Identification and development of talent in surgery
A scoping study across the performance domains of surgery, sport, and music

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Abstract
Purpose – Education of the surgeon and development of surgical expertise have been debated for centuries. Today, research in surgical education applies terms and methods from other performance domains such as sport and music. However, there still seems to be a lack of consensus as to how talent may be brought into the discourse about surgical education. Especially, when it comes to identifying and developing trainees who in the future will perform better than the average surgeon.

Design/methodology/approach – This five-step scoping study aims to map existing literature about talent identification, talent development and development of expertise in the domains of surgery, sport and music in the period of 1985-2014.

Findings – A total of 242 studies, divided in the four domains of surgery (69 studies), sport (115 studies), music (34 studies) and cross-disciplinary studies (24 studies) published in the period 1985-2014 were included.

Originality/value – Informed by the performance domains of sports and music and their inclusion of a holistic, ecological approach to research, this study suggests that research in surgical education may benefit from broadening its view on talent by including psychosocial variables and environmental, demographic and structural influencers when considering how surgical talent may be identified and developed.

Keywords Talent management, Music, Sport, Performance domains, Surgical education, Talent identification

Paper type General review

Introduction
Education and training of surgeons have been debated since the apprenticeship model of “see one, do one, teach one” was introduced over a century ago (Halsted, 1904). Also, the concept of talent development (Thomas, 2008; Bell et al., 2011; Louridas et al., 2016), i.e. the targeted development of gifted young trainees striving to become surgeons, has entered surgical education through the so-called talent development programs (Jensen et al., 2016). The term talent is widely used in our everyday language and can have different meanings such as being talented or being a talent. The etymology of the term talent originates in Ancient Greece. Talent was a coinage corresponding to 60 minas or 6,000 drachmas. This
was an enormous amount of money. Hence, talents had exclusive value (Jensen, 2017). Many centuries later, we still discuss talent as a social construction and “a label of approval we place on traits that have a positive value in the particular context in which we live” (Csikszentmihalyi et al., 1993). For example, talent in the context of surgery requires a large variety of skills such as craftsmanship, communication, teamwork (Bann and Darzi, 2005), decision-making (Apramian et al., 2016), resilience (Anton and Stefanidis, 2016) and not least medical knowledge (Tsuda et al., 2009). Most extant literature on talent development in surgery investigates whether or not manual dexterity, visual-spatial intelligence and psychomotor aptitude correlate with future performance in the OR (McCluney et al., 2007; Lynch et al., 2010; Van Herzeele et al., 2010; Panait et al., 2011; Masud et al., 2012). This focus is likely influenced by the past decade’s growing interest in simulation and virtual reality within surgical education (Tsuda et al., 2009; Stefanidis et al., 2015). The emphasis on technical skills proliferated in 2009 when Grantcharov and Funch-Jensen showed that not everyone could achieve proficiency-level in laparoscopic expertise (Grantcharov and Funch-Jensen, 2009). This finding fuelled a debate on how to predict surgical talent and thereby how to identify talented surgical trainees. Still, the concept of talent in surgical education seems to be positioned somewhere between “born or made” (Sadideen et al., 2013; Van Bruwaene et al., 2015). In other contexts such as high-performance sport and classical music, talent is a longstanding and much-debated concept because talent (to be born or made) has always been regarded as a key prerequisite for practitioners to succeed (Ericsson et al., 1993; Tranckle and Cushion, 2006; Christensen, 2009; Gruber et al., 2010; Henriksen et al., 2010). Also, in surgical education, notions of talent development programs are emerging in the research literature (Jensen et al., 2016). Even though talent seems to be an emerging concept in the literature on surgical education (Bell et al., 2011), there is no consensus on how to conceptualize, identify and consequently develop talent in surgery.

It is known that the literature on surgical education is both broad and innovative, and that surgical education applies terms and methods from other performance domains such as sports and music (Immenroth et al., 2007; Calatayud et al., 2010; Fry and Kneebone, 2011). However, to the best of our knowledge, no prior attempt has been made to thoroughly review and compare research-based literature on talent identification and talent development in surgery with similar literature in other performance domains.

The aim of this paper is to investigate the current variety of perspectives on talent development in surgery. Our purpose is to offer an innovative agenda to researchers and developers within surgical talent development, education and training that may inform medical schools how to design selection processes and talent development programs. For this purpose, our research question was as follows: What are the different types of publications (in terms of methods, population and outcome measures) and what are the key findings in the literature about talent development in the performance domains of surgery, sports and music in the 1985-2014 period? The paper reports findings from a scoping review that identifies current trends in the literature on talent development in the performance domain of surgery compared to those of sports and music. Based on the scoping review and the mapping of the “landscape” of literature on talent in surgery, we will:

- locate the variety of notions of the term talent in the discourse on research and practice in surgical education and training; and
- discuss epistemological approaches to talent development in surgery, including a holistic ecological approach where the person–environment system is the minimal ontology for understanding talented behavior.
Method

Our aim was to investigate the current variety of perspectives on talent development in surgery. To meet this aim, we conducted a scoping study. A scoping study differs from a systematic review in two ways:

1. A scoping study addresses broader topics that have not been reviewed before, whereas a systematic review usually focuses on a limited and well-defined question.
2. A scoping study seeks to map the key concepts of a complex research area across many and diverse publications, whereas a systematic review typically answers questions from fewer, narrowly selected and quality-assessed publications (Arksey and O'Malley, 2005).

A scoping study provides a high level of flexibility in comparison to a traditional systematic review and meta-analysis, as it is able to account for a diversity of relevant literature and methodologies, which may not be feasible in a systematic review or meta-analysis (Daudt et al., 2013; Peterson et al., 2017).

Importantly, a scoping study, according to Arksey and O'Malley (2005), does not necessarily include a normative assessment of the existing literature in the area. Hence, the present scoping review aims to map rather than assess the literature in the selected research area. Instead, we include a broad range of literature to map the different types of publications (i.e. method, population and outcome measures) and key findings on talent development in the selected domains. In line with Thomas et al. (2017), we aimed to make sure that the financial and human resources match the search strategy. Hence, we prioritized to conduct a relatively wide mapping across the three domains instead of mapping one domain in depth (Thomas et al., 2017).

This scoping study was conducted according to the five stages of the methodological framework for organizing a scoping study. This framework was first described by Arksey and O'Malley (2005) and commented upon and further developed by Levac et al. (2010).

The five-stage methodology

Stage 1 was identifying the research question. As mentioned above, we identified the following research question: What are the different types of publications (i.e. method, population and outcome measures) and what are the key findings in the literature about talent development in the performance domains of surgery, sports and music in the 1985-2014 study period?

Stage 2 was identifying the relevant publications. We searched the PubMed, EmBase, Scopus, Eric, Psycinfo and Web of Science databases to identify relevant publications based on title, abstract and keywords using the following three clusters of search terms: [“Aptitude” or “Talent development” or “Gifted”] and [“Education” or “teaching” or “academic training” or “skill acquisition” or “expertise”] and [“surgery” or “academic” or “sport” or “music”]. We included the term “academic” to include publications on medical students’, sport science students’ and musical students’ academic talent development. Choosing the appropriate terminology can have downstream consequences for the selection of relevant literature (Thomas et al., 2017). Hence, another search terminology would self-obviously cause another sampling and mapping of literature. The various databases generated 2,785 peer-reviewed papers.

Stage 3 was study selection. We adopted two inclusion criteria and three exclusion criteria. The inclusion criteria should determine the relevance of each identified paper:
The title, abstract and keywords should declare the focal point. At least one of the four following words was present in title, abstract or keywords: Talent development, Expert*, Skill acquisition, Gifted*. 

The participants were humans. This second inclusion should identify papers focusing on human beings and not artificial development or the training of animals.

The criteria for determining exclusion from the present study were as follows:

- Minority population. The focus and/or population of the study was too narrow or specific (e.g. students with dyslexia) and, therefore, not generalizable to other subdomains.
- Performance domain. The study did not fall within the performance domains of surgery, sports or music.
- Level of performance. The focus of the study did not include identification and/or development and/or prediction of individuals who would perform above average. This exclusion criterion was applied to consolidate the focus of our study.

The first author reviewed all abstracts applying the above criteria to determine their relevance. After the first author had selected the papers, two additional authors scrutinized the papers to do a comprehensive review. The study selection thus comprised three revisions of the abstracts to determine their relevance. See Figure 1 for a flowchart illustrating the review process.

Stage 4, the charting of the data, was a key stage in the scoping study. At this stage, the actual mapping of the publications took place and “the contours of the landscape” began to appear. We charted the included publications by classifying them based on a combination of general information about the study and specific information relating to the study population, the type of interventions, the study design and the outcome measures. Thus, the included papers were divided between the three authors and the following information was recorded for each study:

1. Primary author, year of publication, journal or source and location of study.
2. Type of study (editorial, review, intervention, etc.).
3. Study population (if any).
4. Aims of the study. We allocated each study to one of the following three categories depending of the main mind-set of the publications:
   - talent identification;
   - talent development; or
   - integrated talent identification and development.
5. Outcome measures.
6. Key findings and main conclusion.

Stage 5 was collating, summarizing and reporting the results. This stage formed the link between the methodological work on data generation (Stages 1-4) and the results of the study. Unlike a systematic review, which includes only a small percentage of a large number of publications in the final report, a scoping review presents an overview of all material reviewed. The question of how best to present this potentially large body of material is, therefore, critical (Arksey and O'Malley, 2005). We collated and summarized the data into five charts:

1. A complete list of the included papers sorted by performance domain to provide an overview of the prevalence of domain-specific publications and cross-disciplinary publications (Appendix).
(2) A figure illustrating the publication frequency in the 1985-2014 study period by domains (Figure 2).

(3) A matrix displaying the scope or the “landscape” of the publications by research themes and types of studies (Figure 3).

(4) A list of the included papers within the surgical domain showing the ID number, first author, method, focus and theme for each paper (Table I).

(5) A table displaying the prevalence of papers per domain relating to the following three foci:
   - talent identification (including selection);
   - talent development (including learning processes); or
   - integrated talent identification and development (Figure 4).

The five charts were constructed and their contents confirmed in a process of categorization and comparison of the results based on the charting of data of each paper (Stage 4) and a process of investigator triangulation (Patton, 1999). In line with Patton
(1999), two or more researchers investigated the same data set to reduce selective perception and blind interpretive bias. Furthermore, all authors did all charting of the included literature collectively. For example, all categories and coding for the matrix in Figure 3 were collectively negotiated by the authors.

**Figure 2.** Publication year of the included publication. All publications divided in domains and presented in number of publications per year.

**Figure 3.** Matrix of including publications.

**Notes:** The X-axis includes the main theme and the Y-axis includes the type of study. S = Surgery, M = Music, A = Sport, C = Cross-disciplinary; the identification number refers to the specific publication, which can be found in the Appendix.
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<th>Identification no.</th>
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<th>Theme</th>
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<td>Alderson (2010)</td>
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Table I.
Results
The scoping study resulted in 242 publications divided into the four domains of surgery (69 publications), sports (115 publications), music (34 publications) and cross-disciplinary publications (24 publications) (see Appendix).

Of the 242 publications, 81 per cent (196) was published within the past 6 years. In the past decade, the increasing number of publications on talent could be the result of a growing amount of publications in the research area of sports where talent is a widespread term.

Table I.

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Figure 4.
Prevalence of papers per domain relating to the following three foci: 1) Talent identification (including selection), 2) Talent development (including learning processes), or 3) Talent development and identification.
However, also the research area of surgery seems to generate more publications on talent than it did 10 years ago. This may be a result of an increasing use of the term talent in addition to similar concepts such as aptitude, ability or giftedness and thus simply reflecting more current terminology trends. Notwithstanding, the result may indicate a growing attention to the notion of talent as a phenomenon much debated and consequently worth studying.

Research themes and types of studies: a motley landscape headings

The included publications addressed a variety of research themes and had different study designs. We identified and categorized seven research themes pertaining to definition, identification and development of talent:

1. anthropometric variables and measurements applied in the definition and identification of talented practitioners and high-level performance;
2. the identification and development of technical skills in talented practitioners;
3. the mix of technical skills and visual-spatial skills in talented practitioners;
4. the identification and development of visual-spatial skills in talented practitioners;
5. mixed themes including both technical skills and psychosocial factors in talented practitioners and their talent development environments;
6. psychosocial factors influencing talented practitioners and their talent development environments; and
7. environmental, demographic and structural factors influencing talented practitioners and their talent development environments.

Based on the methodological characteristics (Cohen et al., 2011), we identified and categorized seven types of designs, types of studies and papers:

1. commentaries, editorials and other papers based on selected literature and personal views;
2. qualitative studies including case studies;
3. questionnaires and survey studies;
4. mixed method studies including two or more types of quantitative and/or qualitative data;
5. literature reviews based on specific methodologies;
6. database studies; and
7. experimental studies and quasi-experimental studies.

We categorized each study with regard to research theme and type of study design, which allowed us to outline a scope and determine the contours of the “landscape” of literature. In the matrix (Figure 3) illustrates the mapping of the included publications.

For example, Study S34 (Leff et al., 2008; see Table I) described differences in cortical plasticity in relation to learning and performing technical skills in surgery based on selected literature; hence, we placed this study in Theme 1 and Type 5 in the matrix.

As illustrated in the matrix, the included publications in the domains of surgery, sports, music and cross-disciplinary publications form different landscapes.

The domains of sports and music included a variety of applied research methods, whereas the surgical domain was dominated by intervention studies. Beside intervention studies, the surgical domain contained a few personal views and a limited number of reviews. Moreover, none of the included surgical publications applied qualitative research methods. However, it
should be noted that the present scoping study focused on identification and development of talent and high performance exclusively, and not on surgical education in general.

The domain of cross-disciplinary publications was characterized by a limited number of highly interesting reviews and database studies, and a large group of personal views reflecting potentially interesting venues for comparing different domain strategies and practices regarding talent identification and development.

Among the three domains of surgery, music and sports, music held the broadest variety of different research themes. The domain of sports was characterized by many publications about demographical and structural factors influencing talent development, and a few publications with mixed themes including both technical and psycho-social skills in talented practitioners. The domain of surgery was characterized by publications with mixed themes and publications concerning technical skills and visual-spatial intelligence. This focus was most likely influenced by the increased attention on simulation and virtual reality within surgical education seen in the past decade. Only a limited number of publications in the domain of surgery had a specific focus such as psychological and motivational factors or demographical and structural factors influencing talent development.

The “identification mind-set” and the “development mind-set”

We found it useful to identify the research focus of the included publications as either talent identification or talent development or a combination of the two because these foci represent different overall strategies and mind-sets about talent. The “identification mind-set” would focus on how to identify, classify and select talent based on more or less predefined criteria and standards with the aim of identifying potential future performers. The “development mind-set” would focus on learning processes and the variety of factors influencing the development of skills and abilities in practitioners with the aim of improving performance.

In the domain of music, both mind-sets were represented, while the domains of sports and cross-disciplinary publications were dominated by the “development mind-set” (Burgess and Naughton, 2010; Araújo and Davids, 2011). The domain of surgery, on the contrary, was dominated by the “identification mind-set”. The majority of “identification mind-set” publications in the surgical domain investigated the feasibility of identifying surgical talent by testing if manual dexterity, visual-spatial intelligence and psychomotor skills correlate with performance in a laparoscopic test. Seventeen of 22 publications demonstrated that testing of technical skills could be used to identify and select future surgical talents. For example, Moglia et al. (2014) investigated the possibility of identifying individuals with a specific, well-documented innate talent for manipulative skills, and found that of 121 medical students, only 8 significantly outperformed the rest and showed no significant difference from expert surgeons.

Our scoping study showed that the number of publications about testing of non-technical skills and their role in predicting and identifying surgical talent was very limited. One exception was a study conducted by Bell et al. (2012), who sought a method (the TriMetrix assessment) with which, first, to determine the so-called “personal talents” and “behavioral styles” of applicants for surgical training and, secondly, to study these talents and styles in conjunction this with traits of current residents who demonstrate success in a general surgery program. The authors suggested that the TriMetrix assessment enabled identification of unique behavioral, motivational and personal abilities that were not identifiable from the traditional application process.
**Discussion**

The application of simulation and testing in surgical education (Gough and Bell, 1989), and the continuous refinement of equipment in the OR speak of a surgical domain in constant development. However, the combination of these developments in surgical education and the discourses of talent development is a novel field of research. The present scoping study pinpoints potential research areas within the field of surgical education that may benefit from innovative research inspired by other performance domains such as music and sport, among others.

*Should we take a broader epistemological approach to talent development in surgery?*

In the result section, we showed that the surgical domain to some extent confines itself to focusing on technical skills and visual-spatial intelligence, while the domains of music and sports cover a much wider area (see Figure 4). One could argue that this difference is mainly rooted in the different research traditions. While research in sports as well as music is traditionally a blend of different epistemologies and methodologies which influences the research on talent in these two areas, surgery – including research in surgical talent – is traditionally influenced by a positivist epistemology focusing on quantifiable data and aiming to demonstrate causality (Moore et al., 2014). This may explain the scoping review’s modest number of surgical publications on talent development based on surveys, qualitative methods and mixed methods. However, the emerging wider epistemological approaches to surgical research in talent may possibly expand the scope of research on surgical talent even more (Alderson, 2010).

Already published publications related to talent development in surgery show a variety in epistemological approaches and research topics, for example decision-making in surgery (Cristancho et al., 2013), mental preparation before performance in the OR (Cocks et al., 2014), technical skills in surgical education (Reznick and MacRae, 2006) and cognitive resources at surgical learners (Dubrowski et al., 2012), just to mention a few examples. It is, however, important to bear in mind that the search terminology in the present scoping review aimed for publications that explicitly targeted talent and the development of performance above average, and not surgical education and skills training in general. A tentative suggestion based on this scoping study may be to use the emerging broad research in surgical education as well as the variety of epistemological and methodological approaches to research in talent across the three areas of sport, music and surgery as an inspiration to future publications on talent in surgery.

*More deliberate practice in surgery?*

The term *deliberate practice* has only recently been introduced and to some extent implemented in the field of surgical skills acquisition, even if it has been widely used in the performance domains of sports and music. The original study by Ericsson et al. (1993) showed that up to 10,000 hours of deliberate practice are needed to reach a level of expertise within music; still, a few publications in surgical education have demonstrated that the time allocated to hands-on surgical training in specific procedures falls short of 10,000 hours and has been even been decreasing over the past decade (Kairys et al., 2008; Mullen et al., 2016). In an observational, multi-institutional cohort study, Mullen et al. (2016) found that along with the proliferation of laparoscopy in 2005-2012 for common general surgical procedures there has been a concomitant reduction in junior-level residents’ participation in laparoscopy training courses. Taking Ericsson et al.’s (1993) definition of deliberate practice into consideration, we may add that merely participating in a surgical procedure does not necessarily provide the qualities of deliberate practice.
Even though Macnamara et al. (2014) show that the concept of deliberate practice is not used optimally in many domains, research into the training–performance relationship in sports and music seems to hold inspirational value for the field of surgical education (Macnamara et al., 2014). The relationship between the athlete’s amount and quality of training on the one hand and his or her participation in competition and performance settings on the other is a much-discussed topic in sports. Hence, models have been developed to describe the dynamic aspect of training and the consequence of successive training loads over time (Avalos et al., 2003). While a main research issue in the sports domain is training overload and optimization of the training–performance relationship with a view to controlling fatigue, the use of deliberate practice as a dominant approach to research in surgical education is still incipient. The concept of deliberate practice has been introduced into the surgical domain mainly within research on simulation in surgical education (De Win et al., 2013; Stefanidis et al., 2015).

The roles of deliberate practice in medical education, are, however, much debated. Some scholars favor environment-oriented learning strategies such as mastery learning and deliberate practice and highlight these approaches as “best practice” in simulation-based medical education (McGaghie et al., 2010). Based on this training approach, McGaghie et al. (2006) found a strong association between hours of practice on high-fidelity medical simulators and standardized learning outcomes. From another perspective, Kulasegaram et al. (2013) examined the relationships between expert performances, deliberate practice and an innate cognitive capacity: working memory. They showed that expert performances often are affected by a number of factors, including a range of innate and environmental factors and that reducing expert performances to a single factor is an unfounded proposition. Furthermore, they suggested that individual differences such as working memory capacities would play a role in the development of expert performances (Kulasegaram et al., 2013). Similarly, Hambrick and Engle (2002) investigated the interplay between domain knowledge and working memory capacity and found that innate working memory capacity contributed to memory performance even at high levels of domain knowledge. In this way, innate abilities are by some scholars favored over deliberate practice. To sum up, the debate of nature vs nurture remains popular in the literature and seems to linger in medical education. However, sports science scholars argue that the debate is too simplistic and risks creating blind spots (Tranckle and Cushion, 2006). In our study, we found that the domains of sports and music seem to take a more environment-oriented approach to deliberate practice in which the relationship between the practitioners’ training of technical skills, the dynamic development of psychosocial skills and the employment of feedback from the training context are included in the research. This approach seems to hold inspirational value for surgical education; and we speculate that it would improve the targeted training of a broader range of skills including the surgical trainee’s ability to interact with and learn from the immediate social and cultural environment than those identified in the current surgical literature. This approach would, furthermore, advocate for a circumscribed use of deliberate practice in surgery, and hence, be aware of the limitations of deliberate practice that the literature from Kulasegaram et al. (2013) have added to medical education. Accordingly, we may suggest that instead of investigating what innate “talents” (e.g. visual acuity, motor control, dexterity, cognitive capabilities, working memory capacity, etc.) we should focus on for the selection of future surgeons in training, we should focus on constructing meaningful opportunities for deliberate practice – throughout both surgical training and career.
This scoping study revealed a new inspiration to research in surgical talent: the holistic, ecological approach (hereafter: HEA). This approach to studying talent involves the understanding that it is necessary to include a wide-ranging view of the skills and variables that pertain to the concept of talent and to perform an in-depth investigation of key persons and relationships at micro (individual), meso (relational) and macro (societal) levels in talent development environments. Through an acknowledgement of the ecological nature of talent development and expertise, guided by a theoretical framework presented by Bronfenbrenner and Cesi (1994), Araújo et al. (2010) argue that ecological constrains at the meso and macro levels exert a deliberate or an implicit influence on the development of individual expertise.

HEA and the focus on person–environment systems was introduced to the sports research area over the course of the past few years and has now become a well-established part of the domain (Gagné, 2004; Tranckle and Cushion, 2006; Araújo et al., 2010). As we saw in the Results section above, the matrix clearly shows that the domains of music and sports cover a much broader area of the matrix than surgery does – most likely because surgery does not yet embrace HEA. However, the idea of including HEA in surgical talent development may not be that farfetched. In a comprehensive study from 2011, Subotnik et al. (2011) identified four key elements of talent development that may be useful across domains, including medicine. First, they advocate that talent matters. Hence, students should be allowed to specialize early if they demonstrate high levels of interest, commitment and achievement toward a particular domain in which the demonstrated behavior is positively valued and labeled as talented. Second, Subotnik et al. highlight that talented students have unique developmental trajectories across their life span. Physical and intellectual demands and cultural traditions impact individual entry points, peaks and endings. Third, they argue that effort and opportunity are important at every stage of the talent development process. This argument is closely related to HEA’s view on deliberate practice presented earlier in this scoping study. Finally, Subotnik and colleagues highlight that psychosocial variables are important contributors to outstanding performance at every stage of development. They state that willingness to take strategic risks, ability to cope with challenges and criticism, competiveness, motivation and task commitment will differentiate those who move to higher levels of talent development from those who do not (Subotnik et al., 2011). Perhaps those to be selected into surgical training programs early on should clearly demonstrate a penchant for internal drive and motivation toward constantly improvement, rather than motor skills or interpersonal tendencies? Nonetheless, the surgical literature seems to concentrate on measuring cognitive skills rather than adopting Subotnik and colleagues’ environmental and psychosocial approach. For example, Groenier et al. (2014) have shown that measurement of cognitive skills (spatial memory, perceptual speed and general reasoning skills) cannot be utilized for selection of residents. A few publications stress that visual-spatial ability and motivation are important elements in the development of laparoscopic skills (Stefanidis et al., 2006; Maan et al., 2012) and that the development and assessment of personal skills may play a significant role in surgery (Van Eaton and Pellegrini, 2011). Even though consensus on concepts (e.g. the difference between motivation, visual-spatial intelligence and personality traits) and direction (e.g. identification mind-set and/or development mind-set) in the research on talent development and expertise is not evident in the surgical literature, the discussion of these issues is valuable (Van Eaton and Pellegrini, 2011). Based on the present scoping study, we suggest adopting the holistic, ecological approach to talent identification and development process in surgical education when aiming to develop experts. As stated above, this approach is
already a well-established part of research into giftedness and talent development within other performance domains.

**Taking talent development one step further**

The focus on the person-environment systems is not fundamentally different from the prevalent view in existing literature in surgical education and surgical skill acquisition. An incipient emphasis on non-technical skills and curricular development is seen, for example, and Dedy *et al.* (2016) demonstrated the effectiveness of structured curricular training in improving non-technical performance during the first year of surgical residency. Another innovative contribution is Alderson (2010). In his study on developing expertise in surgery, Alderson introduces a broad view on expertise development that includes conceptions of skill acquisition, decision-making and learning in a community of practice. In particular, the latter concept is comparable to HEA, as it represents the idea that a person is talented only when he or she matches the expectations of the surrounding community of practice in terms of what being talented means. It follows that “talent” is not a universal or generic feature. This example is in line with Araújo and Davids (2011) who state that talented performance derives from a functional fit between the individual and the performance environment. Following this statement, we suggest that the minimal ontology for understanding talented performances is the person-environment system. Consequently, we cannot predict talented performance disconnected from the actual performance environment. To take Araújo and Davids’ argument one step further, talent development has to be perceived as a non-linear cultural-and context-dependent process, because an environment (including e.g. a surgical department) is constantly changing as a subject to political, societal and organizational demands, i.e. work-hours instructions, procedures and educational requirements.

“What makes one individual’s behavior more talented than another is not some possessed ability, but its contextualized functional value: its usefulness in particular performance contexts” (Araújo and Davids, 2011, p. 24).

This quote highlights that talent most likely is a socially constructed phenomenon. This means that talent developers must be aware of the functional value of a given performance in their specific context, when predicting and fostering future performers. For example, in a surgical setting this would mean that the surgical trainee should learn to engage adequately in sayings, doings and relatings embedded in the department – or in other words, they should be “cultivated and stirred into practice” – and not be perceived as an object to be changed (Kemmis *et al.*, 2014).

Another example of an incipient interest in the meso and macro levels in surgical education is Eidt’s (2012) comparative study of training paradigms in vascular surgery and aviation.

Eidt listed ten items representing specific areas for improvement in vascular surgical education. The list includes a clearer selection process, a boot camp, encouragement of vascular surgeon leadership including team training and development of a competency-based syllabus. These elements are also key parts of high performance in other domains (Tranckle and Cushion, 2006; Gagné, 2007). Nevertheless, despite the fact that the publications by Eidt and Alderson include a few recommendations related to the meso and macro levels of surgical talent development, the majority of the surgical literature included in this scoping study focuses on the micro level of surgical talent development, i.e. on the traits and abilities of the individual person. Consequently, the domain of surgery seems to overlook the potential new insights that could be gained by applying a holistic, ecological approach to the investigation of interactions and structures in the meso and macro levels of surgical talent development.
Limitation
A scoping study has some limitations compared with a systematic review. It addresses broader topics and is less suitable for answering questions raised in a limited number of narrowly selected and quality assessed publications. Thomas et al. (2017) highlight scoping studies, as they potentially can identify gaps in the literature and maps research areas where a systematic review is needed. Thus, we are aware of this study’s limited strength in recommending domain-specific guidelines regarding talent identification and development. Instead, we suggest that each of the included domains conduct a systematic review to recommend talent development guidelines. In this way, this study should be seen as an initial step to illuminate and investigate the dynamic and emerging area of surgical talent development.

The publications in this scoping study were included based on inclusion and exclusion criteria delimited by the authors. Hence, a similar scoping study done by other authors would possibly include and/or exclude some other publications. The study is also limited by the fact that the concept of talent is not yet a well-established element in surgical educational literature. Consequently, some of the included publications pertaining to the domain of surgery address talent identification and/or development in an implicit or indirect manner, which called for our careful estimation of these publications’ inclusion into or exclusion from our study, knowing that other researchers may assess inclusion/exclusion differently. For example, in the charting of the included publications, we highlighted the main focus of each publication, whereas other authors may have highlighted other main findings. To diminish the subjective influence in the charting process, each author categorized the publications and we then compared our findings.

However, this is a premise (and a limitation) when doing a scoping study in an area that is not well established. On the other hand, it is also unavoidable because part of the aim of this scoping study was to map gaps and emerging concept across domains.

Conclusion
In this scoping study, we included 242 publications, mapping similarities and gaps in research into talent identification and talent development within the performance domains of surgery, sport and music. The chosen search terminology tended to yield that the performance domains of sports and music included a broader range of research themes and types of publications than the surgical domain did. Furthermore, the surgical domain differs from sports and music as the vast majority of publications in this domain represent a “talent identification mind-set”, whereas the domain of sports represents a “talent development mind-set” and the domain of music represents both mind-sets. We also identified a gap in the domain of surgery pertaining to specific types of publications, especially database studies, literature reviews, mixed method and qualitative studies. More importantly, we identified a considerable gap in the surgical literature with respect to research into psychosocial variables as well as the environmental, demographic and structural elements of talent identification and development. Based on the included publications, it seems reasonable to argue that surgery may draw valuable inspiration from the other performance domains which adopt a broader view on talent development and cover a wider variety of themes and study designs.

Based on this scoping review, we argue that future research into surgical education may benefit from broadening its focus on talent by including aspects such as psychosocial variables and environmental, cultural, demographic and structural influencers. Besides the novel mapping of literature from three performance domains
who share a deep interest in talent and excellence, this scoping study is a modest attempt to push researchers in the direction of investigating if and how the surgical and medical domain may benefit from perceiving talent identification and talent development as a non-linear process, where the person–environment system is the minimal ontology for understanding talented behavior. Next step for the surgical education domain could be to conduct a systematic review to recommend guidelines for talent identification and development.

References


Appendix. List of included publications

**Surgery**


Sport


Music


Cross-disciplinary


C17 Shavinina L V. What does research on child prodigies tell us about talent development and expertise acquisition? Talent Dev Excell. 2010;2: 29-49.


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