

Review

Possible relationship between rural surgical rotations during a residency period and an increased number of general surgeons in rural areas: a systematic review

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Abstract

Objective: Rural surgical training for residents is expected to increase the number of general surgeons working in rural areas; however, the impact of rural training programs to ensure such surgeons remains to be determined. Therefore, we reviewed the relevance of rural surgical rotation to the increase of general surgeons in rural areas.

Materials and Methods: Studies on the outcomes of rural surgical rotations during the residency period in comparison to non-rural surgical rotations were retrieved using electronic databases through April 2022.

Results: Among the 514 articles, five were eligible for review. All studies were published in the United States. Four studies reported an increased number of general surgeons in rural areas owing to rural surgical rotations. A meta-analysis of all studies showed a positive impact on the number of general surgeons in rural areas (odds ratio=2.19, 95% confidence interval=1.23–3.91). The programs generally ranged from 2 to 12 months with extensive experience with minor surgery and subspecialties necessary for surgery.

Conclusions: Rural surgical rotations during the residency period can increase the number of general surgeons working in rural areas. Further studies are needed to evaluate the placement of general surgeons in rural areas.

Key words: education, internship, residency, rural health services, rural surgery

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Introduction

Rural dwellers generally face poorer health conditions than urban dwellers owing to a lack of easy access to medical care^{1, 2)}. For instance, cancer is a common contributor to rising mortality³⁾, and the rural-urban disparity in cancer treatment is attributed to difficulty in accessing specialists in rural areas, where there is a shortage of surgeons^{4–7)}. Hospitals are financially supported to provide surgical services, and there is a need for an increased number of general surgeons in rural areas⁸⁾. However, surgeons in rural practice

are often required to have a broad scope of practice (i.e., common gynecological and urological conditions, otorhinolaryngological conditions, injury and fracture emergencies, etc.) with special experience in the surgical management of these issues^{9–12)}.

Physicians, including surgeons born and/or raised in rural areas, tend to work in rural facilities more frequently than those of an urban origin. Thus, a surgeon's native environment is a factor affecting the placement of surgeons in rural areas¹³⁾. During residency, surgical rotations in rural areas have been conducted in some cases^{14–21)}; thus, these training programs may also increase the number of general surgeons in rural areas.

However, the impact of such surgical residency on ensuring that general surgeons work in rural areas remains undetermined. Therefore, through a systematic review, we investigated whether rural surgical rotations during residency can increase the number of general surgeons working in rural areas.

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Materials and Methods

The present study was performed in accordance with the guidelines outlined in the Preferred Reporting Items for Systematic Reviews and Meta-Analysis (PRISMA)²². The MEDLINE and CENTRAL databases were searched for studies published before April 4th, 2022. The following combinations of keywords were used: (“Rural Health Services” OR “Rural Health” OR “Hospitals, Rural”) AND (“General Surgery”[Mesh] OR “Surgeons”[Mesh]) AND (“Internship and Residency”[Mesh] OR “Clinical Competence”[Mesh] OR “Specialization” [Mesh] OR “Education, Medical, Graduate”[Mesh] OR “Clinical Competence”[Mesh]) (Appendix 1).

Studies that evaluated the outcomes of rural surgical rotations during residency periods compared with those of non-rural surgical rotations were extracted. Studies that described a single rural surgical rotation without any comparison, scope of rural surgery, or national surveys of rural surgical rotations were excluded. The national survey of rural surgical rotations was a report describing only the percentage of surgical programs, including rural surgical rotations. The present review had no restrictions on the language, country, or observation period. In addition, if the reference lists of studies eligible for review were checked and we found articles that should also be reviewed, such articles were included. The authors of the original studies were also asked to provide additional data, if necessary. The outcome was primarily the number of general surgeons working in rural areas in the comparison between the programs of rural and non-rural surgical rotations.

The titles and abstracts for inclusion were independently screened by two reviewers according to the Cochrane Handbook²³. After screening, the full texts of potentially eligible studies were checked. From the full texts of the eligible ar-

ticles, we analyzed whether rural surgical rotations could increase the number of rural general surgeons. The risk of bias was evaluated using the Newcastle–Ottawa Quality Rating Scale (NOS)²⁴.

In addition, based on eligible studies, a meta-analysis of rural surgical rotations for the number of general surgeons in rural areas was performed using the generic inverse variance method with Review Manager 5.4.1 (RevMan 2020; The Nordic Cochrane Centre, Copenhagen, Denmark). A random-effects model was used. The results are expressed as odds ratios (OR) and 95% confidence intervals (CI). Statistical heterogeneity was observed by visual inspection of the forest plots and calculation of the I^2 statistic was conducted. We considered that while I^2 values of 0%–40% may not be important, the values of 30%–60%, 50%–90%, and 75%–100% may represent moderate, substantial, and considerable heterogeneity, respectively²³. Because the present study identified fewer than 10 studies, potential publication bias was not assessed in accordance with the Cochrane Handbook guidelines through a visual inspection of the funnel plot or by the Egger test²³.

Results

A total of 514 papers were recorded in our database search. After removing duplicate publications, 502 papers were screened, and 36 full-text documents were checked. The following 31 studies were then excluded: 17 studies on rural surgical rotations without any comparison^{25–41}, eight on the national survey of rural surgical rotation programs^{14–21}, four on the scope of rural surgery^{9–11}, and two focused on medical students^{42, 43}. Ultimately, five studies^{44–48} were considered eligible for inclusion. No additional articles that met the inclusion criteria were identified from the reference lists of the studies in the present review (Figure 1).

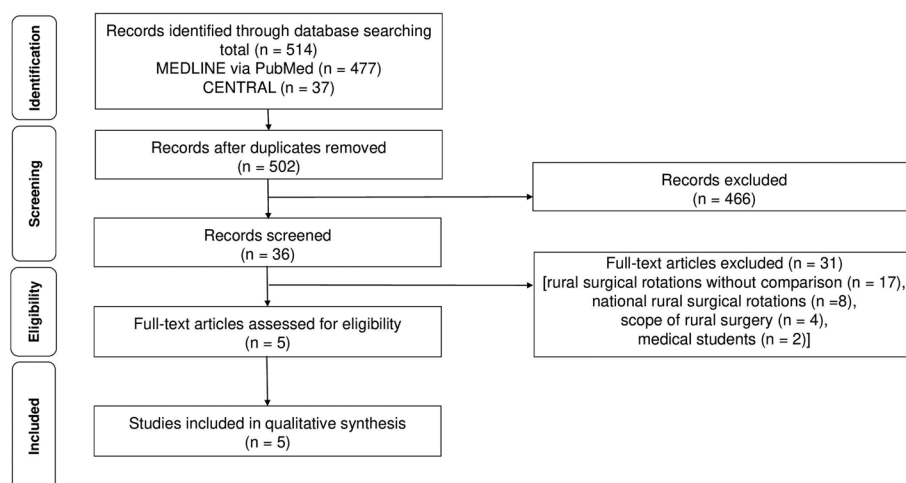


Figure 1 Flow of the literature search process.

Table 1 summarizes the characteristics of the five eligible studies. All the studies were published in the United States^{44–48}. Four studies were conducted at a single center^{44–47}, and the other was conducted at multiple centers⁴⁸. The study periods of most studies^{44–46, 48} were approximately 10–11 years (one study did not describe the period⁴⁷). Study quality was assessed using NOS, with a median score of 5 and a range of 5–7. Four studies reported that rural surgical rotations increased the number of general surgeons in rural areas relative (36%–58%) to that of non-rural specialty-based programs (6.7%–37%)^{44–47}. Another study⁴⁸ compared the number of general surgeons in rural areas between the programs of general surgery (where rural surgical rotations were performed but not all residents attended the rotations) and non-rural specialty-based programs, and reported that the programs of general surgery were not necessarily effective in increasing the number of general surgeons in rural areas. In the meta-analysis of all studies, rural surgical rotations increased the number of general surgeons in rural areas (OR = 2.19, 95% CI, 1.23–3.95; Figure 2).

Table 2 shows the details of the rural surgical rotations. Three studies reported that the duration of rotation ranged from 2 to 12 months^{44–46}. There was a program of one-on-one instruction and follow-up with a mentor⁴⁴. In the programs, more training experience with minor surgeries and certain subspecialties, such as endoscopy, obstetrics/gynecology, urology, otolaryngology, orthopedics, and cardiothoracic surgery, appeared to be provided to the surgeons^{44–46, 48}.

Discussion

The present review demonstrated that rural surgical rotations during the residency period could increase the number of general surgeons working in rural areas. Ensuring the availability of surgeons is an issue in rural practice. Therefore, the finding of such residency programs, via a systematic review, would offer useful insights into the increased number of general surgeons in rural areas.

Previous systematic reviews on recruitment and retention of professionals, such as general practitioners working in rural areas^{49–54}, have indicated that early exposure to rural practice and/or training can contribute to their recruitment and retention^{49, 51, 52, 54}. Although the detailed mechanisms remain unclear, such exposure is thought to enhance the affinity for work in rural areas. This may partly explain the relationship between rural surgical rotations and the increased number of rural general surgeons.

Rural origin is well recognized as a predictor of work in rural areas¹³. In the present systematic review, one study described the possibility of rural residents becoming general surgeons in rural areas⁴⁷. If possible, such programs may be recommended for individuals of rural origin, thereby promoting their participation in rural surgical rotations to increase the number of rural general surgeons.

The development of efficient programs for rural surgical rotation is an issue that must be discussed. In general, rural surgical rotations are considered to be of substantial value, providing residents the benefit of experiencing a wide range of cases⁵⁵. Cesarean section, management of gynecological conditions and hand injuries, urologic emergencies, tonsil-

Table 1 Summary of the studies included in the present review

| Authors (ref no.) | Year published | Location studied | Study design | Study period (year) | Participants (no.) | Center studied | General surgeons/ all participants (no. or %) in rural vs. non-rural programs* | The impact of rural programs on the number of general surgeons in rural areas* OR (95% CI) | NOS |
|------------------------|----------------|------------------|-----------------|---------------------|--------------------|----------------|--|---|-----|
| Asher ⁴⁴ | 1984 | Kentucky, USA | Cross-sectional | 1972–1981 | 52 | Single | 19/33 (58%) vs. 4/19 (21%) | 5.1 (1.4–18.7) | 5 |
| Milligan ⁴⁵ | 2009 | Tennessee, USA | Cross-sectional | 1997–2007 | 17 | Single | 58% vs. 37% | 2.4 (1.3–4.2) | 5 |
| Deveney ⁴⁶ | 2013 | Oregon, USA | Cross-sectional | 1993–2002 | 70 | Single | 4/11 (36%) vs. 4/59 (6.7%) | 7.9 (1.6–38.7) | 5 |
| Hughes ⁴⁷ | 2021 | Kansas, USA | Cross-sectional | 2017 | 3,070 | Single | ND | 2.1 (1.6–2.8) | 6 |
| Halline ⁴⁸ | 2021 | All states, USA | Cross-sectional | 2011–2020 | 2,582 | Multiple | 30/424 (7.1%) vs. 17/267 (7.4%) | 0.96 (0.7–1.6) | 7 |

CI: confidence interval; ND: not described; No.: number; NOS: Newcastle-Ottawa quality assessment scale; OR: odds ratio; vs: versus. *The studies^{44–47} compared the outcomes between the rural and non-rural surgical rotation programs (as reference). One study⁴⁸ compared the outcome between the programs of general surgery (where not all residents were included into the rural surgical rotation programs) and non-rural specialty-based programs (as reference).

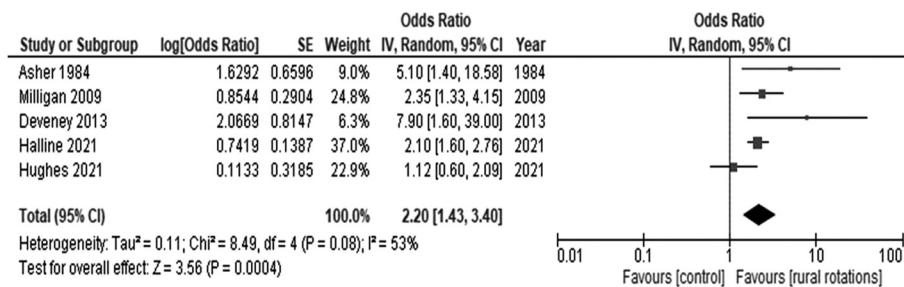


Figure 2 Forest plot of the number of general surgeons in rural areas.

Table 2 Characteristics of the programs in each study

| Authors (ref no.) | Residency duration | Details |
|-------------------------|---------------------|---|
| Asher ⁴⁴⁾ | 2 months | The programs had much experience of minor surgery with mentor-followed instruction. |
| Milligan ⁴⁵⁾ | 3 months | The programs had much experience of endoscopic, anorectal, skin and soft-tissue, hand, gynecological, genital/urological, thoracic, and vascular cases. |
| Deveney ⁴⁶⁾ | 12 months | The programs provided training in general surgery and surgical management of problems common to the specialties of obstetrics and gynecology, orthopedics, urology, and otolaryngology. |
| Hughes ⁴⁷⁾ | ND | The programs included knowledge and skills necessary in rural areas with fewer than 250,000 population. |
| Halline ⁴⁸⁾ | ND (several months) | The programs included rural surgical rotations which had much experience of subspecialty in endoscopy, obstetrics/gynecology, urology, burn care, otolaryngology, and cardiothoracic surgery. |

No.: number; ND: not described.

lectomy, and fracture management are usually proposed as skills in which proficiency is necessary for rural surgical rotations^{36, 56)}. In fact, extensive experience with minor surgeries and subspecialties for rural surgery was emphasized in the programs in most studies in the present systematic review, as listed in Table 2^{44–48)}. In addition, other aspects of these programs, such as the duration (which varied from as 2 to 12 months in some studies^{44–46)} and instructional methodology (one-on-one follow-up with a mentor in one study⁴⁴⁾), should also be discussed. Even though the existing programs^{44–47)} (except for one study⁴⁸⁾) seem effective in increasing the number of general surgeons in rural areas, continuous effort is still required to improve these programs further.

Although a shortage of surgeons seems to be a worldwide issue^{4–7)}, the articles eligible for the present review were published in the United States only^{44–48)}. This is thought to be a notable finding, which indicates that the evaluation of rural surgical rotations has not been developed in other countries. Therefore, it is necessary to develop standardized methods to evaluate such programs across countries.

This systematic review had several limitations. First, the number of included studies was relatively small, although this review was rigorously performed using the PRISMA approach. Second, there have been no studies with a randomization of rotation programs⁵⁷⁾, and the choice of rural surgical rotations may have been influenced by the intention

of residents. Third, the definition of rural areas was operationalized differently across studies, potentially leading to heterogeneity. Fourth, the outcome of the review was “simply work in rural areas”; other outcomes, such as the length of work in rural areas and work-related satisfaction, were not measured. Fifth, while most studies assessed the approximate 10-year cumulative number of general surgeons in rural areas, the follow-up period appropriate to judge an increase in such surgeons is not yet fully known in these studies. Further studies are warranted on various aspects of rural surgical rotations.

Conclusions

In conclusion, the present systematic review demonstrated that rural surgical rotations during the residency period is a possible approach to increase the number of general surgeons working in rural areas. However, further studies are needed to ensure adequate general surgeons in rural areas.

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Conflicts of interest: The authors declare no conflict of interest associated with this study.

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Appendix 1. Electronic database search strategy

MEDLINE

(((Rural*[tiab] OR agricultur*[tiab] OR wilderness* OR frontier*[tiab] OR (native[tiab] AND reservation*[tiab]) OR farmers[tiab] OR farming[tiab] OR nonurban*[tiab] OR “non-urban”[tiab] OR remote*[tiab] OR isolated[tiab] OR “small town”[tiab] OR “small towns”[tiab] OR village*[tiab] OR settlement*[tiab] OR “Rural Population”[Mesh]) AND ((practice*[tiab] OR “health care” [tiab] OR “rural care” [tiab]) OR (“Rural Health Services”[Mesh] OR “Rural Health”[Mesh] OR “Hospitals, Rural”[Mesh]))) OR (“country side”[tiab] OR “countryside” [tiab] OR “pastoral setting” [tiab])) AND (“General Surgery”[Mesh] OR (general[tiab] AND (“surgery” [Subheading] OR (“Surgeons”[Mesh] OR (“surger*”[tiab] OR “surgeon*”[tiab])))))) AND (“Internship and Residency”[Mesh] OR “Clinical Competence”[Mesh] OR Specialization[Mesh] OR “Education, Medical, Graduate”[Mesh] OR “Clinical Competence”[Mesh] OR train*[tiab] OR program[tiab])

Cochrane

(((Rural*:ti,ab OR agricultur*:ti,ab OR wilderness* OR frontier*:ti,ab OR (native:ti,ab AND reservation*:ti,ab) OR farmers:ti,ab OR farming:ti,ab OR nonurban*:ti,ab OR non-urban:ti,ab OR remote*:ti,ab OR isolated:ti,ab OR “small town”:ti,ab OR “small towns”:ti,ab OR village*:ti,ab OR settlement*:ti,ab OR [mh “Rural Population”]) AND ((practice*:ti,ab OR “health care”:ti,ab OR “rural care”:ti,ab) OR ([mh “Rural Health Services”] OR [mh “Rural Health”] OR [mh “Hospitals, Rural”])) OR (“country side”:ti,ab OR countryside:ti,ab OR “pastoral setting”:ti,ab)) AND (([mh “General Surgery”]) OR ((general:ti,ab) AND (“surgery [Subheading]”) OR ([mh Surgeons]) OR (surger*:ti,ab OR surgeon*:ti,ab)))) AND ([mh “Internship and Residency”] OR [mh “Clinical Competence”] OR [mh Specialization] OR [mh “Education, Medical, Graduate”] OR [mh “Clinical Competence”] OR train*:ti,ab OR program:ti,ab)