C ase studies are a critical link between the best available research evidence and clinical practice. As we have described in previous editorials, case studies are under-appreciated and their value diminished in the light of large-scale clinical trials and systematic reviews. As we have previously highlighted, a major factor for this lack of appreciation is that it remains unclear what evidence a case study can provide. Is all case study evidence equal? We proposed a new model in which we can break down the purpose of case studies into two main classifications: validation and exploration.

Validation case studies are used to describe clinical decision outcomes which were guided by the best available research evidence. These are considered evidence-based practice reports. By contrast, exploration case studies are descriptions of clinical decision outcomes that were based predominantly on clinical expertise and the professional body of knowledge. These clinical decisions rely more heavily on internal evidence and, therefore, are considered practice-based evidence reports. Both evidence-based practice reports and practice-based evidence reports can contribute to a profession’s body of knowledge in meaningful ways.

By testing the best available research evidence with a validation case study, we can determine which elements should be incorporated into professional education, and truly close the circle of evidence-based practice. In turn, practice-based evidence reports highlight the value of internal evidence derived from professional training and clinical experience. The published practice-based evidence reports become a source of external evidence for other practicing clinicians and researchers, and can guide clinical research by revealing where there are gaps in our knowledge base. Thus a symbiotic relationship between validation and exploration case studies is created.

The purpose of this editorial is to provide a logical blueprint to describe the value of these reports in shaping our professional body of knowledge. In this editorial, we present a model for defining four levels of evidence for case studies in the context of evidence-based practice (validation) and practice-based evidence (exploration). We provide a description of the hallmarks of each level and the value as it relates to using external and internal evidence for making clinical decisions.

In the following section, we present these levels of evidence from lowest (level 4) to highest (level 1) to help readers develop an appreciation for the logical progression from practice-based evidence to evidence-based practice. The rare events (level 4) and exploration case studies (level 3) have been previously described in an editorial. Synopses of these, in conjunction with higher levels of case study evidence, are presented below. Please see the Table for details pertaining to the levels of case study evidence and the logical flow from one level to the next.

**Level 4: Rare Events (The Zebras)**

Rare events are reports of cases that are both highly infrequent in the physically active population and also life- or limb-threatening. While these cases do not have particularly atypical features, they are not generally part of athletic training education. These reports serve to raise awareness of particular problems or conditions...
### Table. The Levels of Evidence for Case Studies

<table>
<thead>
<tr>
<th>Level of Evidence</th>
<th>Description</th>
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<tbody>
<tr>
<td><strong>Level 1:</strong></td>
<td>Provides confirmation of the application of sound external evidence that can be used in clinical decisions within the population of interest.</td>
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<tr>
<td><strong>Level 2:</strong></td>
<td>Provides compelling evidence for the systematic investigation of factors related to the clinical presentation and/or resolution.</td>
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<tr>
<td><strong>Level 3:</strong></td>
<td>Provides a framework for advancing the current perspectives of the key features associated with the condition of interest and warrants (at least) investigation at the next level of evidence (case series).</td>
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<tr>
<td><strong>Level 4:</strong></td>
<td>Cases that provide evidence for ATs interacting with other health care professionals in making decisions associated with a condition that is not prevalent in physically active populations.</td>
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#### Case Manuscript Type

<table>
<thead>
<tr>
<th>Format</th>
<th>Validation Cases</th>
<th>Exploration Case Series</th>
<th>Exploration Cases</th>
<th>Rare Cases</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Present a case that confirms (or refutes) a previously published result. A strong emphasis on comparing/contrasting methods, results, and interpretations from current case with previous study would be expected.</td>
<td>Present a series of unique AND similar cases. A strong emphasis on not only unique diagnoses, but also unique prognoses, treatments, observations, and more would be expected.</td>
<td>Present unique cases. Unique cases are those which have atypical presentation of features. A strong emphasis on not only unique diagnoses, but also unique prognoses, therapies, observations, and more is expected.</td>
<td>Present an important condition that is uncommon (but relevant to AT) that has been documented in other literature. Typical presentation of prognoses, diagnoses, therapeutic strategies, and more is a hallmark of these cases.</td>
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#### Purpose

<table>
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</tr>
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<tr>
<td>The purpose of the validation case is to test the results of previously published research. The expectation for the previous research is that it was performed at a high level: rigorous control, low expectations of bias (high expectation of internal validity), clearly defined population of interest (high expectation of external validity), and more. Testing the results of a well-conducted systematic review or meta-analysis would be acceptable. To compare to CEBM, level 1 (SR or MA) or 2 (individual RCTs) evidence would be expected of the previously published study. Previous research that address therapeutic, prognostic, diagnostic, and more would all be acceptable.</td>
<td>The purpose of the case series is to report a more definitive and rigorous presentation of the exploration single cases. Observational (risk factor, symptom prevalence), diagnostic, prognostic, therapeutic, and other cases should all be considered. Specific details on the characteristics that emphasize that cases truly are similar in both presentation of condition, treatment strategies, and observation criteria would all be necessarily described and confirmed in reporting, indicating that a certain level of generalization/external validity is available.</td>
<td>The purpose of the exploration case is to educate clinicians on alternate or irregular presentations of either common (highly prevalent) or uncommon conditions. Observational (risk factor, symptom prevalence), diagnostic, prognostic, therapeutic, and other cases should all be considered. Critical key features that led to clinical decision should be reported.</td>
<td>The purpose is to bring attention to conditions that are important to the AT, however, may not be as familiar to ATs. For instance, “no fault errors” are rare case reports originally based on cases that were unexpected and potentially had poor or grave results. These reports may be considered if critically beneficial information for ATs is presented. The documentation of how/when/in what capacity other health care professionals were involved and interacted WITH ATs for an inter-professional approach to making clinical decisions would be expected, if appropriate.</td>
</tr>
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Case Manuscript Type

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<td>Explanation</td>
<td>For example, a published RCT indicates that a particular active treatment is better than control. The active treatment is tested clinically “in real life”. The clinician reports (appropriately, of course) on the treatment’s effectiveness in that particular setting, on drawbacks associated with the real-world setting, and more. This validation completes the circle of clinical evidence.</td>
<td>For example, the novel taping/bracing technique developed by a clinician (which is presented in the adjacent cell, right) is performed for five track athletes with subluxing peroneal tendons. All are collegiate-level varsity track and field athletes. All athletes are sprinters or field athletes for long or triple jump, demonstrating extreme need for high speed and power. All five are able to continue to participate successfully.</td>
<td>For example, a novel taping/bracing technique developed by a clinician for a track athlete with a subluxing peroneal tendon that allowed the athlete to continue to participate successfully.</td>
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Abbreviations: AT = athletic trainer; SR = systematic review; MA = meta-analysis; RCT = randomized controlled trial; DVT = deep vein thrombosis.
with which athletic trainers may not be very familiar. These case reports represent the lowest level of evidence because the features of the case would already be well described in other medical literature. Please see the editorial in *IJA TT* 20(3) for a complete description of these reports.4

**Level 3: Exploration Cases (The Unicorns)**

Exploration case studies are reports in which truly unique cases are presented. The purpose of these case studies is to educate clinicians on atypical presentations of either common or uncommon conditions. These reports serve to highlight the gaps in our internal evidence derived from our profession’s body of knowledge and provide opportunities for furthering clinical research. Please see the editorial in *IJA TT* 20(3) for a complete description of these reports.4

**Level 2: Exploration Case Series**

Exploration case series report compelling practice-based evidence across multiple patients to offer new insights toward the future investigation of factors related to a particular clinical problem and its resolution. Case series, as with case studies described above, are not only limited to unique diagnoses, but can also include unique prognoses, treatment effects, and clinical observations.

The purpose of the case series is to report a more definitive and rigorous presentation of the exploration single cases. Observational (risk factor, symptom prevalence), diagnostic, prognostic, and therapeutic cases should all be considered. Specific details on the characteristics that emphasize that cases truly are similar in both presentation of condition, treatment strategies, and observation criteria should be described and confirmed in reporting, indicating that a certain level of generalization and external validity is available. Exploration case series are based on clinical decisions stemming from a clinician’s internal evidence across multiple patients; these now serve as a strong starting point for refining the external evidence available for other practicing clinicians and researchers.

**Case Series Example**

A clinician develops a novel taping or bracing technique to enhance the clinical outcomes for five track athletes with subluxing peroneal tendons. All of the patients are collegiate level varsity track and field athletes who are sprinters or field athletes. The technique is successful in that the athletes are able to compete without restriction. As with individual case studies,4 key features of the athletes’ specific cases, the taping technique that allowed the athletes to fully participate symptom-free, and discussion of the outcomes of this case series would be expected.

The intervention strategy within the case series should be described in a way that other clinicians can readily reproduce it. The patient-oriented and clinician-oriented outcomes used to determine success of the treatment would also be expected to be clearly reported. The essential elements of a well-designed case series include a clear description of (1) the patients in the series; (2) the interventions, assessments, or exposures evaluated; and (3) the outcomes used in tracking the effectiveness of clinical decisions. Lastly, a discussion comparing potentially unique responses each patient had compared to one another assists in highlighting similarities in presentation.

**Level 1: Validation Cases**

As described in a previous editorial,1 validation case studies provide confirmation of the application of sound external evidence that can be used in clinical decisions within the population of interest. Within these cases, authors present a case that confirms (or refutes) a previously published result derived from clinical research. This report describes how the techniques and outcomes of an external evidence source guided decisions made within the case, and therefore, strong emphasis on comparing and contrasting the similarities of the patient to the participants in the study, the interventions (intervention, exposure, assessment), the outcomes, and interpretations from the current case with the external evidence would be expected.

The purpose of the validation case is to test the results of published external evidence. The expectation for the published external evidence is that it was performed at a high level (e.g., rigorous control, low expectations of bias, clearly defined population of interest, and more). Testing the results of a well-conducted systematic review or meta-analysis would be considered stronger external evidence compared to the results of an individual study. To compare to CEBM,5 level 1 (systematic review or meta-analysis) or level 2 (individual, well-designed randomized clinical trial) evi-
evidence would be expected of the previously published study. These sources of external evidence that address therapeutic, prognostic, diagnostic, and others would all be acceptable.

**Validation Case Example**

A clinician is confronted with a rehabilitation problem. After searching the best available evidence, the clinician decides to use external evidence from a published randomized controlled trial. In order to validate the external evidence, the clinician would first need to determine whether the patient was similar to those described in the study. Further, the clinician should utilize outcomes that would be comparable to those used in the study in order to contrast the patient’s outcomes to those in the original study. If outcomes were similar, then this would provide validation that the rehabilitation protocol is effective in helping patients within the target population. If outcomes were different than the original study, then the clinician has the opportunity to report on the possible reasons for the lack of similar response. This then becomes an assessment of whether the external evidence is valid “in real life”. The clinician reports on the treatment’s effectiveness in that particular setting and/or on drawbacks associated with the real-world setting. This validation completes the circle of clinical evidence.¹

The levels of case study evidence provide a framework for the transition of practice-based evidence to evidence-based practice and also highlight the symbiotic relationship between the two paradigms. In our new case study model, we aim to provide clinicians and researchers with guidance to truly close the loop between practice-based evidence and evidence-based practice.² As we validate our external evidence through validation case studies, we can determine what the best external evidence is to incorporate into professional preparation. Our internal evidence, derived from professional preparation and experience, affords us the ability to chart a course for the development of external evidence for our clinical decisions. This model supports the role of the case study and defines the significance and the clinical importance of these clinical communications. The levels also help to characterize the rigor of the evidence that can be derived from each type of clinical case report. It does appear that some case studies are more equal than others.²

**References**


*Weak reference to Animal Farm by George Orwell.

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Marjorie A. King is a guest author for this editorial, contributing substantially to this model. King is the Director of Graduate Athletic Training Education at Plymouth State University, Plymouth, NH and is also a section editor for the *Journal of Athletic Training.*