

EQIP's First Year: A Step Closer to Higher Quality in Surgical Education.

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EQIP's First Year: A Step Closer to Higher Quality in Surgical Education

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OBJECTIVE: To describe the first year of the Educational Quality Improvement Program (EQIP)

DESIGN: The Educational Quality Improvement Program (EQIP) was formed by the Association of Program Directors in Surgery (APDS) in 2018 as a continuous educational quality improvement program. Over 18 months, thirteen discrete goals for the establishment of EQIP were refined and executed through a collaborative effort involving leaders in surgical education. Alpha and beta pilots were conducted to refine the data queries and collection processes. A highly-secure, doubly-deidentified database was created for the ingestion of resident and program data.

SETTING & PARTICIPANTS: 36 surgical training programs with 1264 trainees and 1500 faculty members were included in the dataset. 51,516 ERAS applications to programs were also included. Uni- and multi-variable analysis was then conducted.

RESULTS: EQIP was successfully deployed within the timeline described in 2020. Data from the ACGME, ABS, and ERAS were merged with manually entered data by programs and successfully ingested into the EQIP database. Interactive dashboards have been constructed for use by programs to compare to the national cohort. Risk-adjusted multivariable analysis suggests that increased time in a technical skills lab was associated with increased success on the ABS's Qualifying Examination, alone. Increased time in a technical skills lab and

the presence of a formal teaching curriculum were associated with increased success on both the ABS's Qualifying and Certifying Examination. Program type may be of some consequence in predicting success on the Qualifying Examination.

CONCLUSIONS: The APDS has proved the concept that a highly secure database for the purpose of continuous risk-adjusted quality improvement in surgical education can be successfully deployed. EQIP will continue to improve and hopes to include an increasing number of programs as the barriers to participation are overcome. (J Surg Ed 000:1–8. © 2022 Association of Program Directors in Surgery. Published by Elsevier Inc. All rights reserved.)

KEY WORDS: APDS, Educational Quality Improvement, Surgical Residency, Risk-adjusted

COMPETENCIES: Professionalism, Interpersonal and Communication Skills, Practice-Based Learning and Improvement, Systems-Based Practice

INTRODUCTION

The Educational Quality Improvement Program (EQIP) received its charter by the officers and executive committee of the Association of Program Directors in Surgery (APDS) in 2018. EQIP has been designed as “a continuous educational quality improvement program that will allow surgical Program Directors to assess their programs and make necessary changes to improve surgical training with the ultimate goal of producing the highest

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TABLE 1. Initial Goals for EQIP's First Year

1. Selection of data elements
2. Marketing strategy
3. Participant Use Agreement for Program Directors and Institutions
4. Development of the data entry interface
5. Development of an interactive dashboard for PDs to use
6. Data integrity/analysis/display of results
7. Data warehousing principles and security
8. EQIP Governance
9. EQIP Finance
10. Principles around the creation of multi-institutional collaboratives
11. Articulation of "best practices" in training programs based on results
12. Collaboration and communication with accrediting/certifying/allied organizations (ABS, ACGME, AAMC/ERAS, NRMP)
13. Integration of clinical outcomes data of early-career graduates

quality surgeons."¹ EQIP will allow data to inform training directors' educational decisions to improve their programs. Additionally, EQIP will help directors advocate for their residents and their programs and hopefully improve the care their patients receive.

In January of 2019, the APDS circulated a request for proposals to select an information management organization to assist with the project. The initial timeline for this project called for completion of an EQIP *beta* test with pilot programs by June 2021 followed by a nationwide launch for full EQIP by September 2021, and delivery of data and dashboards on a web page² back to participating EQIP programs by the Spring of 2022.

The conception and initial goals of EQIP have been described previously.³ The purpose of this manuscript is to report on the methodologic design and results of EQIP's national rollout in 2022.

METHODS

With approval from the APDS Executive Committee and officers to proceed with development of EQIP, a working group convened on a weekly basis 8 months prior to the release of the *beta* trial. This group included representatives from the Surgical Council on Resident Education (SCORE) and APDS. An initial set of goals for EQIP was agreed to by this working group with a target of June, 2021 for the *beta* test (Table 1).

¹ <https://apdsweb.s3.amazonaws.com/webfiles/docs/eqiplaunchletter%20V13.pdf>

² <https://eqipsurgery.org/>

³ Brunsvold ME, Fise TF, Hickey M, Jarman BT, Joshi ART, Klingensmith ME, Korndorffer JR Jr, Nfonsum VN, Relles DM, Smink DS, Harrington DT. The APDS General Surgery Education Quality Improvement Program (EQIP). *J Surg Educ.* 2022 Mar 29:S1931-7204(22)00050-2. doi: 10.1016/j.jsurg.2022.02.010. Epub ahead of print. PMID: 35365435.

The next phase of planning was focused on refining the list of data elements to be captured by the *alpha* and *beta* phases. An initial list of 40 elements was proposed. Each one was then evaluated based on importance, feasibility of obtaining, and labor required to obtain. As an example, the working group agreed that USMLE scores were high-priority, easy to obtain without much consumption of time. In contrast, the amount of time that incoming interns spent on an ICU rotation in medical school was felt to be medium priority, and while relatively easy to obtain directly from trainees, might be a time-consuming process.

Once the data element list had been refined, the group then set about determining with precision which data elements needed to be manually entered by program personnel vs. those that could be downloaded from existing databases. As an example, class rank was an element that required manual entry whereas USMLE results could be downloaded from the ERAS's program director Work Station (PDWS). This process resulted in a clear understanding of which organizations needed to be approached with a proposal to collaborate with EQIP: ERAS (AAMC), American Board of Surgery (ABS), ACGME, and NRMP.

Meanwhile, an EQIP task-force comprising 10 program directors from the APDS began to develop a marketing strategy directed toward programs. First, a one-page description of EQIP was written including a mission statement, goals of the project, and timeline. This would be used for solicitation of programs for the beta and national rollouts, as well as to reach out to potential organizational collaborators. The task force distributed a survey to all ACGME-accredited general surgery training programs in the US. It asked about basic demographics of the program (size, university affiliation), current educational resources available at their individual programs, their general interest in participating in EQIP, and any challenges they foresaw with the development of a continuous educational quality improvement program.

The working group quickly determined that the most important constituency for broad and successful adoption of EQIP was the administrators and coordinators of training programs, represented by the Association of Residency Administrators in Surgery (ARAS). The working group had a series of meetings with ARAS leaders to keep them updated about the vision, scope, and progress of EQIP, as well as to solicit important feedback from the that would be formative in its execution. EQIP leadership also approached trainees through the RAS of the ACS and the resident representatives on the APDS's Board of Directors.

At this point, the working group paused to consider planning for the possible incorporation of clinical data into EQIP. Several issues were considered. First, the

inclusion of patient data would require a level of data-security not previously planned for. Second, it would require willingness on the part of programs and organizational collaborators to participate with the knowledge that trainee and program data would be linked to clinical (albeit, de-identified) data. The working group concluded that an IT platform capable of engineering a highly-secure database, and also skilled with ingesting identified trainee and program data, pairing it with clinical data of recent trainees, but then de-identifying all data in the database would be necessary. A suitable vendor (Thought Leadership Institute) was identified for this purpose. This strategic decision would prove to be highly valuable as it allowed the working group to then begin to engage with potential organizational partners for the purpose of requesting important data elements.

The Alpha Pilot

The next step in EQIP development was an *alpha* test to be conducted amongst 4 training programs represented by program directors in the working group. The principal goals of this test were to measure the time burden of data entry and to fine-tune the questions being asked regarding programs and their trainees. Over a 2-week period, each of the 4 program directors completed online surveys (Survey Monkey) to populate the alpha database. It took between 5-9 minutes to enter data on each trainee and between 30-120 minutes for data entry about programs.

Valuable lessons were also learned about specific items of inquiry. For example, it was hoped that demographic characteristics could be collected about both faculty and trainees. PDs in this phase noted that there was no central repository for self-identified demographics for faculty and that the demographics listed for trainees in Web-ADS were entered by PDs and PAs, rather than by trainees themselves.

The Beta Pilot

The working group now had clarity on the feasibility of reaching its goal of deploying a *beta* test by June, 2021. The EQIP task-force selected 26 programs as *beta*-test sites (Table 2). Each program completed an online survey (Survey Monkey) about characteristics of their training environment. In addition, each completed an online survey for each of its trainees in the 2019-2020 academic year. By the end of April, 2021, 26 programs had completed program surveys and 754 individual trainee surveys.

This *beta* test proved that the data entry form was feasible and not overly burdensome. Valuable lessons were gained about how to format some of the questions and

TABLE 2. Phases of EQIP Data Collection

	Source	Document
1. Document download	ACGME	Program Data
	WebADS	Resident Rosters (Active, Graduated, Left Program)
	AY 2020-2021	Faculty Roster Participating Sites Faculty Scholarly Activity Resident Scholarly Activity Milestones (Mid-year and Year-end) Common Program Requirement Questions Graduating Chief Resident Case Logs
	ERAS	Applicant archives AY 2016-2021
	ABS	2021 ABSITE reports 2018-2020 3-yr QE/CE Summary of Performance
2. Completion of surveys	Local	Program Survey
3. Upload to EQIP	Local	Trainee Survey

what parts of the surveys were more difficult to complete.

Design of the EQIP Database

In parallel, the EQIP team, working with Thought Leadership Institute, designed a fully-independent database capable of ingesting and deidentifying all data prior to analysis. Data used for EQIP was collected by each participating program and deidentified by the use of a mathematical hashing algorithm provided to them by EQIP. This algorithm converted data fields containing identifying information of both program identifiers and resident identifiers into a scrambled numerical value, called a hash value. The files with the deidentified data were then uploaded to a secured file location specific to the individual program, and only accessible to their program staff and the EQIP. The data in these files was then validated by EQIP as complete and without any lost data. Once the data was deemed valid, a second mathematical hashing algorithm was used to again scramble the already scrambled data fields containing identifying information. Once the second deidentification was complete, the file containing the singly-deidentified data was deleted from the secure folder, and the twice-deidentified version of the data was ingested into EQIP for use in the system's dashboards and queries (Fig. 1).

This hashing prevented identifiable data of programs and their trainees from being electronically transmitted outside of the program's secured network environment. The double-hashing ensured that any security breach of the EQIP system would not result in personally-

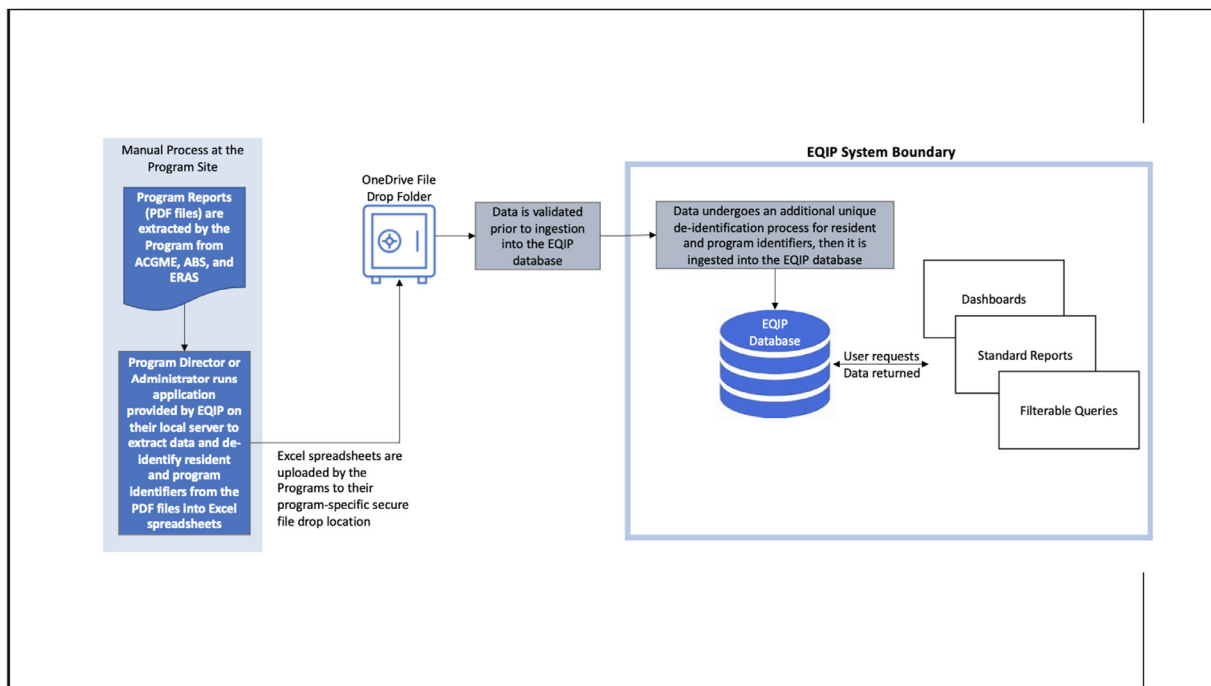


FIGURE 1. EQIP data workflow.

identifiable information spillage and ensured that reversing the deidentification could not be accomplished without knowledge of both algorithms.

This design ensured that neither APDS or EQIP would at any point be in possession of any identifiable program or trainee data. This was felt to be an important characteristic to protect the APDS and EQIP from legal queries relating to malpractice and trainee performance, and to engender confidence from program directors and institutions that their identifiable data was secure. The data aggregation process consisted of 3 phases: document download (from the ABS⁴, ACGME WebADS⁵, and ERAS⁶), completion of local surveys, and upload to EQIP (Table 2).

RESULTS

Overall, 36 programs submitted manually entered data about their programs. They submitted manually entered data for 1117 individual trainees. From WebADS, data about 1264 unique trainees and 1500 unique faculty members were downloaded. Two thousand three hundred fourteen types of operative procedures were included. From ERAS, 55,516 unique applications to the 36 programs were included. From the ABS, 1207 ABSITE

results from academic year 2020 to 2021, 467 trainees with Qualifying Exam results, and 391 with Certifying Exam results were included.

Data Analysis and Creation of Interactive Graphical Results

Using Google Data Studio, specific components of the submitted data were tabulated and categorized by program size (large, medium, and small) and type of program (university, university-affiliated, and independent). These basic descriptors allow EQIP participants to graphically compare their programs for the 46 different data elements collected by EQIP. Table 3 depicts the specific metrics used for simple comparative analysis.

Interactive graphs were produced for display on program-accessible dashboards (Fig. 2).

Risk-Adjusted Performance

One of EQIP's most important goals was to provide program directors a risk-adjusted assessment of their training program's performance using success rates on the American Board of Surgery (ABS) Qualifying Exam (QE) and Certifying Exam (CE) as the outcome measures. ABS certification data from 28 EQIP programs was able to be used for risk-adjusted analysis. This risk adjusted assessment was done in 4 steps:

⁴<https://www.absurgery.org/default.jsp?index>

⁵<https://www.acgme.org/data-collection-systems/overview/>

⁶<https://myeras.aamc.org/myeras-web/#/landing>

TABLE 3. Metrics Used for Univariable Analysis

Metric	Source
ABS QE 3-yr results	ABS
ABS CE 3-yr results	ABS
2021 ABSITE results (including percentiles, percent correct, and sub-category results)	ABS
Number of Approved Chief Residents	Program Survey
Quality database participation (NSQIP, Vizient, Crimson)	Program Survey
Specialty Program Designation (National and state trauma designation, ACS-Accredited Educational Institute, NCI)	Program Survey
Simulation resources (size of lab, laparoscopy/endoscopy simulator, simulation mannequin)	Program Survey
Curricular components (wellness program, communications program, mock oral examinations)	Program Survey
Number of licensed beds	Program Survey
PD and chair turnover	Program Survey
Dedicated time for PDs, APDs, and Program Administrators	Program Survey
Number of students, NPs, Pas	Program Survey
Gender of trainees	ACGME
Remediation/Probation of trainees	Resident Survey
Characteristics of applicants (Age, Race/ethnicity, AOA status, USMLE Step 1 & 2 scores, type of degree, location of medical school)	ERAS
Mean case log data (by defined category)	ACGME

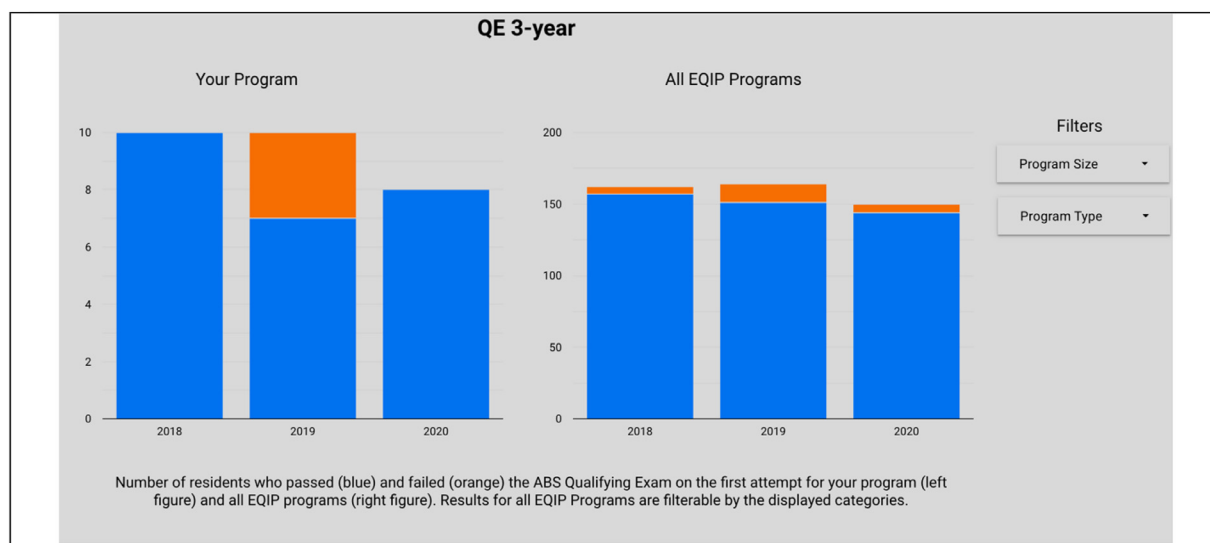
1. The creation of a 50% random sample of the EQIP data file which served as the dataset to build the predictive equation (Supplementary Table 1).
2. Performance of a univariable analysis on all the data elements by either ANOVA or Pearson correlation, as

appropriate, on this 50% sample (Supplementary Tables 2 and 3). Variables that attained statistical significance at the <0.20 level for the QE and CE (Supplementary Table 4).

3. All the variables on univariable analysis which attained a p-value of <0.20 were used to run an ordinary least squares step-wise linear regression equation using these variables to create the predictive equations – one predictive equation for the QE and the second equation for the CE.
4. The use of these predictive equations against the entire data set to allow for the creation of observed passage rates for the program to the expected (predicted) passage rates for the program. The variables that entered the equation for the QE and CE predictive equations are listed in Supplementary Table 5.

These O/E ratios for both the QE and the CE were then plotted to give a familiar “caterpillar plot” (Figs. 3 and 4).

Any conclusions from this first year’s worth of EQIP data should be qualified by the limited number of programs that were able to be used for analysis. That being said, a few notable findings bear mentioning. The multivariable equation for QE identified time in a technical skills lab as associated with improved pass rates on the ABS QE. The multivariable equations for CE identified time in a technical skills lab and the presence of a formal teaching curriculum as associated with increased success on both ABS QE and CE. Both the technical skills lab and formal teaching curriculum might reflect that programs that invest in more intentional training produce graduates better equipped for the QE and CE (Fig. 5).

**FIGURE 2.** Example of graphical display of comparative graphical data.

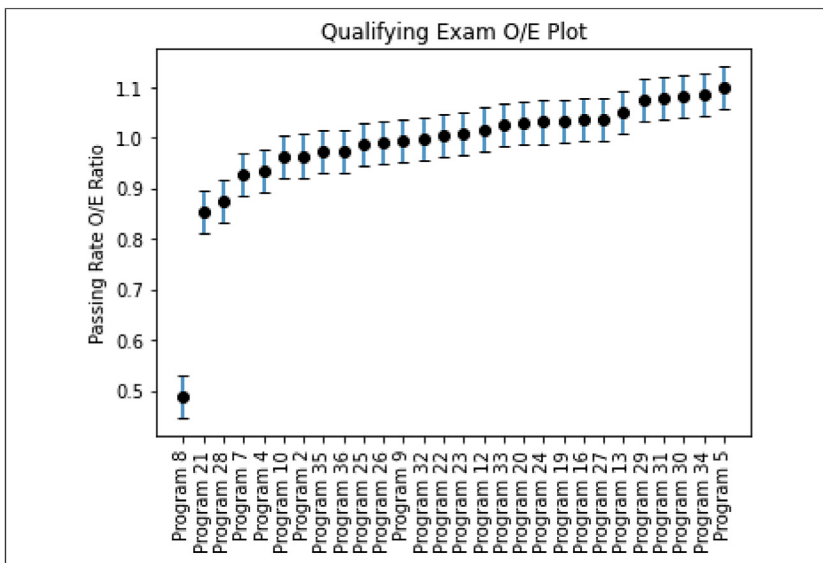


FIGURE 3. Odds: Expected ratio for ABS qualifying examination.

The impact of program type in these equations is also notable with better QE results from university and university-affiliated programs as compared to independent programs. This may reflect true differences in training and outcomes or may reflect that other endpoints of performance such as clinical outcomes might be a better marker of our general surgical training programs. It is important to note that EQIP currently is reporting on only 36 of the over 325 surgical training programs in the US and that the data presented cannot be generalized to all programs.

There were many Defined Categories in the case log data which showed an association on univariable

analysis to success rates on the ABS QE and CE. Some of these associations were positive associations (high number of that defined category associated with higher pass rate) and some associations were negative associations (lower number of that defined category associated with higher pass rate). The “additional procedure” category was negatively associated with QE pass rate on univariable and multi-variable analysis. “Additional procedures” are generally minor cases like incision & drainage, excision of cutaneous lesions, and muscle biopsies. The relative technical ease of this category and the low number of these “additional procedures” being logged in high QE pass rate programs might suggest that more complex

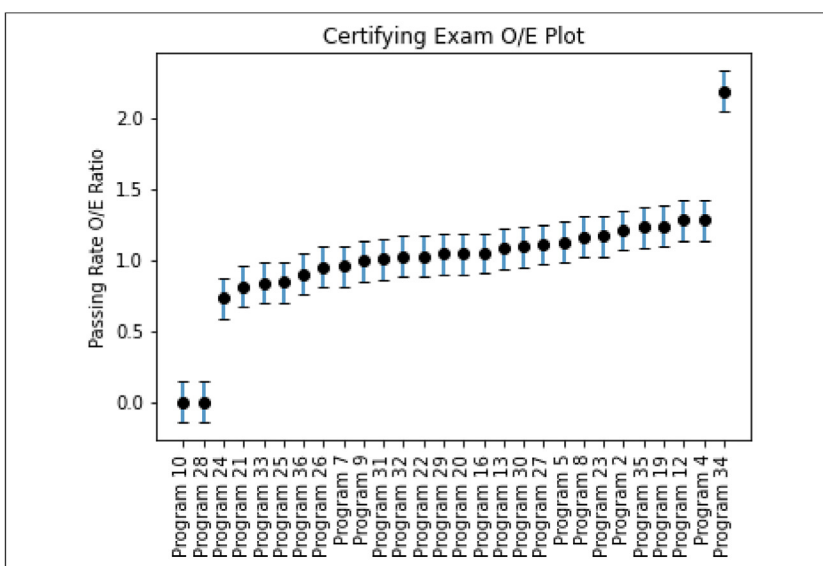


FIGURE 4. Odds: Expected ratio for ABS certifying examination.

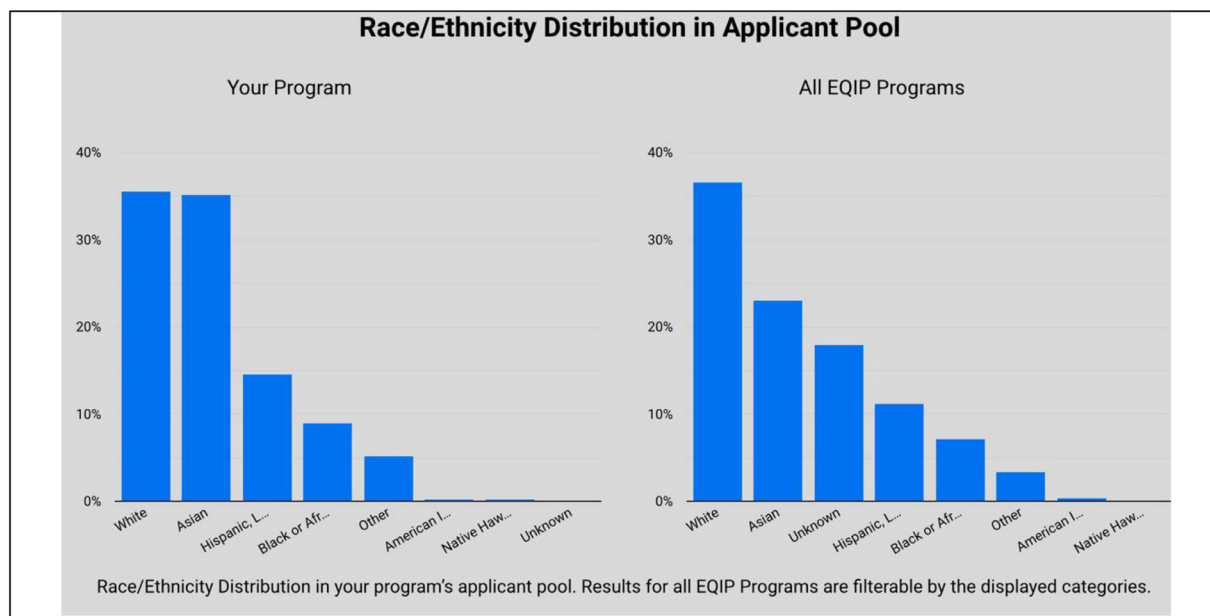


FIGURE 5. Example of ERAS applicant data within EQIP.

and technically challenging cases are being logged by the residents in that program.

CONCLUSIONS

Over a 2-year period, EQIP has completed an *alpha*- and *beta*-pilot, along with a first year of data gathering and analysis, and delivered a finished product to the 36 participating programs in the spring of 2022. EQIP has been able to give participating program directors meaningful, comparative data through interactive dashboards on their programs. With this information, the programs will hopefully be able to run quality improvement cycles and advocate for needed resources for their programs thereby improving the education their residents receive.

It is worth noting that of the goals initially articulated in 2020 (Table 1), all but 2 were accomplished. The development of best practices will derive in years to come from increased participation by programs. And, integration of clinical outcomes data is an important goal for future data queries. The rigorous de-identification solution built by EQIP will pay rich dividends in this regard.

The future directions of EQIP are to annually reassess and redefine its data elements, recruit more programs to participate, and to improve the method for data collection to minimize the burden on the individual training programs. The risk-adjusted analysis of the first year was limited by having a small number of years of data collection, but as the EQIP data files mature, the predictive equations should yield more valuable data. The eventual

goal for this analysis is to build the predictive equations with 3 years of data and then use the next 3 years to create the observed-to-expected plots. When the dataset is more mature and the analysis more robust, EQIP should also begin to develop recommendations for best practice. Additional future plans for EQIP include linking these educational and training variables to clinical outcomes. With its database and web-platform now having been built, EQIP is easily scalable and applicable for other surgical specialties who are interested in continuous educational quality improvement.

DEI CONSIDERATIONS

It was a foundational principle of EQIP to incorporate robust analysis of demographic characteristics to be included in the database for analysis. Multiple hurdles were encountered in this goal. Until recently, during a surgeon's professional development including registration for ERAS and the NRMP, matriculation into an ACGME-accredited programs, and the journey through the ABS-certification process, each individual's self-identified demographic data is collected exactly once. Only ERAS had self-identified data-entry fields for "gender," racial identity, and military service. Missing values included sexual orientation and ethnicity. In addition, rather than use more commonly recognized US Census Bureau classifications for race, ERAS has many more options—for example "Asian-Taiwanese" or "Asian-Indian" instead of "Asian." EQIP entertained constructing de-identified data forms to solicit directly from trainees

these desired data but had concerns about completion rates and inability to deidentify. It is a fervent goal of EQIP to be able to include self-identified demographic characteristics of both surgical trainees and faculty in the coming years as we feel this will be an important means of measuring the impact of diversity in the quality of training programs.

Compromises and Limitations

Because of the ambitious timeline and limitations in both personnel and financial resources, many compromises had to be made in EQIP's first year. The most important was the use of ERAS data. Annual archived ERAS data is accessible through the Program Director Workstation and includes hundreds of data fields for every individual who submits an application to a given program. It was originally hoped that we would be able to extract from these lists of applicants actual individuals who embarked on training at an individual institution so that we could then match their USMLE/COMLEX data, honor society inclusion, and demographic data (limited as it was) into the EQIP database. However, a technical solution could not be found to do that within the constraints of budget, time, and personnel. Instead, we used ERAS data to provide data to programs about characteristics of applicants to their programs (instead of trainees within their programs).

Other limitations were noted in accruing large numbers of programs into this first year of data collection. For reasons of legal protection (for both programs and the APDS), participant use agreements (signed by institutional DIOs and Chairs of Surgery) were required for all programs who wished to have their data incorporated

into EQIP. This presented different levels of challenge at interested programs. The 2 primary hurdles were dramatically varying levels of scrutiny and concern by institutional legal and IT offices. At least a dozen interested programs were unable to secure signed PUAs in time for participation in EQIP 2022 because of inability to clear these institutional hurdles. It is a goal of EQIP to streamline the PUA process through a technical solution that requires no institutional IT resources and an even clearer data integrity solution to assuage legal concerns.

Organizational Collaboration

As noted above, EQIP will continue to mature in years to come to make it increasingly easy for programs to participate. While some of that progress will be derived from programming solutions to the EQIP database, we are hopeful that further cooperation with other accrediting and certifying organizations will come to fruition. The more data that can be incorporated directly from existing databases at the ACGME, ABS, ERAS, and the NRMP, the less manual data entry will be needed by participating programs and the more trustworthy will the data itself be considered. Furthermore, with the now executed proof of concept that a highly secure, doubly-deidentified database can be used for comprehensive data-sharing, the community of organizations that strive to govern and improve surgical training in the US should feel more comfortable about working together for that common goal.

SUPPLEMENTARY INFORMATION

Supplementary material associated with this article can be found in the online version at [doi:10.1016/j.jsurg.2022.05.018](https://doi.org/10.1016/j.jsurg.2022.05.018).