A Systematized Review of Pediatric Resident Selection Criteria

Nasser Sanjar Moussavi [1], Majid Sezavar [2], Somayeh Akbari Farmad [3], Mohamad Hadi Imaniyeh [4], Hamidreza Kianifar [5], * Arezou Farajpour [6]

[1] Assistant Professor, Department of Surgery, Faculty of Medicine, Mashhad Medical Sciences, Islamic Azad University, Mashhad, Iran.

[2] Assistant Professor of Pediatric Intensive Care, Department of Pediatrics, Faculty of Medicine, Mashhad University of Medical Sciences, Mashhad, Iran.

[3] Assistant Professor, Department of Medical Education, Mashhad University of Medical Sciences, Mashhad, Iran.

[4] Full Professor, Department of Pediatrics, Faculty of Medicine, Shiraz University of Medical Sciences, Shiraz, Iran.

[5] Associate Professor, Department of Pediatrics, Faculty of Medicine, Mashhad University of medical sciences, Mashhad, Iran.

[6] Assistant Professor, Department of Education Development Center, Faculty of Medicine, Mashhad Medical Sciences, Islamic Azad University, Mashhad, Iran.

Abstract

Background: Providing high-quality medical services and training future specialists is one of the most vital tasks of the medical education system but there is still no agreement on the best strategy for selecting the most competent candidates in the future. This study aimed to review studies on the currently used criteria.

Methods: In this systematized review, the research question was "What are the criteria for selecting pediatric residents in medical universities?" PubMed, Scopus and ISI databases were searched electronically on March 23, 2022 with the defined strategies, based on which 624 articles were retrieved. After omitting duplicates along with title and abstract screening, 72 remaining full papers were studied and the results were extracted from 17 eligible articles.

Results: Based on the review, 11 criteria and tools were identified; they includes: Structured Interview (SI), Letter of Recommendation (LoR), Multiple Mini-Interview (MMI), P-Mex, Assessment Letter for Pediatrics (ALPs), Situational Judgment Test (SJT), Scholar activities, Global assessment, Competency-based assessment center, University grades, and USMLE scores.

Conclusion: The findings suggested that it is necessary to determine a valid and reliable framework to assess the expected competencies and specific tasks including cognitive and non-cognitive qualities that predict successful future performance.

Key Words: Admission Criteria, Pediatric Assistant, Selection Criteria.

*Corresponding Author:

Arezou Farajpour, Assistant Professor, Department of Education Development Center, Faculty of Medicine, Mashhad Medical Sciences, Islamic Azad University, Mashhad, Iran. Email: ar_farajpour@sbmu.ac.ir

1- INTRODUCTION

Undoubtedly, providing high-quality medical services and training future specialists is one of the most vital tasks of the medical education system. Resident selection is always a challenging and time-consuming process in medical education programs; and program directors and faculty members make considerable efforts to identify and select the best candidates, so as to train the best specialists for the health system. Despite all efforts, there is still no agreement on the best strategy to identify the best candidate with excellent practice in the future, and most ongoing processes are non-standard, with low validity and reliability. Therefore, it is necessary to study and determine valid and reliable criteria that predict the future performance of residents (1, 2).

Medical schools usually admit a group of students with homogeneous cognitive competencies and individual characteristics through a test in general, and provide them with the same curriculum and the same educational experiences. Then graduates are required to select a variety of specialties with very different vocational context, job responsibilities, and essential skills, while individual characteristics and occupational interests, and the expected competencies are not defined in each specialty (3).

Statistics show that despite intense competition and selection of the best candidates in a specialty such as neurosurgery, about 15% of candidates who start a neurosurgery residency do not complete it (4). Another study reported that 17-26 % of candidates of residency courses eventually drop out and do not complete their course (5). Changing medical curricula to competency-based curricula is a great opportunity to develop selection criteria of a specialist in various disciplines (2, 4). Altmaire et al. (1990) used critical event methods to investigate attitudes and behaviors vital to the successful practice of pediatric residents at Lowa University; and reported that the traditional pediatric resident selection method was only 30% consistent with identifying characteristics and competencies required for successful practice and in fact characteristics that are non-cognitive in nature have been overlooked in this regard, and need to be addressed (6). Candidates who are already interested in their field of study experience problems less frequently, but those who select their field of study mainly due to test conditions and better grades, etc., have a hard way ahead, so that it is more difficult for them to endure difficult residency conditions; and this has a negative impact on their efficiency in the education, research and treatment domains (7-9). There is no aggregated study about selection criteria in the pediatrics field; therefore, the present study was designed and conducted with the aim of reviewing the criteria for selecting pediatric residents in the world.

2- METHODS

This was a systematized review in which the pediatric resident selection criteria were investigated. The research question was "What are the criteria for selecting pediatric residents in medical universities?" PubMed, Scopus and ISI databases were searched electronically on March 23, 2022. The following strategies were used to search for resources:

- PUB MED: pediatrics AND Residency AND (practice OR recruitment OR PERFORMER) AND predict *

- In Scopus: ((pediatric residents) OR (Residency AND pediatrics)) AND (practice OR recruitment OR PERFORMER) AND predict *

(TITLE-ABS-KEY (pediatric AND resident *) OR TITLE-ABS-KEY (residency AND pediatrics) AND TITLE-ABS-KEY ((practice OR recruitment OR

performer)) AND TITLE-ABS-KEY (predict *))

 - Web of Science: ((pediatric residents) OR (Residency AND pediatrics)) AND (practice OR recruitment OR PERFORMER) AND predict *
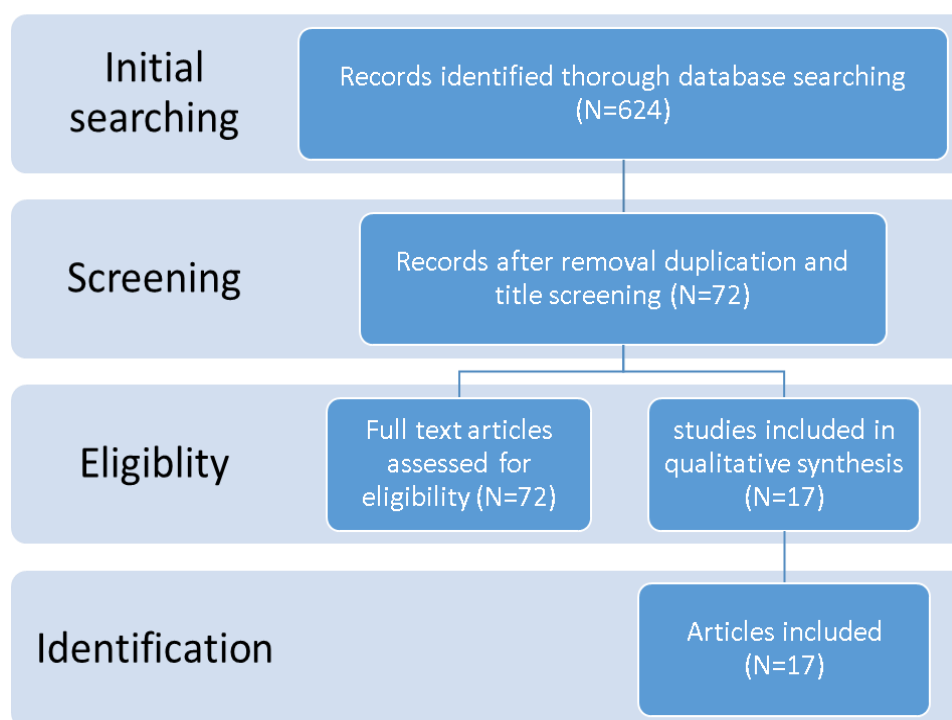
A total of 624 articles were found during the initial search. After removing duplicate titles in the EndNote software ver. 7 and title screening, 72 items were selected (**Table 1**).

Table-1: Retrieved articles

Variable	Search	Title screening
Pub med	447	37
Scopus	93	18
Web of sciences	84	17

Inclusion criteria included the studies on pediatric residents published from 2000 to now with a focus on "selection criteria" or its synonymous expressions. Preliminary studies that included observational, descriptive, and interventional and cohort studies, were selected. Exclusion criteria included studies performed on residents of other specialties, non-English articles, non-full-text articles, systematic reviews and meta-analysis studies.

Fig. 1: Selection process of the final articles

Then, two researchers, pediatric and medical education specialists, reviewed the titles and abstracts of the articles and eliminated the irrelevant and non-eligible items. A consensus strategy was used in cases where there was no agreement on the exclusion of articles. Then, the full text of the selected articles was obtained and

studied. At this stage, the inclusion and exclusion criteria were considered by the researchers too and the required information was extracted from each study and entered on an Excel sheet. This information included the ID number of each article, author name, and year of publication, year of study, country, and type of study (**Table 2**). Ethical considerations included honesty in accurate reporting and referencing of all studies. The results of this review were reported in the Results Section.

Table-2: information of the articles

Num.	Title	Author	Publication year	Study year	Country	Study design
1	Should pediatric chairs be expected to write letters of recommendation for all students applying to pediatric residency programs?	Ackerman et al	2019	2016-2017	US Virginia Tech Carilion School of Medicine	Survey
2	Can professionalism mini-evaluation exercise scores predict medical residency performance? Validity evidence across five longitudinal cohorts?	Nadia M. Bajwa et al	2019	2012-2016	Switzerland University of Geneva	5 cohorts
3	Improving the residency admissions process by integrating a professionalism assessment: a validity and feasibility study	Nadia M. Bajwa et al	2016	2012-2013	Switzerland University of Geneva	Validity study
4	Validity evidence for residency admissions: a standardized assessment letter for pediatrics	Nadia M. Bajwa et al	2017	2012-13	Switzerland University of Geneva	Validity study
5	Information collected during the residency match process does not predict clinical performance	Stephen M. Borowitz	2000		University of Virginia, charlottesville	Cross sectional study
6	Improving our ability to predict resident applicant performance: validity evidence for a situational judgment test	Michael J. Cullen et al	2020	2016–17 2017-18	University of Minnesota–Twin Cities	Observational
7	The reliability and acceptability of the multiple mini-interview as	Kelly L. Dore, et al	2010	2008-2009	Canada	Observational

Num.	Title	Author	Publication year	Study year	Country	Study design
	a selection instrument for postgraduate admissions					
8	Application factors associated with clinical performance during pediatric internship	Caroline Gross et al	2020	The summers of 2013 to 2017.		retrospective cohort study
9	Scholarly activity as a selection criterion in the Canadian Residency Matching Service (CaRMS): a review of published criteria by internal medicine, family medicine, and pediatrics programs	Jorin Lukings et al	2020	2019	Canada	Descriptive study
10	Personality as a prognostic factor for specialty choice: a prospective study of 4 medical school classes	Ronald J. Markert, et al	2008	2003–2006	Four Tulane University School of Medicine	Prospective Study
11	Predicting performance of first-year residents: correlations between structured interview, licensure exam, and competency scores in a multi-institutional study	Brittany Marcus-Blank et al	2019	2013–2015	US	Cross sectional
12	Predicting residents' performance: a prospective study	Philip O Ozuah	2002	92-99	US	Prospective study
13	Selecting doctors for postgraduate training in pediatrics using a competency based assessment center	R Randall et al	2006	2006	UK	Observational study
14	Dear program director: deciphering letters of recommendation	Kris Saudek et al	2018	2016	US	cross-sectional
15	Pediatric, surgery, and internal medicine program director interpretations of letters of recommendation	Kris Saudek et al	2019	2016	US	survey
16	The impact of the interview in pediatric residency selection	Wendy Sue Swanson et al	2005	99-2002	US	Observational study

Num.	Title	Author	Publication year	Study year	Country	Study design
17	Are we measuring what matters? How student and clerkship characteristics influence clinical grading.	Ingram MA, Pearman JL, Estrada CA, Zinski A, Williams WL.	2021	2015-2017	UK	Cross sectional

3- RESULTS

A total of 624 articles were retrieved in the initial search up to March 23, 2022. After deleting duplicate articles and title screening, 72 full-text articles were found relevant in this stage, and 17 eligible articles were finally selected based on the full-text studying. Ultimately, 11 criteria and tools were extracted from the reviewed articles:

3-1. Structured Interview (SI)

Studies have shown that interviews are the most important factor for ranking applicants in the final decision of residency programs. Therefore, it is necessary to investigate the factors that affect the interview scoring and the final ranking. Swanson et al. (2005) reported the results of a residency interview in both blind and non-blind states to his/her academic information.

Investigating a total of 935 pediatric residency candidates indicated that the mean USMLE score was 227 ± 17.1 and the mean score of blind and non-blind interview was 2.1 ± 0.8 (ranging from 6 (the poorest) to 1 (excellent)). The results showed a strong correlation between the interview scores and the final score of the admission committee during three years (ISC score: $r = 0.69$, $p < 0.0005$ & non-ISC score: $r = 0.54$, $r < 0.0005$). There was also a significant correlation between interview scores with the final ranking of the candidates during the three years (ISC score: $r = 0.49$, $p < 0.0005$ & non-ISC score: $r = 0.36$, $r < 0.0005$). In the linear regression model, the interview score was

a strong and influential variable in the final rank.

Since the interview score is a combination of what is available to the interviewer, it is difficult to evaluate the interview alone. The "halo effect" may play an important role in confirming the interviewer's expectations of the candidate. In addition to the easy and strict interviewer, gender differences and stereotypes may play a role in interview scoring. Therefore, techniques to control diversity and focus on criteria for selecting successful residents should be considered. It is suggested that blind interviews and behavioral assessments be included in the selection process. In addition, the admission committee members follow a more structured scoring system based on curriculum priorities (10).

Structured Interview (SI) is one of the instruments for measuring non-cognitive competencies, including two dimensions; the first dimension is content structure, which includes asking questions based on job analysis, asking similar questions of applicants, defining a framework, and controlling secondary information. The second is the evaluation structure which includes the use of behavior grading scales, similar interviewers among applicants and the interviewers' training. Meta-analysis studies show that SIs are reliable and credible predictors of job practice.

In this multidisciplinary and multicenter study, non-cognitive competencies such as following conscience, teamwork, adaptability, stress tolerance capacity,

communication skills, etc. were assessed through SI and USMLE, in which scores 1,2 were considered as cognitive competencies and the relationship between these two categories with residency competencies was investigated in terms of six areas of ACGME competency and overall practice.

At the end of the first year of residency, the validity of USMLE 1 for medical knowledge and patient care competencies was 0.17 (P <0.05), 0.17 (P <0.05) and 0.21 (P <0.05), 0.16 (P = 0.08) for USMLE 2 respectively. Therefore, USMLE scores positively correlated with one or both cognitive competencies. The predictive validity of SI scores for mid-year practice in communication skills, professionalism and PBLI was 0.20 (P <0.05), 0.08 (P = 0.36), and 1.8 (P <0.05), respectively. Also, the validity of these competencies was 0.22 (P <0.01), 0.20 (P <0.05), and 0.09 (P = 0.30) for SI scores, respectively, at year-end practice. In addition, the predictive validity of SI scores was confirmed for mid-year and end-of-year practice in patient care areas (R = 0.22. 0.23) (P <0.01) and overall practice (R = 0.18 and 0.19) (P <0.05), respectively. SI scores predicted overall residency practice at the end of the first year based on ACGME milestones, and interestingly, SI scores were better predictors of middle and end of the first year of residency practice than USMLE scores because patient care requires not only medical knowledge but also interpersonal skills, which play an important role in providing care. However, it does not mean that USMLE scores are not useful predictors, as both SI scores increase incremental validity of USMLE scores and USMLE scores increase incremental validity of SI scores in patient care. Therefore, both SI and USMLE scores are suggested be used as appropriate measures (11).

3-2. Letter of Recommendation (LoR)

Gross et al. (2020) conducted a retrospective cohort study on pediatric residency students during 2013-2017 to investigate residency admission criteria in relation to future clinical practice. In this study, the relationship between some criteria and the milestone scores of six ACGME competencies for the residency was investigated. Multivariate analysis showed that the top milestone scores in the pediatric residency course were significantly related to the LOR score, the number of core clerkship honors, medical school ranking, and having a master's degree, not PhD. There was, however, no relationship between milestone scores with interview score, AOA membership, type of university (public, private), gender, USMLE score 1, academic break of two years and longer after graduation. The study also revealed that LOR score was correlated with a higher mean score of five of the six competencies (except medical knowledge) while the internship scores were related to three competencies (medical knowledge, SBP, PBLI). Ultimately, this retrospective cohort study showed a significant relationship between LOR and the overall practice of the residents; and predicted their practice in five of the six competencies of ACGME (12).

Many pediatric residency candidates, due to the real or perceived importance of the LORs, seek to prepare and submit them through the dean or head of the department, while these individuals are less familiar with students' clinical and academic practice than the professors who spend more time with students Ackerman et al. (2019) conducted a study on LORs by the use of a 14-item electronic questionnaire among 163 AMSPDC participants. Time was spent on writing a LOR to obtain information and gain knowledge in 59% of the cases and 12% of them also stated that they didn't submit

a LoR for residency programs. Most LoRs were written by the head or course manager. Fifty percent of the respondents had stated that LoR writing should not be the duty of managers of large departments. The results of this study indicate that it is better to remove LoRs, but it is suggested that LoR writing is valuable for students with special qualifications (13).

Saudek et al. (2018) conducted a national cross-sectional study on the most important features of LoR, applicants' competencies, and the strength of the LoRs provided by the pediatric residency and flow program managers. In response to the question "How important are letters of recommendation in your overall perception of the applicant?" 399 respondents (85%) considered them important, while 418 (89%) also stated that a well-constructed LoR can make a weak applicant desirable, and 296 (63%) also stated that a poorly-constructed LoR can make a strong candidate less desirable. The findings of this national survey showed that LoRs influence the decision of flow and residency program managers both positively and negatively. LoRs consist of key elements that indicate different degrees of approval of an applicant (14, 15).

3-3. Multiple Mini-Interview (MMI)

Dore et al. (2010) reported the results of their three cohort studies on the admission process for pediatrics, gynecology, and internal medicine residency at McMaster and Alberta Universities using MMI. All candidates went through the stations where there was a separate question in each station and there were two minutes to study the scenario on the door of the room before entering the station, and an they finally attended an eight-min interview session about the scenario. The station content was designed based on the CANMED framework and the evaluator evaluated communication skills, discussion power and overall practice

using a rating scale in each station. Unprofessional behaviors were also reported as a red flag during the interview and led to the candidate rejection. Overall, MMI reliability with seven stations relatively acceptable was within 0.55-0.72. A total of 88% of the candidates believed that they had been able to demonstrate their competencies properly through MMI, and 77% stated that specialized knowledge was not required at the stations (16).

3-4. P-Mex

Considering the competitive nature of residency selection in many residency programs, it is recommended that final selection should be based on benchmarking standards after a normative evaluation in order to better distinguish candidates from the pool (17). Evaluating Professionalism is a key part of any admission and selection process. Studies show that professionalism has a high predictive validity. Professionalism can be assessed through SIs, LoR, MMI, and situational judgment test (SJT). Previous studies have reported high predictive validity for MMI and SJT (18-21) and low predictive validity has also been reported for SIs (18). Bajwa et al. showed that P-MEX scores among 195 pediatric candidates in Geneva predicted attitude and personality, global and final scores at the end of the first year of residency, but did not predict knowledge, skills and clinical reasoning scores. P-MEX scores were significantly related to SLR scores ($r = 0.25$, $P = 0.036$), SI scores ($r = 0.34$, $P = 0.004$) and global scores ($r = 0.48$, $P <0.001$). P-MEX scores were significantly related to the final admission result ($R = 0.56$, $P <0.001$) and this test was a strong predictor of the admission result in both 2012 and 2013. According to the results of logistic regression in 2012, the percentage of impact weight of the standardized LoR, SI and P-MEX was 18%, 25%, and 57%, which was regarded as acceptable by the admission committee. In a study

17164

conducted in 2013, the reliability of SLR, SI, and P-MEX combination was reported as 0.74.

P-MEX focuses on professional practice; and was implemented under standardized conditions through direct observation, so the researchers proposed the implementation of P-MEX with three standard cases along with other instruments such as SLR and SI or part of a complete MMI to achieve a better understanding of the behavior of pediatric residency applicants. The resources required to perform P-MEX with a standard patient are less than the cost of remediating a resident with professionalism issues (17).

Triangulation improves validity and reliability; therefore, direct observation of residency applicant's behaviors through interviews, MMI, and indirect observation of behaviors, through LoRs and tests, is a better combination for assessing professionalism during the residency process (19-22). P-MEX is a 21-item MINI-CEX direct observation instrument that assesses the physician-patient relationship, rethinking skills, time management, and interprofessional skills during a clinical encounter. Bajuva et al. (2012-2013) investigated the validity and applicability of P-MEX based on standard patients in pediatric residency admission. Admission begins with an assessment of cognitive competency through federal and university exam scores, review of resumes, and previous publications. However, it is needed to obtain a minimum score in order to be on the interview list. Non-cognitive competencies are assessed through scores obtained through standard LoR, SI and global faculty scoring, and a P-MEX score is added.

The interrater reliability was reported to be 0.51, 0.66, 0.87, and 0.36 for SLR, SI, global assessment, and P-MEX, respectively in this study. The G-factor for

P-MEX was obtained 0.45, 0.67 and 0.65 for three, seven, and ten standard patients, respectively (23).

3-5. Assessment Letter for Pediatrics (ALPs)

Narrative Letter of Recommendation (NLOR) is the most unreliable instrument in the residency admission process, which includes individual endorsement of non-cognitive domains such as professionalism and communication skills; and studies have reported poor reliability and low predictive validity for it. It is difficult to interpret and score the LoRs and differentiate the candidates accordingly. Thus, in the mid-1990s, LoRs were standardized based on expected competencies in the pediatric field and were called ALPS, which included competencies in pediatric specialties such as professional integrity, scientific curiosity, patient management skills, autonomy and organization, teamwork and partnership skills, and communication skills. ALPS consists of background information, assessment of the expected competencies of the pediatricians, comparison of competencies, and a comment section. Approximately, one year before the admission, the forms are completed by two professors selected by the candidate and sent confidentially to the residency program. In Bajwa et al.'s study (2017), Cronbach's alpha, G coefficient and PHI coefficient for ALPS were reported to be 0.93, 0.59 and 0.58, respectively. ALPS scores were correlated with both SI and global scores as well as the outcome of the final decision; therefore, these forms can be used with further remediation for resident admission. The weak positive correlation of ALPS scores with SI and global scores indicates that ALPS assesses competencies that are not assessed by SI and global assessments. ALPS does not have the limitations of NLOR and their interpretation and scoring

are facilitated due to their structured nature (24).

3-6. Situational Judgment Test (SJT)

Today, despite being emphasized, the assessment of professionalism and interpersonal skills is not considered in the admission process of medical schools, and as a result, deficiencies in this area can lead to resident remediation (11, 25). In a typical situational judgment test (SJT), candidates are given a written or video scenario, and they have to choose from a list of actions, which may range from choosing the best action to prioritizing and ordering effectiveness. SGT is an instrument used in residency admission processes in countries such as Belgium, Singapore, Canada, and Australia. Some evidence suggests that SJTs are useful predictors of short-term and long-term implications (20, 26, 27). Results of a study by Cullen et al. (2020) showed that SJT scores were not correlated with USMLE STEP 1 scores, but they were correlated with USMLE STEP 2, and 3 scores. USMLE scores of steps 1, 2, and 3 did not correlate with medical knowledge and patient care competencies. SJT scores are good predictors of overall practice in ACGME domains and have both concurrent and predictive validity. Concurrent validities of SJT for the areas of practice-based learning and improvement (PBLI), systems-based practice (SBP) and interpersonal communication skills were r = 0.13, P = 0.037, r = 0.13, P = 0.049; r = 0.14, P = 0.032, respectively, and predictive validity for PBLI, SBP, professionalism and interpersonal communication skills and patient care was r = 0.15, P = 0.037; r = 0.15, P = 0.41, r = 0.16, P = 0.022; r = 0.17, P = 0.015; r = 0.16, P = 0.022, respectively (28).

3-7. Scholar activities

The Canadian Medical Education Directives (CAN MED) for specialists refer to scholar activities as an essential competency for physicians. However, there is no clear information on the level of attention paid to scholar activities during residency selection; and the applicants tend to know the criteria that have the greatest impact on obtaining a higher ranking by their chosen residency program. Lukings et al. (2020) reviewed the information contained in the websites and programs and the guidelines of various programs for resident admission using specific keywords and the relevant information was extracted. About 51 residency programs in seven medical schools, family medicine programs 41% (7 out of 17), pediatric programs 71% (12 out of 17) and internal medicine residency programs 65% (11 out of 17) explicitly announced their interest in applicants with scholar activities. However, examples of scholar activities must also be stated in various programs. The examples of scholar activities include quality improvement activities, curriculum development, having an MS or PhD degree, etc. (29).

3-8. Global assessment

Many programs also rely on subjective assessment by experienced educators within residency. Ozuah investigated the relationship between global assessment by the pediatric residency selection committee and their clinical and cognitive performance during residency. In this prospective study, 227 pediatric applicants from 1992-1997 were surveyed. The selection committee consisted of 20 members with an average of ten years of experience in resident selection. Important factors from the point of view of the committee included interview, dean's letter, written comments from clinical rotations, clinical grades, and LoR.

After admission and 12, 24 and 36 months after the residency training courses, clinical performance was assessed using the global rating scale used by the resident

admission committee by four chief residents who were relatively blind to each other, and cognitive competency was assessed using an absolute American Board of Pediatrics (ABP) score at the end of the first, second and third years, the result of which revealed a significantly positive and high agreement coefficient (kappa = 0.75, p <0.0001). Also, residents with poor scores upon admission had poor clinical practice evaluation at the aforementioned three time periods with a downward trend. There was a positive and significant relationship between ISC scores and ABP scores during the residency period. The findings showed that the opinions of experienced professors should be considered as a valuable resource in the list of residency selection criteria (30).

3-9. Competency-based assessment center

There are competency-based assessment centers in the UK that are used to select general practitioners and have shown good predictive validity because more accurate evaluation of candidates is carried out. The content of this evaluation is determined based on the results of a job analysis, and the areas of competency evaluation are determined accordingly. Randall et al. (2006) performed a Multi-Source & Multi-Method study to determine the areas of competency of a pediatrician, and after determining the desired competencies by the technical and specialized committee, the assessment instrument based on the identified competencies were prepared observing psychometric principles; and evaluators received the necessary training. The evaluation content in the present study included a structured interview and three other activities including simulated counseling (with parents and children), teamwork, and a written reflection test. The results showed a positive and significant relationship between the final result of the structured interview and the final result of the non-interview evaluations (p <0.05). Candidates believed that the assessment center performed a more fair assessment and provided a better opportunity to demonstrate their competencies than other selection processes they had previously experienced. They also frequently expressed that the evaluated content was relevant to the scope of the pediatrician' job and also helped them to learn about their strengths and weaknesses (31).

3-10. University grades

Saudek et al. (2020) stated that based on the results of their three-year study on the evaluation of the overall residency practice as well as in the study of 203 pediatric residents during the years 2014-2017, the predictor variables related to the pre-residency practice include university grades (especially internship grades and interview scores (r = 0.3-0.6, p <0.005) and were not significantly correlated with USMLE and COMLEX scores (32). Ingram et al. (2021) state that the scores of the basic sections of the internship are considered as one of the important predictors of future residency practice. However, the components of clinical scores and judgment of student practice are complex and difficult to understand. Internship scores are obtained from the evaluations of clinical professors and practice in standardized tests. Scores may also include other components such as practice in objectively structured clinical examinations, practice in simulated situations, presentations, oral examinations, and so on. In a study conducted at the University of Alabama at Birmingham, 3947 medical students were evaluated in three areas: internal medicine, surgery, and pediatrics. Of these, 1075 (27.2%) were related to the pediatric ward. Factor analysis showed that one factor explains the variance for all internships including similarity, application of

knowledge, interview skills, physical examination skills, oral presentation skills, clinical reasoning, ward and clinic tasks, and case registration (33).

3-11. USMLE scores

Although USMLE scores are not related to clinical practice in some residency programs, due to its being standardized, it is used as a screening instrument for deciding to invite for interviews (10). USMLE scores of 1.2 are usually used as cognitive competencies. Patient care is considered not only to store medical knowledge but also to have desirable interpersonal skills. However, it does not mean that USMLE scores are not useful predictors, as SI scores increase incremental validity of USMLE scores and from the other way round, USMLE scores increase incremental validity of SI scores in patient care. Therefore, the results suggest that both SI and USMLE scores can be appropriately implemented (11).

It is, then, suggested that future studies be done in various specialty fields according to the expected competencies and focused studies on validity and reliability of various tools are necessary.

4- DISCUSSION

Rapid changes in health care delivery and speciality workforce tasks necessitate explorations for essential competencies in each field (34-36). Many academic and regulatory bodies define Competency frameworks for the directors of programs to perform accordingly. Despite all efforts in this regard, performance gaps are identified and reported in many studies (6, 37, 38). In this synthesis study we tried to collect the criteria and methods used in the selection of pediatrics residents. According to the reported findings, expected competencies include cognitive and non-cognitive competencies. In the cognitive dimension, screening the applicant pool by USMLE scores as a valid and reliable tool is logical. Williams

et al. (2020) in their retrospective cross sectional study revealed that the USMLE step 1 cutoff score can be used as an initial filter for applicant selection (39). The non-cognitive dimension including professionalism, personality traits and so on should be also planned to evaluate. Brothers (2007) reported that subjective evaluations of personal characteristics and letters of reference likely predict future clinical performance (40, 41) and USMLE scores along with the academic grades predict subsequent formalized testing in the course (41).

5- CONCLUSION

Studies show that the criteria for selecting and admitting pediatric residents should be based on the framework of expected competencies, professional tasks, and required roles, while the cognitive and non-cognitive competencies required in specialty fields should be also taken into account. Using a benchmark or a single tool is not a good option; so various tools have been used in most of the studies. Further studies are needed to examine the relationship between the admission criteria and successful future practice. It is also recommended to carry out meta-analysis studies to investigate the psychometric properties of these criteria.

6- ACKNOWLEDGE

7- REFERENCES

1. Selber JC TW, Koshy J, Ibrahim A, Liu J, Butler C. Correlation between trainee candidate selection criteria and subsequent performance. Journal of the American College of Surgeons 2014 219(5):951-7.

2. DeZee KJ TM, Mintz M, Durning SJ. Letters of recommendation: rating, writing, and reading by clerkship directors

of internal medicine. Teaching and learning in medicine 2009 21(2):153-8.

3. Borges NJ SS. Work style preferences among medical specialties. Journal of Vocational Behavior. 2014 84(3):303-6.

4. T. P. Can we more wisely choose residents? World Neurosurgery 2014; 82(3-4):e553-4.

5. Hoffman BM CM, Kuo PC. Personality differences between surgery residents, nonsurgery residents, and medical students. Surgery. 2010 148(2):187-93.

6. Altmaier EM MG, Wood P, Ross RR, Bartley J, Smith W. 1990 Feb 1; 85(2): Defining successful performance among pediatric residents. Pediatrics. 1990; 85(2):139-43.

7. Ahmadipour H SE. Investigating Burnout in Medical Residents at Kerman University of Medical Sciences. Health_Based Research 2020; 6(2):129-37.

8. Kalani SD AP, Oreyzi HR, Azizkhani R, Adibi P. Prevalence of burnout syndrome among the residents in Isfahan University of Medical Sciences, Isfahan, Iran. Journal of Isfahan Medical School. 2017 35(442):993-9.

9. Yaghmaei M HA, Jalali MM. Relationship between residents' success on the certifying examinations within–Training exam and internal evaluation. Research in Medical Education 2017 9(1):26-18.

10. Swanson WS HM, Master C, Gallagher PR, Mauro AE, Ludwig S. The impact of the interview in pediatric residency selection. Ambulatory Pediatrics 2005 5(4):216-20.

11. Marcus-Blank B DJ, Braman JP, Borman-Shoap E, Tiryaki E, Chipman J, Andrews JS, Sackett PR, Cullen MJ. Predicting performance of first-year residents: Correlations between structured interview, licensure exam, and competency scores in a multi-institutional study. Academic Medicine. 2019 94(3):378-87.

12. Gross C OHC, Winn AS, Lux SE, Michelson CD, Sectish T, Sox CM. Application factors associated with clinical performance during pediatric internship. Academic Pediatrics. 2020 1-6.

13. Ackerman AD FL. Should Pediatric Chairs Be Expected to Write Letters of Recommendation for All Students Applying to Pediatric Residency Programs? The Journal of pediatrics. 2019 208:3-4.

14. Saudek K SD, Treat R, Bartz P, Weigert R, Weisgerber M. Dear program director: deciphering letters of recommendation. Journal of graduate medical education. 2018 10(3):261-6.

15. Saudek K TR, Goldblatt M, Saudek D, Toth H, Weisgerber M. Pediatric, surgery, and internal medicine program director interpretations of letters of recommendation. Academic Medicine 2019 94:S64-8.

16. Dore KL KS, Ladhani M, Rolfson D, Kurtz D, Kulasegaram K, Cullimore AJ, Norman GR, Eva KW, Bates S, Reiter HI. The reliability and acceptability of the multiple mini-interview as a selection instrument for postgraduate admissions. Academic Medicine. 2010 85(10):S60-3.

17. Bajwa NM NM, Galetto-Lacour A, Posfay-Barbe K, Yudkowsky R, Park YS. Can Professionalism Mini-Evaluation Exercise Scores Predict Medical Residency Performance? Validity Evidence across Five Longitudinal Cohorts. Academic Medicine. 2019 94(11s):S57-63.

18. Marcus-Blank B DJ, Braman JP, Borman-Shoap E, Tiryaki E, Chipman J, Andrews JS, Sackett PR, Cullen MJ. Predicting performance of first-year residents: correlations between structured interview, licensure exam, and

competency scores in a multi-institutional study. Academic Medicine 2019 94(3):378-87.

19. Eva KW RH, Trinh K, Wasi P, Rosenfeld J, Norman GR. Predictive validity of the multiple mini-interview for selecting medical trainees. Med Educ. 2009; 43:767–75.

20. Patterson F LF, Kerrin M, Munro N, Irish B. The predictive validity of selection for entry into postgraduate training in general practice: Evidence from three longitudinal studies. Br J Gen Pract. 2013; 63:e734–e41.

21. 21. Patterson F, Rowett E, Hale R, Grant M, Roberts C, Cousans F, Martin S. The predictive validity of a situational judgment test and multiple-mini interview for entry into postgraduate training in Australia. BMC Med Educ 2016; 16:87.

22. Education. ACfGM. GME Data Resource Book 2017–2018 https://wwwacgmeorg/About-Us/Publications-and-Resources/Graduate-Medical-Education-Data-Resource-Book; Accessed July 12, 2019.

23. Bajwa NM, Rachel Yudkowsky, Dominique Belli, Nu Viet Vu, and Yoon Soo Park. "Improving the residency admissions process by integrating a professionalism assessment: a validity and feasibility study". Advances in Health Sciences Education 2017; 22(1):69-89.

24. Bajwa NM YR, Belli D, Vu NV, Park YS. Validity evidence for a residency admissions standardized assessment letter for pediatrics. Teaching and Learning in Medicine. 2018 30(2):173-83.

25. Cusimano MD YA, Tucker WS. An analysis of attrition from Canadian neurosurgery residency programs. Academic Medicine. 1999 74(8):925-31.

26. Lievens L SP. The validity of interpersonal skills assessment via situational judgment tests for predicting academic success and job performance. J Appl Psychol 2012; 97(2):460–8.

27. Patterson F LF, Kerrin M, Zibarras L, Carette B. Designing Selection Systems for Medicine: The importance of balancing predictive and political validity in high-stakes selection contexts. International Journal of Selection and Assessment. 2012 20(4):486-96.

28. Cullen MJ ZC, Marcus-Blank B, Braman JP, Tiryaki E, Konia M, Hunt MA, Lee MS, Van Heest A, Englander R, Sackett PR. Improving Our Ability to Predict Resident Applicant Performance: Validity Evidence for a Situational Judgment Test. Teaching and Learning in Medicine. 2020 18:1-14.

29. Lukings J BA, Stobbe K, Basha V, Brazier J, Dragomir D, Glibbery M, Kearney H, Knapp A, Levin D, Tucker D. Scholarly activity as a selection criterion in the Canadian Residency Matching Service (CaRMS): A review of published criteria by internal medicine, family medicine, and pediatrics programs. Canadian Medical Education Journal. 2020 11(3):e116–e21.

30. PO. O. Predicting residents' performance: A prospective study. BMC Medical Education 2002 2(1):1-4.

31. Randall R DH, Patterson F, Farrell K. Selecting doctors for postgraduate training in pediatrics using a competency based assessment center. Archives of disease in childhood. 2006 91(5):444-8.

32. Saudek K RA, Treat R, Pilon C, Auble B, Hahn D, Schuh A, Weisgerber M. A 3-Year Longitudinal Study Evaluating Predictors of Overall Resident Performance. Journal of Graduate Medical Education 2020 12(3):357-8.

33. Ingram MA PJ, Estrada CA, Zinski A, Williams WL. Are we measuring what matters? How student and clerkship characteristics influence clinical grading. Academic Medicine. 2021 96(2):241-8.

34. Wright B SI, Woloschuk W, Brenneis F. 2004 Jun 22; 170(13): Career choice of new medical students at three Canadian universities: family medicine versus specialty medicine. Cmaj. 2004; 170(3):1920-4.

35. Villanueva AM, Kaye, D., Abdelhak, S. S., & Morahan, P. S. Comparing selection criteria of residency directors and physicians' employers. Academic Medicine. 1995; 70(4):261–71.

36. Roberts C, Khanna P, Rigby L, Bartle E, Llewellyn A, Gustavs J, Newton L, Newcombe JP, Davies M, Thistlethwaite J, Lynam J. Utility of selection methods for specialist medical training: A BEME (best evidence medical education) systematic review: BEME guide no. 45. Med Teach 2018; 40:3–19.

37. Lüer S AC. Assessment of residency program outcomes via alumni surveys. Advances in medical education and practice. 2017; 8:307-15.

38. Aibana O SJ, FLoRes RJ, Love L. Bridging the gap: holistic review to increase diversity in graduate medical education. Academic Medicine 2019 94(8):1137-41.

39. Williams M KE, Pappas K, Uwemedimo O, Marrast L, Pekmezaris R, Martinez J. The impact of the United States Medical Licensing Exam (USMLE) step 1 cutoff scores on recruitment of underrepresented minorities in medicine: A retrospective cross-sectional study. Health Science Reports 2020 3(2):e2161.

40. Borowitz SM SF, Wilson WG. Mar 1; 154(3). Information collected during the residency match process does not predict clinical performance. Archives of pediatrics & adolescent medicine. 2000 154(3): 256-60.

41. Brothers TE WS. Importance of the faculty interview during the resident application process. Journal of surgical education 2007; 64(6):378-85.