A Systematic Review of Simulation in Otolaryngology Residency Training
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Introduction
Simulation has taken on an increasingly important role in resident education in recent years. This holds especially true for surgical fields, including Otolaryngology training programs. The landscape of medical education has changed in recent years, with greater emphasis being placed on patient safety despite the ever present need to train novices that will become the next generation of surgeons.

A systematic review was performed in order to answer the question: where does the field of Otolaryngology stand in incorporating simulation into residency training? The objectives of this study were to determine the number of publications produced per year, country of origin of each study, the resident training level targeted, the specific area within Otolaryngology being simulated including potential deficits within these areas, and whether each simulation described represented high fidelity, low fidelity, or both. We believe that there has been a profound increase in the use of simulation in Otolaryngology residency training programs recently, which can be described by a simultaneous increase in the number of Otolaryngology simulation publications.

Methods
A systematic literature review was undertaken using the Ovid Medline and PubMed search engines. All relevant literature published though the year 2012 was reviewed. The search was performed using the key terms “Otolaryngology” and “simulation.” Search results were limited to those articles with the abstract and/or full text available. The Ovid Medline search produced 79 articles and the PubMed search provided 125, of which, 62 overlapped. Full text articles were obtained for all publications deemed potentially relevant.

Review Methods: Two independent reviewers, JUT and MES, separately evaluated the 142 articles for relevance using specific inclusion and exclusion criteria.

Inclusion: English language, full text available, must describe the training of Otolaryngology residents using simulation, and published within the past 20 years. Randomized control trials, validations studies, reviews, cohorts, and survey studies were included.

Exclusion: simulation of specific patients for pre-operative purposes, focus on imaging rather than surgical training, and anatomy education.

Results
Sixty-nine of these articles were included and broken down into number of publications produced per year, country of origin, resident training level targeted, the specific area being simulated, and the fidelity of the simulation. The number of simulation-based publications has increased from 1996 through 2012. The United States has produced 61% of the articles, with another 8 countries also contributing. Most articles included all resident training levels. However, 22% of the articles specifically targeted junior level (PGY3 or below) residents. The simulated areas were broken down into temporal bone/ear 28, airway/endoscopy 19, sinus 15, head and neck cancer, and esophagus 1. The fidelity of these simulations was also described as high (55 articles, 80%), low (6 articles, 9%), or both (8 articles, 11%).

Key:
FIGURE 1: PRISMA Flow Diagram of Simulation Article Review Process
FIGURE 2: Publications Per Year
FIGURE 3: Publications Per Country of Origin
TABLE 1: Breakdown of Simulation Areas by Specific Focus

Discussion
The field of Otolaryngology is undergoing a transformation in how its resident surgeons are trained. Simulation Based Medical Education (SBME) has played an increasingly important role throughout the world of medical education since the 1990’s as programs look for innovative ways to overcome the barriers that exist in today’s healthcare training system. Otolaryngology is no exception to this recent trend. The number of publications within the field regarding the use of simulation in resident training has increased markedly since the first noted publication in 1996 to a peak of 12 articles produced in 2011.

Not only have we witnessed an increase in the volume of publications, but also a globalization of the incorporation of simulation into resident training. Emphasis has been placed on producing high fidelity simulators for surgical training. Factors that are driving this expanded role for simulation in otolaryngology residency training include increased pressure on teaching faculty to be more efficient, duty hour restrictions, decreased availability of previously used materials such as cadavers, need for standardized assessment of technical skills, increasing complexity of surgical procedures, as well as increasing pressure to practice skills in an environment that prevents harm to patients.2,3,4,5

Incorporating simulation into the training process early can abate many of these pressures.

Conclusions
Simulation Based Medical Education in Otolaryngology has grown tremendously since the 1990’s with a corresponding increase in the number of publications. We anticipate this trend will continue, as simulation takes an increasingly important role in providing the field with innovative solutions to meet the challenges it faces in training future Otolaryngologists.

References