INTRODUCTION
Carpal tunnel syndrome (CTS) is the most prevalent condition of the upper extremity in the United States; it affects 1.5% of the adult American population. CTS develops due to repeated movements of the hand and wrist, especially those associated with using electronics such as cellular phones and computers. Over time, these movements cause the tendons within the carpal tunnel in the wrist to thicken, which puts pressure on the median nerve, which also runs through the carpal tunnel. Symptoms of CTS include numbness and tingling in the hand, decreased strength, and in severe cases, nerve damage.

Two common options for treatment of CTS exist currently. The first, conservative treatment, involves monitoring everyday tasks and limiting those that trigger CTS symptoms, wearing a wrist splint while conducting such movements and while sleeping, and fighting inflammation via drugs and injections.

The other, more aggressive method of CTS treatment is Carpal Tunnel Release (CTR) surgery. This procedure involves severing the transverse carpal ligament, which forms the roof of the carpal tunnel. In return, this relieves the pressure within the carpal tunnel and allows the median nerve to function properly. CTR is a standard, safe procedure, although it is unable to repair nerve damage and therefore can be more useful to patients suffering from less severe cases of CTR.

While contemplating CTR, many patients desire an estimation of post-surgical recovery time. Once understanding the post-surgery lifestyle and inhibition of normal activities, patients can make a more informed decision as to whether they should receive CTR. Many patients wonder if the recovery time associated with CTR outweighs the benefits of correcting their CTS.

The severity of patients’ CTS is mainly evaluated by nerve conduction studies (NCS). These studies measure the transmission of electric impulses throughout the upper extremity nervous system and are generally considered the ‘gold standard’ for CTS diagnoses. NCS places patients into one of three categories: Normal/Mild CTS, Moderate CTS, or Severe CTS. Due to the discrete results of NCS, it could be beneficial to establish whether these results of patients’ NCS severity could be utilized to predict their recovery time after a CTR procedure.

Another method for quantifying the performance of a patient’s median nerve is a 2-point discrimination test. This sensory exam involves probing the pad of a patient’s fingertip and asking them to discern whether they feel one probe or two. Because the set of probes on a 2-point discrimination instrument range between 0 and 8 mm apart, conducting a 2-point discrimination test allows the function of a patient’s median nerve to be distinguished down to the order of magnitude of the millimeter.

By utilizing 2-point discrimination test and NCS results, patient profiles can be constructed that split CTR patients into a number of groups. Establishing these baseline measurements of CTS severity and tracking the resolution of these patients’ CTS symptoms over time can provide a representative picture that accurately describes the CTR recovery process. Future patients would find this information useful when contemplating whether or not to choose CTR as their treatment method.

OBJECTIVE
The purpose of this study is to compare patients with mild, moderate, and severe NCS results before and after their CTS procedures. Their recovery is evaluated categorically and longitudinally in order to evaluate whether or not their symptoms persist. For each patient, one 10-minute presurgical examination was completed, followed by up to twelve 10-minute postsurgical phone calls. All CTR patients at the Hand & UpperEx Center in Wexford, PA over a three-month period were included in the study.

HYPOTHESIS/SUCCESS CRITERIA
This study will be deemed successful if it can be determined whether or not the ranking of a patient’s NCS study can accurately predict their post-CTR recovery time. The UPMC Department of Orthopaedic Surgery’s statistical team will calculate 95% confidence intervals for each group of
patients’ recovery times. If these confidence intervals do not overlap, then they can accurately be used to predict patients’ recovery time based on NCS severity. It was expected that patients with more severe NCS rankings would take longer to recover than those patients with less severe NCS results.

METHOD
Before communicating with any patients, IBR approval was granted and a script was developed for evaluating the subjects in an unbiased manner. Therefore, any results predicted by this study could be attributed solely to patients’ CTR recovery experiences and not to any bias of the study itself. In addition, data was compiled for all participants including their age, sex, dominance, surgery side, diabetic history, and NCS results, among other aspects of their medical history. This data and all study results were stored in a single Excel spreadsheet.

Each patient’s pre-operative examination was conducted in the pre-operative wing of the Western Pennsylvania Surgery Center within one hour of the procedure itself. Each examination consisted of confirming the patient’s medical history, conducting a 2-point discrimination test, and discussing the prevalence of the patient’s CTS symptoms. If the patient frequently experienced daytime symptoms (numbness/tingling) and/or nighttime symptoms (nocturnal awakening), they were included in the study and would be asked to participate in a number of follow-up phone calls.

Follow-up phone calls were conducted at discrete postsurgical time points: 1-3 days after surgery, biweekly for the next 3 months, and then every 3 months until the 1-year mark. Each phone call consisted of measuring the patient’s recovery based on the prevalence of these same daytime and nighttime symptoms. Once patients observed that their daytime and nighttime symptoms had resolved, they were deemed “recovered” and their phone calls were discontinued.

Originally, 90 patients were included in pre-operative examinations. Patients who either had not acquired NCS studies or failed to return follow-up calls were omitted from the statistical analysis, resulting in inclusion of 61 subjects.

RESULTS

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<th>Table 1: Daytime Symptom Resolution Times</th>
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<td>NCS Result</td>
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<th>Table 2: Nighttime Symptom Resolution Times</th>
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Resolution time for patients’ daytime and nighttime symptoms can be found in Tables 1 and 2. These two tables consider the resolution times for all 61 patients through the 6-month mark. As of April 2014, the study is in its tenth month; therefore all data collection will be completed by June 2014.

DISCUSSION
As can be seen in Table 1, there is a significant difference between the resolution times of daytime symptoms between severely ranked CTR patients and patients of other rankings. Because this distinction can be made, the design criteria will be considered met.

However, there is no significant difference between mild and moderate daytime symptom resolution times or between any of the three categories of nighttime symptom resolution times. Due to this lack of significance, the future of this study could implement additional criteria in order to distinguish between recovery experiences for these various groups. Once data collection has been completed, symptom resolution times will also be evaluated with respect to diabetic history, age, and results of 2-point discrimination tests.

Limitations of the study involved the lack of face-to-face contact with subjects. Because patients only enter the physician’s office twice postsurgically, the greater part of data collection must occur via telephone calls. In future studies, it would be beneficial to set up additional checkpoints in person, in order to re-evaluate patients via 2-point discrimination tests. The results of these tests with regards to improvement after surgery could then be included in subsequent statistical analysis. In addition, it would be beneficial to evaluate fingers separately with regards to numbness. Over the course of their recovery, many patients noted improvement in all fingers except for one or two. However, by the standards of the study, these patients’ symptoms were simply deemed ‘unresolved’.

With the implementation of these additional components, a more detailed picture of CTR recovery could be provided to all individuals affected by CTS and contemplating surgery.

ACKNOWLEDGMENTS
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REFERENCES