A/B TEST DATASET

- The MuscleHub sign-up process funnel follows the following steps :
  - 1) Visit, 2) Take(or don't take) fitness test, 3) Complete application, 4)Purchase Membership
- The data collected on potential customers of MuscleHub was recorded into four SQL Database tables, each corresponding to a funnel step:
  - 'visits' consists of data corresponding to each visiting potential customer
  - 'fitness_tests' contains data for each potential customer in Group A (those who took a fitness test)
  - 'applications' contains data for each potential customer who completed an application
  - 'purchases' contains data for all customers who made a MuscleHub fitness membership purchase
- Each table of data had a recorded first name, last name, email, gender, and associated date
- The data from the four SQL tables was then combined into a comprehensive Python Pandas DataFrame named 'df'. They were combined using a series of SQL Left Joins in the funnel process step order. Also an SQL WHERE statement that excluded all data entries corresponding to a visit date prior to July 1,2017 was applied in order to exclude data collected prior to the separation of visitors into groups A and B.

A/B TEST SAMPLE SIZE GROUPS A AND B

- From the comprehensive DataFrame ‘df’ the numbers of visitors belonging to each group type (A or B) were computed. The results confirmed that the sample sizes of each group were nearly the same, as shown in the following pie chart:



- Nearly equal sample size numbers, approximately equal to the sample size computed in a sample size determination study, are essential to minimizing error in the Hypothesis Tests undertaken within the A/B Test.

PREPARATION FOR HYPOTHESIS TEST 1: GROUP TYPE VS. VISITOR APPLICATION TURN-IN RATE

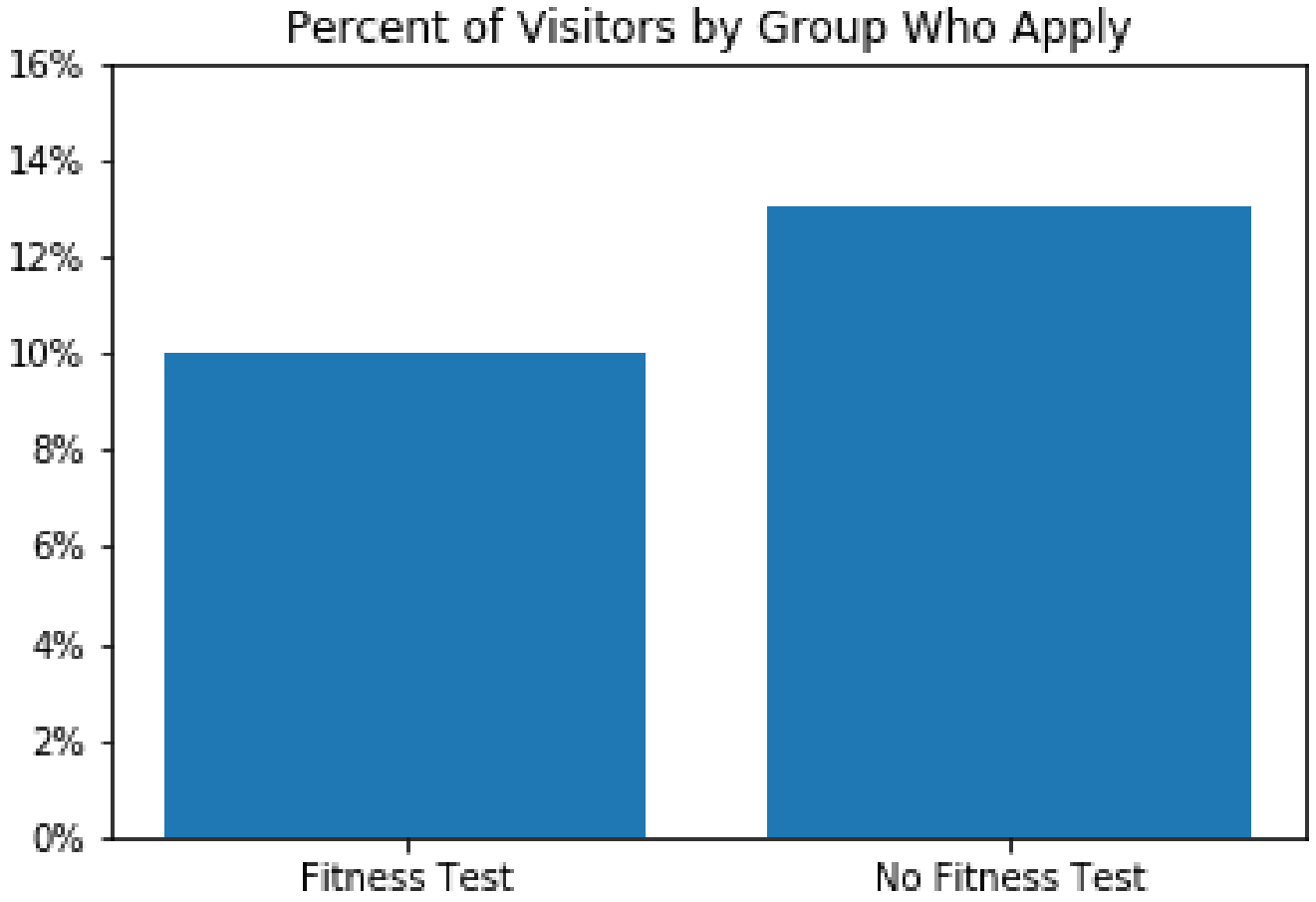
- Comprehensive DataFrame ‘df’ was first modified by having added two additional columns, one attributing a group type value (A or B) depending on the existence of a fitness test date, another attributing an application status based on the existence of an application date.
- First ‘df’ is grouped into a DataFrame where the rightmost column contains the total count for number of prospective members associated with each distinct pair (of left column values): consisting of a group type (A vs. B) and application completion status (Application vs. No Application). Then this DataFrame was converted into a pivot table where the vertical dimension labels contain group type values (A and B) and the horizontal dimension labels contain both application status values. The four values of the table each contain the number of prospective members that match the vertical label to its left and the horizontal label to its right (such as the intersection of ‘Application’ and ‘A’). Then two additional columns were added to the table: ‘Total’ and ‘Percent with Application’. The ‘Total’ column equals the sum of ‘Application’ and ‘No Application’ columns. Each ‘Percent with Application’ column value equals its corresponding ‘Application’ column value divided by its corresponding ‘Total’ column value.
- The original four values (each equal to the number of visitors who fit a specific group type/application status combination) of the newly created pivot table constitutes the categorical data to be used for the hypothesis test.

HYPOTHESIS TEST 1: GROUP TYPE VS. VISITOR APPLICATION TURN-IN RATE

Group	Application	No Application	Total	Percent with Application
A	250	2254	2504	9.984%
B	325	2175	2500	13.000%

- The above table shows the pivot table resulting from the process described in the previous slide.
- We want to run a hypothesis test that tests two competing hypotheses as shown as below:
  - Null hypothesis: Out of the pool of all potential members, 'Group Type' is independent of 'Percent with Application'. This would imply that the population 'Percent with Application' is the same in both groups
  - Alternative hypothesis: Out of the pool of all potential members, 'Group Type' is dependent on 'Percent with Application'. This would imply that the population 'Percent with Application' differs between groups
- 'Percent with Application' refers to the percent of visitors within a given group who completed an application
- Given that 1) the data provided (dotted in above table) is categorical data that represents the relation between mutually exclusive condition type (A vs. B) and outcome ('Application' vs. 'No Application') and 2) we want to compare the provided data by Group Type, it is best to use the Chi Square Test to decide the outcome of the hypothesis test.
- The resulting p-level=0.000964782760072, which is less than the chosen significance level of .05.
- Since the p-level is less than the significance level, the result is statistically significant. Thus the null hypothesis is rejected in favor of the alternative hypothesis. Thus, the greater Group B visitor application turn-in rate is statistically significant.

HYPOTHESIS TEST 1: GROUP TYPE VS. VISITOR APPLICATION TURN-IN RATE BAR GRAPH



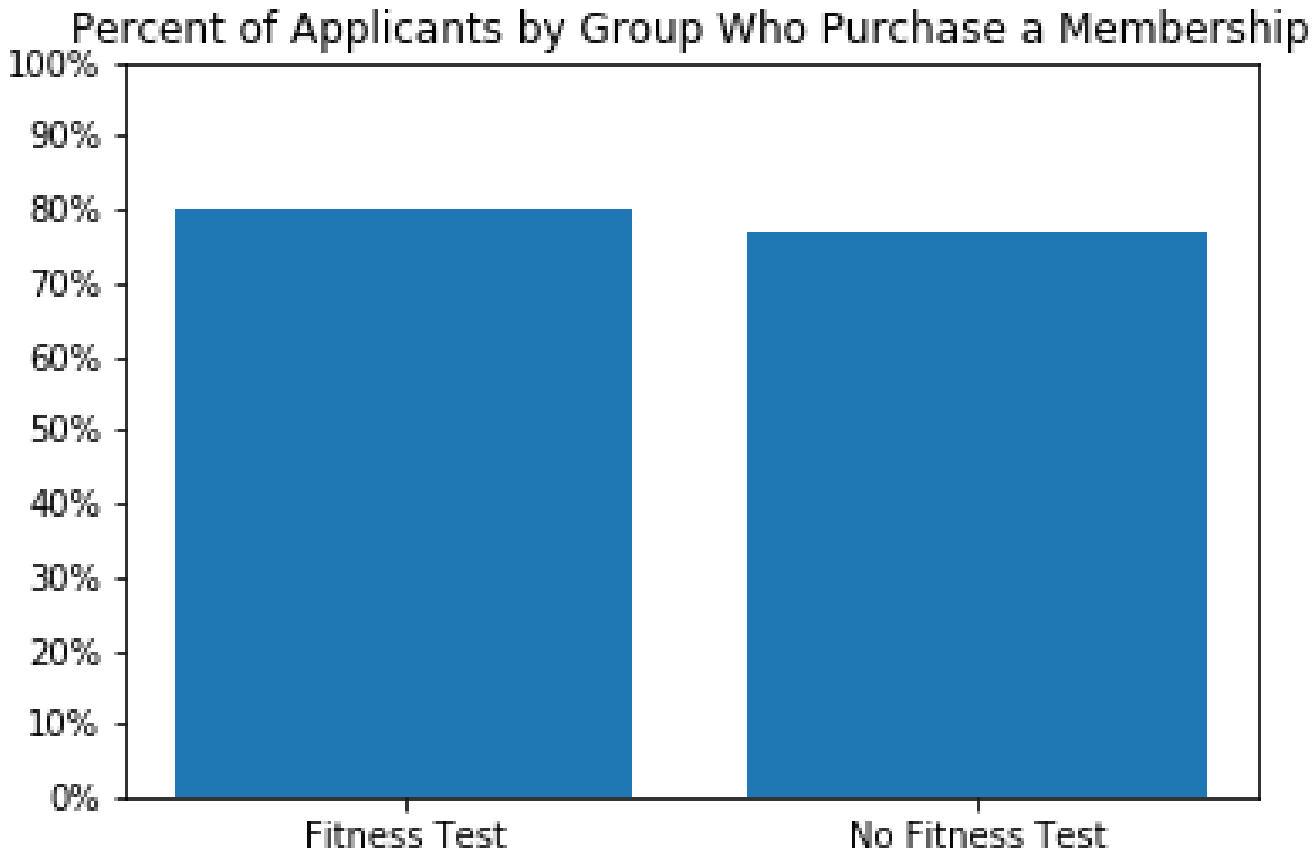
This Bar Graph displays the data from the 'Percent with Application' column from the pivot table in the previous slide. This bar graph visually shows the noticeable difference between the visitor application turn-in rates of the two respective groups.

HYPOTHESIS TEST 2: GROUP TYPE VS. APPLICANT MEMBERSHIP PURCHASE RATE

Group	Member	Not Member	Total	Percent Purchase
A	200	50	250	80.0000%
B	250	75	325	76.9231%

- The above table is the pivot table resulting from a process similar to that described in slide 6. One main difference is that a step is added after the initial step: the data was filtered to only include entries associated with the completion of the application. The second difference is that the data is grouped and labeled by membership purchase status instead of application status.
- We want to run a hypothesis test that tests two competing hypotheses as shown as below:
  - Null hypothesis: Out of the pool of all applicants, 'Group Type' is independent of 'Percent Purchase'. This would imply that the population 'Percent Purchase' is the same in both groups when considering only applicants.
  - Alternative hypothesis: Out of the pool of all applicants, 'Group Type' is dependent on 'Percent Purchase'. This would imply that the population 'Percent Purchase' differs between groups when considering only applicants.
- 'Percent Purchase' refers to the percent of applicants within a given group who purchased a membership
- Given that 1) the data provided (dotted in above table) is categorical data that represents the relation between mutually exclusive condition type (A vs B) and outcome ('Member' vs 'Not Member') and 2) we want to compare the provided data by Group Type; it is best to use the Chi Square Test to decide the outcome of the hypothesis test.
- The resulting p-level=0.432586460511, which is greater than the chosen significance level of .05.
- Thus the result is not statistically significant and the null hypothesis is not rejected. Thus the smaller Group B applicant membership purchase rate is not statistically significant.

HYPOTHESIS TEST 2: GROUP TYPE VS. APPLICANT MEMBERSHIP PURCHASE RATE BAR GRAPH



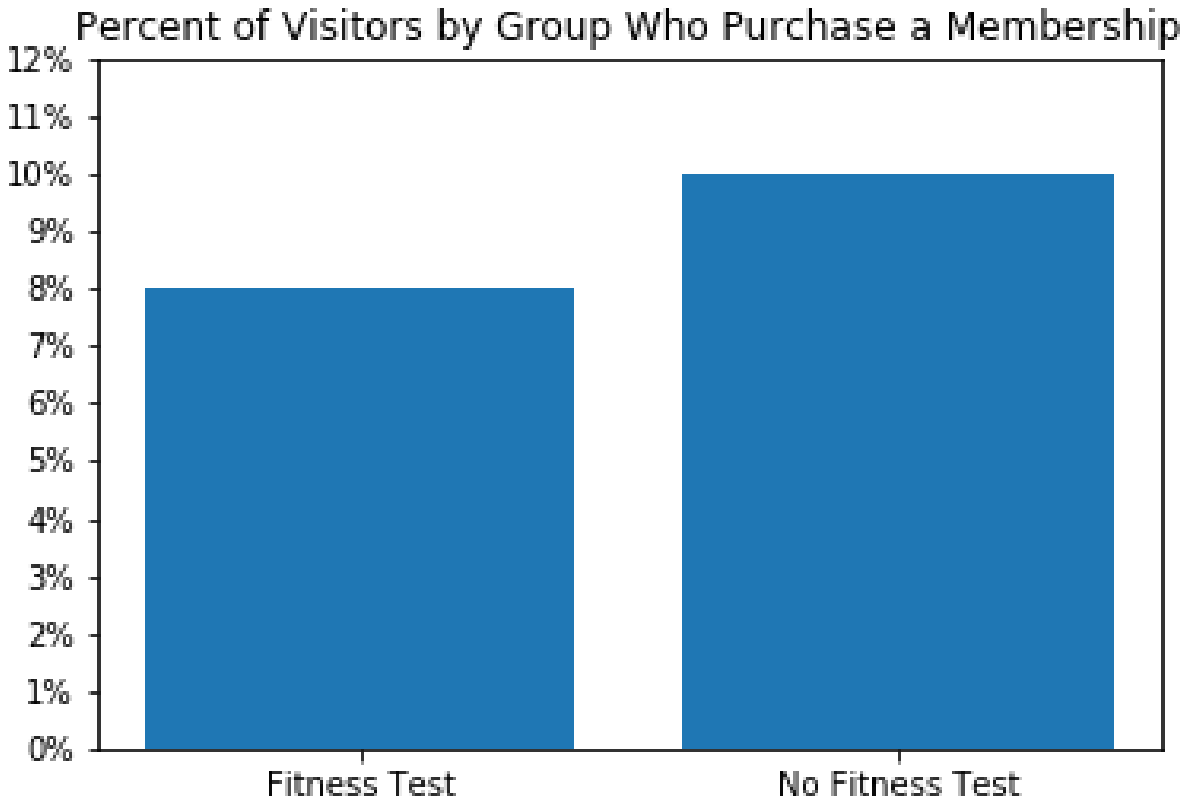
This Bar Graph displays the data from the 'Percent Purchase' column from the pivot table in the previous slide. This bar graph visually shows the almost undiscernible difference between the applicant membership purchase rates of the two respective groups.

HYPOTHESIS TEST 3: GROUP TYPE VS. VISITOR MEMBERSHIP PURCHASE RATE

Group	Member	Not Member	Total	Percent Purchase
A	200	2304	2504	7.9872%
B	250	2250	2500	10.0000%

- The above table shows the pivot table resulting from the process similar to that described in slide 6. . The difference in the process is that the data is grouped and labeled by membership purchase status instead of application status.
- We want to run a hypothesis test that tests two competing hypotheses as shown as below:
  - Null hypothesis: Out of the pool of all potential members, 'Group Type' is independent of 'Percent Purchase'. This would imply that the population 'Percent Purchase' is the same in both groups
  - Alternative hypothesis: Out of the pool of all potential members, 'Group Type' is dependent on 'Percent Purchase'. This would imply that the population 'Percent Purchase' differs between groups
- 'Percent Purchase' refers to the percentage of visitors within a given group who purchase a membership
- Given that 1) the data provided (dotted in above table) is categorical data that represents the relation between mutually exclusive condition type (A vs B) and outcome ('Member' vs 'Not Member') and 2) we want to compare the provided data by Group Type, it is best to use the Chi Square Test to decide the outcome of the hypothesis test.
- The resulting p-level=0.0147241146458 , which is less than the chosen significance level of .05.
- Thus, the result is statistically significant and the null hypothesis is rejected in favor of the alternative hypothesis. Thus the greater Group B visitor membership purchase rate is statistically significant.

HYPOTHESIS TEST 3: GROUP TYPE VS. VISITOR MEMBERSHIP PURCHASE RATE BAR GRAPH



This Bar Graph displays the data from the 'Percent Purchase' column of the pivot table in the previous slide. This bar graph visually shows the notable difference between the visitor membership purchase rates within each of the two groups.

A/B TEST HYPOTHESIS TEST SUMMARY

- The collected data from the four respective SQL tables were merged, grouped and further manipulated into compact Python pivot tables containing aggregate statistics that could be used for hypothesis testing. The following three tests were carried out:
    - Effect of required fitness test on visitor application turn-in rate
    - Effect of required fitness test on membership purchase by applicants
    - Effect of required fitness test on membership purchase by visitors
- The results of the hypothesis tests are as shown below:
    - Group B (the non-fitness-tested group) was determined to have a significantly greater rate of application completion than Group A (the fitness-tested group) within the pool of all potential members
    - Group B was determined to have a smaller but insignificantly different rate of membership purchase than Group A within the pool of potential members who completed the application
    - Group B was determined to have a significantly greater rate of member purchase than Group A within the pool of all potential members

QUALITATIVE DATA SUMMARY

- Four reviews of the MuscleHub Sign-Up process were left by prospective members.
  - The first reviewer, Cora (Group A), found the fitness test helpful and after becoming a member was motivated to return and try hard by having a personal trainer.
  - The second reviewer, Jesse (Group B), was appreciative of not being required to take a fitness test, and found the fitness test at a competing gym to be too challenging. However Jesse ended up not becoming a member due to sweat stains being present on the weight machines.
  - The third reviewer, Sonny (Group A), was turned off by the fitness test and probably ended up not becoming a member.
  - The fourth reviewer, Shirley (Group B), became a member because the sign up process was quick and required no fitness test, unlike one of our competitors.
- The results of these reviews seem to indicate there being no real difference between Group A and Group B in terms of membership purchase rate, since half of those in each group became members and half didn't. It seems that Group B members were more likely to fill out an application since the Group A member who didn't purchase membership didn't bother to complete an application, while the Group B member who didn't purchase membership might have completed an application since the second reviewer went far enough to observe the weight machinery.
- In conclusion, the qualitative data from the reviews although insufficient for determining a precise conclusion for this study, seems to at least partially agree with the more precisely determined quantitative study results shown in the previous slides. It is also worth mentioning the possibility of looking into the situation concerning weight machinery sweat stains, and if it is a widespread problem, and whether or not it significantly affects the membership purchase rate.

RECOMMENDATION FOR MUSCLEHUB

- Based on the results of the A/B Test analysis as shown in the previous few slides, it is strongly recommended that MuscleHub dispense with the fitness test requirement that is currently enforced on prospective members.

- Also, as noted in the previous slide, it might be worth conducting a survey to help flesh out other deciding factors (such as stains on machinery) affecting the decision of prospective members to purchase membership.