

APPENDIX 1. SEARCH STRATEGY

KQ1 – RURAL HEALTH PROVIDER NEEDS

DATABASE SEARCHED & TIME PERIOD COVERED:

PubMed – 1/1/2005-2/11/2015

LANGUAGE:

English

SEARCH STRATEGY:

Rural*[tiab] OR agricultur*[tiab] OR wilderness* OR frontier* OR (native AND reservation*) OR farmer OR farmers OR farming OR farm OR farms OR nonurban* OR "non-urban" OR remote*[tiab] OR outback* OR isolated[tiab] OR "small town" OR "small towns" OR village*[tiab] OR settlement* OR "Rural Population"[Mesh] OR "Rural Nursing"[Mesh] OR "Rural Health Services"[Mesh] OR "Rural Health"[Mesh] OR "Hospitals, Rural"[Mesh]

AND

"Health Personnel"[Mesh] OR physician*[tiab] OR nurses[tiab] OR nursing[tiab] OR hospitalist*[tiab] OR hospital staff*[tiab] OR healthcare professional*[tiab] OR health care professional*[tiab] OR doctor[tiab] OR doctors[tiab] OR health manpower[mh] OR manpower[tiab] OR workforce OR medical staff, hospital

AND

need[tiab] OR needs[tiab] OR needed[tiab] OR needing[tiab] OR supply[tiab] OR demand[tiab] OR "supply and distribution" [Subheading]

AND

predict* OR projected OR future OR trend*

DATABASE SEARCHED & TIME PERIOD COVERED:

CIN/AHL – 1/1/2005-2/11/2015

LANGUAGE:

English

SEARCH STRATEGY:

Rural*[tiab] OR agricultur*[tiab] OR wilderness* OR frontier* OR (native AND reservation*) OR farmer OR farmers OR farming OR farm OR farms OR nonurban* OR "non-urban" OR remote*[tiab] OR outback* OR isolated[tiab] OR "small town" OR "small towns" OR village*[tiab] OR settlement* OR "Rural Population"[Mesh] OR "Rural Nursing"[Mesh] OR "Rural Health Services"[Mesh] OR "Rural Health"[Mesh] OR "Hospitals, Rural"[Mesh]

AND

"Health Personnel" OR physician* OR nurses OR nursing OR hospitalist* OR hospital staff* OR healthcare professional* OR health care professional* OR doctor OR doctors OR manpower

AND

need OR needs OR needed OR needing OR supply OR demand

Narrow by SubjectGeographic: - usa

KQ2 – DECISION FACTORS

DATABASE SEARCHED & TIME PERIOD COVERED:

PubMed – 1/1/2005-2/13/2015

LANGUAGE:

English

SEARCH STRATEGY:

Rural*[tiab] OR agricultur*[tiab] OR wilderness* OR frontier* OR (native AND reservation*) OR farmer OR farmers OR farming OR farm OR farms OR nonurban* OR "non-urban" OR remote*[tiab] OR outback* OR isolated[tiab] OR "small town" OR "small towns" OR village*[tiab] OR settlement* OR "Rural Population"[Mesh] OR "Rural Nursing"[Mesh] OR "Rural Health Services"[Mesh] OR "Rural Health"[Mesh] OR "Hospitals, Rural"[Mesh]

AND

"Health Personnel"[Mesh] OR physician*[tiab] OR nurses[tiab] OR nursing[tiab] OR hospitalist*[tiab] OR hospital staff*[tiab] OR healthcare professional*[tiab] OR health care professional*[tiab] OR doctor[tiab] OR doctors[tiab] OR health manpower[mh] OR manpower[tiab] OR workforce OR medical staff, hospital

AND

choice* OR choos* OR decision* OR decid*

AND

incentive* OR attract* OR pecuniary OR non-pecuniary OR income OR monetary OR economic* OR financial OR opportunit*) OR influen*

DATABASE SEARCHED & TIME PERIOD COVERED:

CIN/AHL – 1/1/2005-2/13/2015

LANGUAGE:

English

SEARCH STRATEGY #1:

Rural*[tiab] OR agricultur*[tiab] OR wilderness* OR frontier* OR (native AND reservation*) OR farmer OR farmers OR farming OR farm OR farms OR nonurban* OR "non-urban" OR remote*[tiab] OR outback* OR isolated[tiab] OR "small town" OR "small towns" OR village*[tiab] OR settlement* OR "Rural Population"[Mesh] OR "Rural Nursing"[Mesh] OR "Rural Health Services"[Mesh] OR "Rural Health"[Mesh] OR "Hospitals, Rural"[Mesh]

AND

"Health Personnel" OR physician* OR nurses OR nursing OR hospitalist* OR hospital staff* OR healthcare professional* OR health care professional* OR doctor OR doctors OR manpower

AND

choice* OR choos* OR decision* OR decid*

SEARCH STRATEGY #2:

Rural*[tiab] OR agricultur*[tiab] OR wilderness* OR frontier* OR (native AND reservation*) OR farmer OR farmers OR farming OR farm OR farms OR nonurban* OR "non-urban" OR remote*[tiab] OR outback* OR isolated[tiab] OR "small town" OR "small towns" OR village*[tiab] OR settlement* OR "Rural Population"[Mesh] OR "Rural Nursing"[Mesh] OR "Rural Health Services"[Mesh] OR "Rural Health"[Mesh] OR "Hospitals, Rural"[Mesh]

AND

"Health Personnel" OR physician* OR nurses OR nursing OR hospitalist* OR hospital staff* OR healthcare professional* OR health care professional* OR doctor OR doctors OR manpower

AND

incentive* OR attract* OR pecuniary OR non-pecuniary OR income OR monetary OR economic* OR financial OR opportunit* OR incentive*

KQ3 & 4 – RECRUITMENT & RETENTION

DATABASE SEARCHED & TIME PERIOD COVERED:

PubMed – 1/1/2005-2/23/2015

LANGUAGE:

English

SEARCH STRATEGY:

Rural*[tiab] OR agricultur*[tiab] OR wilderness* OR frontier* OR (native AND reservation*) OR farmer OR farmers OR farming OR farm OR farms OR nonurban* OR "non-urban" OR remote*[tiab] OR outback* OR isolated[tiab] OR "small town" OR "small towns" OR village*[tiab] OR settlement* OR "Rural Population"[Mesh] OR "Rural Nursing"[Mesh] OR "Rural Health Services"[Mesh] OR "Rural Health"[Mesh] OR "Hospitals, Rural"[Mesh]

AND

"Health Personnel"[Mesh] OR physician*[tiab] OR nurses[tiab] OR nursing[tiab] OR hospitalist*[tiab] OR hospital staff*[tiab] OR healthcare professional*[tiab] OR health care professional*[tiab] OR doctor[tiab] OR doctors[tiab] OR health manpower[mh] OR manpower[tiab] OR workforce OR medical staff, hospital

AND

"Personnel Selection"[Mesh] OR recruit* OR retention OR turnover OR turn over* OR burnout OR burn* out

AND

interven* OR increas* OR program OR programs[tiab] OR programme*[tiab] OR project[tiab] OR projects[tiab] OR telehealth OR telemedicine OR ehealth

DATABASE SEARCHED & TIME PERIOD COVERED:

CIN/AHL – 1/1/2005-2/23/2015

LANGUAGE:

English

SEARCH STRATEGY:

Rural*[tiab] OR agricultur*[tiab] OR wilderness* OR frontier* OR (native AND reservation*) OR farmer OR farmers OR farming OR farm OR farms OR nonurban* OR "non-urban" OR remote*[tiab] OR outback* OR isolated[tiab] OR "small town" OR "small towns" OR village*[tiab] OR settlement* OR "Rural Population"[Mesh] OR "Rural Nursing"[Mesh] OR "Rural Health Services"[Mesh] OR "Rural Health"[Mesh] OR "Hospitals, Rural"[Mesh]

AND

"Health Personnel" OR physician* OR nurses OR nursing OR hospitalist* OR hospital staff* OR healthcare professional* OR health care professional* OR doctor OR doctors OR manpower

AND

recruit* OR retention OR retain* OR personnel selection OR turnover OR turn over* OR burnout OR burn* out

KQ5 – EDUCATION**DATABASE SEARCHED & TIME PERIOD COVERED:**

PUBMED - 1/1/2005-2/24/2015

LANGUAGE:

English

SEARCH STRATEGY:

Rural*[tiab] OR agricultur*[tiab] OR wilderness* OR frontier* OR (native AND reservation*) OR farmer OR farmers OR farming OR farm OR farms OR nonurban* OR "non-urban" OR remote*[tiab] OR outback* OR isolated[tiab] OR "small town" OR "small towns" OR village*[tiab] OR settlement* OR "Rural Population"[Mesh] OR "Rural Nursing"[Mesh] OR "Rural Health Services"[Mesh] OR "Rural Health"[Mesh] OR "Hospitals, Rural"[Mesh]

AND

"Schools, Health Occupations"[Mesh]) OR "Students, Health Occupations"[Mesh] OR internship and residency[mh] OR graduate[tiab] OR post-graduate[tiab] OR postgraduate[tiab] OR college[tiab]

AND

training OR train[ti] OR educat*[tiab] OR medical education OR education, professional

AND

program OR programs[tiab] OR programme*[tiab] OR project[tiab] OR projects[tiab] OR effort[tiab] OR efforts[tiab] OR evaluat*[tiab] OR improv*[tiab] OR success*[tiab] OR efficacy OR survey* OR questionnaire*

DATABASE SEARCHED & TIME PERIOD COVERED:

CIN/AHL – 1/1/2005-2/24/2015

LANGUAGE:

English

SEARCH STRATEGY:

Rural*[tiab] OR agricultur*[tiab] OR wilderness* OR frontier* OR (native AND reservation*) OR farmer OR farmers OR farming OR farm OR farms OR nonurban* OR "non-urban" OR remote*[tiab] OR outback* OR isolated[tiab] OR "small town" OR "small towns" OR village*[tiab] OR settlement* OR "Rural Population"[Mesh] OR "Rural Nursing"[Mesh] OR "Rural Health Services"[Mesh] OR "Rural Health"[Mesh] OR "Hospitals, Rural"[Mesh])

AND

"Health Personnel" OR physician* OR nurses OR nursing OR hospitalist* OR hospital staff* OR healthcare professional* OR health care professional* OR doctor OR doctors OR manpower

AND

training OR train OR trained OR educat* OR graduat* OR post-graduate OR postgraduate OR college

DATABASE SEARCHED & TIME PERIOD COVERED:

GREY LITERATURE REPORT – 1/1/2010-1/16/2015

NUMBER OF RESULTS: 76

SEARCH STRATEGY:

Rural

APPENDIX 2. LIST OF EXCLUDED STUDIES

This appendix lists the publications assessed as full text and not meeting inclusion criteria.

BACKGROUND

A large number of publications did not meet inclusion criteria for the review but were retained as background information. Publications either reported more information on an included study (multiple publication), potentially contained sources of studies potentially meeting inclusion criteria, or were used in the introduction and discussion.

[no author] Challenges, solutions & opportunities : affordable housing, workforce training, recruitment & retention of health care professionals. Northern Arizona University, the W.A. Franke College of Business; 2007: <http://www.franke.nau.edu/RPI/projects/ARPF2007FinalReport.pdf>

[no author] Shortage of general surgeons coming? *OR Manager*. 2008;24(6).

[no author] Young physicians not keen on rural areas. *Managed care (Langhorne, Pa.)*. 2012;21(10):16.

Aseltine RH, Jr., Katz MC, Geragosian AH. Connecticut 2009 Primary Care Survey: physician satisfaction, physician supply and patient access to medical care. *Connecticut medicine*. 2010;74(5):281-291.

Avery DM, Jr., Wheat JR, Leeper JD, McKnight JT, Ballard BG, Chen J. Admission factors predicting family medicine specialty choice: a literature review and exploratory study among students in the Rural Medical Scholars Program. *The Journal of rural health : official journal of the American Rural Health Association and the National Rural Health Care Association*. 2012;28(2):128-136.

Baker E, Schmitz D, Epperly T, Nukui A, Miller CM. Rural Idaho Family Physicians' Scope of Practice. *Journal of Rural Health*. 2010;26(1):85-89.

Ballance D, Kornegay D, Evans P. Factors that influence physicians to practice in rural locations: a review and commentary. *The Journal of rural health : official journal of the American Rural Health Association and the National Rural Health Care Association*. 2009;25(3):276-281.

Balshem H, Helfand M, Schunemann HJ, et al. GRADE guidelines: 3. Rating the quality of evidence. *Journal of clinical epidemiology*. 2011;64(4):401-406.

Barnighausen T, Bloom DE. Financial incentives for return of service in underserved areas: a systematic review. *BMC health services research*. 2009;9:86.

Barrett FA, Lipsky MS, Lutfiyya MN. The impact of rural training experiences on medical students: a critical review. *Academic medicine : journal of the Association of American Medical Colleges*. 2011;86(2):259-263.

Bowman RC. Measuring primary care: the standard primary care year. *Rural Remote Health*. 2008;8(3).

Bridgham RG. Final report : HB 1615, (Chapter 367:3, Laws of 2008), establishing a Commission to Recommend Policies and Programs to Increase the Number of New Hampshire Individuals in Health Professions Servicing New Hampshire's Rural and Underserved Areas with a Focus on Primary Care. Concord, N.H.: N.H. General Court; 2009.

Broughan TA. SAGES 2007 rural surgery panel. *Surgical endoscopy*. 2008;22(7):1579-1581.

Carlton EL, Simmons LA. Health decision-making among rural women: physician access and prescription adherence. *Rural Remote Health*. 2011;11(1).

Chen C, Xierali I, Piwnica-Worms K, Phillips R. The redistribution of graduate medical education positions in 2005 failed to boost primary care or rural training. *Health affairs (Project Hope)*. 2013;32(1):102-110.

- Chipp C, Dewane S, Brems C, Johnson ME, Warner TD, Roberts LW. "If only someone had told me...": lessons from rural providers. *The Journal of rural health : official journal of the American Rural Health Association and the National Rural Health Care Association*. 2011;27(1):122-130.
- Cogbill TH, Cofer JB, Jarman BT. Contemporary issues in rural surgery. *Current problems in surgery*. 2012;49(5):263-318.
- Collier D. Rural Michigan physician retention study reveals motivators. *Michigan medicine*. 2010;109(5):21.
- Cook AF, Hoas H. Hide and seek: The elusive rural psychiatrist. *Academic Psychiatry*. 2007;31(6):419-422.
- Corbett CD. Recruitment and retention of physicians in rural North Dakota : testing for congruency between current policies and physician motivation. 2012:ii, 37 leaves ; 29 cm. Dissertation: Paper (M.S.)--Minnesota State University Moorhead, 2012.
- Crouse BJ, Munson RL. The effect of the physician J-1 visa waiver on rural Wisconsin. *WMJ : official publication of the State Medical Society of Wisconsin*. 2006;105(7):16-20.
- Curran V, Rourke L, Snow P. A framework for enhancing continuing medical education for rural physicians: A summary of the literature. *Medical teacher*. 2010;32(11):e501-508.
- Deveney K, Deatherage M, Oehling D, Hunter J. Association between dedicated rural training year and the likelihood of becoming a general surgeon in a small town. *JAMA surgery*. 2013;148(9):817-821.
- Dill MJ, Salsberg ES. *The Complexities of Physician Supply and Demand: Projections Through 2025*. November 2008. Washington, DC: Association of American Medical Colleges, Center for Workforce Studies.;2008.
- Doescher MP, Andrilla CH, Skillman SM, Morgan P, Kaplan L. The contribution of physicians, physician assistants, and nurse practitioners toward rural primary care: findings from a 13-state survey. *Medical care*. 2014;52(6):549-556.
- Dolea C, Stormont L, Braichet JM. Evaluated strategies to increase attraction and retention of health workers in remote and rural areas. *Bull World Health Organ*. 2010;88(5):379-385.
- Dornan T, Littlewood S, Margolis SA, Scherpbier A, Spencer J, Ypinazar V. How can experience in clinical and community settings contribute to early medical education? A BEME systematic review. *Med. Teach*. 2006;28(1):3-18.
- Dorsey ER, Nicholson S, Frist WH. Commentary: improving the supply and distribution of primary care physicians. *Academic Medicine: Journal of the Association of American Medical Colleges*. 2011;86(5):541-543.
- Doty B, Andres M, Zuckerman R, Borgstrom D. Use of Locum Tenens Surgeons to Provide Surgical Care in Small Rural Hospitals. *World J. Surg*. 2009;33(2):228-232.
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- Edwards JB, Wilson JL, Behringer BA, et al. Practice locations of graduates of family physician residency and nurse practitioner programs: considerations within the context of institutional culture and curricular innovation through Titles VII and VIII. *The Journal of rural health: official journal of the American Rural Health Association and the National Rural Health Care Association*. 2006;22(1):69-77.
- Escarce JJ, Kapur K. Do patients bypass rural hospitals? Determinants of inpatient hospital choice in rural California. *J. Health Care Poor Underserved*. 2009;20(3):625-644.
- Everitt-Deering P. The adoption of information and communication technologies by rural general practitioners a socio technical analysis. [Internet Resource; Computer File; Archival Material]. 2008; <http://eprints.vu.edu.au/1412>.
- Filipova AA. Factors influencing the satisfaction of rural physician assistants: a cross-sectional study. *Journal of allied health*. 2014;43(1):22-31.
- Fordyce MA, Chen FM, Doescher MP, Hart LG. 2005 physician supply and distribution in rural areas of the United States [Internet]. Seattle, WA: Rural Health Research and Policy Centers;2007.

Fournier GM, Henderson C. Incentives and physician specialty choice: a case study of Florida's Program in Medical Sciences. *Inquiry : a journal of medical care organization, provision and financing*. 2005;42(2):160-170.

Fraher EP, Knapton A, Sheldon GF, Meyer A, Ricketts TC. Projecting surgeon supply using a dynamic model. *Annals of surgery*. 2013;257(5):867-872.

Gagnon MP, Pollender H, Trepanier A, Duplaa E, Ly BA. Supporting health professionals through information and communication technologies: a systematic review of the effects of information and communication technologies on recruitment and retention. *Telemedicine journal and e-health : the official journal of the American Telemedicine Association*. 2011;17(4):269-274.

Garrison-Jakel J. Patching the rural workforce pipeline--why don't we do more? *The Journal of rural health : official journal of the American Rural Health Association and the National Rural Health Care Association*. 2011;27(2):239-240.

Getson DS. Rural practice realities. *The West Virginia medical journal*. 2013;109(4):34-37.

Grobler L, Marais BJ, Mabunda SA, Marindi PN, Reuter H, Volmink J. Interventions for increasing the proportion of health professionals practising in rural and other underserved areas. *The Cochrane database of systematic reviews*. 2009(1):Cd005314.

Haggerty TS, Fields SA, Selby-Nelson EM, Foley KP, Shrader CD. Physician Wellness in Rural America: A Review. *International journal of psychiatry in medicine*. 2013;46(3):303-313.

Halaas GW. The Rural Physician Associate Program: successful outcomes in primary care and rural practice. *Rural and remote health*. 2005;5(2):453.

Henry LR, Hooker RS, Yates KL. The role of physician assistants in rural health care: a systematic review of the literature. *The Journal of rural health : official journal of the American Rural Health Association and the National Rural Health Care Association*. 2011;27(2):220-229.

Hilty DM, Yellowlees PM, Cobb HC, Bourgeois JA, Neufeld JD, Nesbitt TS. Models of telepsychiatric consultation-liaison service to rural primary care. *Psychosomatics*. 2006;47(2):152-157.

Hirsh D, Walters L, Poncelet AN. Better learning, better doctors, better delivery system: possibilities from a case study of longitudinal integrated clerkships. *Medical teacher*. 2012;34(7):548-554.

Holmes GM. Increasing physician supply in medically underserved areas. *Labour Econ*. 2005;12(5):697-725.

Huff C. Where are the specialists? *Hospitals & health networks / AHA*. 2011;85(12):26-28, 31, 21.

Huff C. Please doc, stay. Give docs a reason to set up shop. *Hospitals & health networks / AHA*. 2012;86(2):20.

Huff C. Done recruiting? Start retaining. *Trustee : the journal for hospital governing boards*. 2014;67(1):8-12, 11.

Kochar MS. The J-1 visa waiver program for rural Wisconsin. *WMJ : official publication of the State Medical Society of Wisconsin*. 2006;105(7):13.

Larson EH, Hart LG. Growth and change in the physician assistant workforce in the United States, 1967-2000. *Journal of allied health*. 2007;36(3):121-130.

Lee DM, Nichols T. Physician recruitment and retention in rural and underserved areas. *International journal of health care quality assurance*. 2014;27(7):642-652.

Lindsay S. Gender differences in rural and urban practice location among mid-level health care providers. *The Journal of rural health : official journal of the American Rural Health Association and the National Rural Health Care Association*. 2007;23(1):72-76.

Lynch S. Hospice and palliative care access issues in rural areas. *The American journal of hospice & palliative care*. 2013;30(2):172-177.

Lyng DC. Rural general surgeons: manpower and demographics. *Surgical endoscopy*. 2008;22(7):1593-1594.

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- MacDowell M, Glasser M, Fitts M, Fratzke M, Peters K. Perspectives on rural health workforce issues: Illinois-Arkansas comparison. *The Journal of rural health : official journal of the American Rural Health Association and the National Rural Health Care Association.* 2009;25(2):135-140.
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- MacDowell M, Glasser M, Hunsaker M. A decade of rural physician workforce outcomes for the Rockford Rural Medical Education (RMED) Program, University of Illinois. *Academic medicine : journal of the Association of American Medical Colleges.* 2013;88(12):1941-1947.
- Maley M, Worley P, Dent J. Using rural and remote settings in the undergraduate medical curriculum: AMEE Guide No. 47. *Med. Teach.* 2009;31(11):969-983.
- Mareck DG. Federal and state initiatives to recruit physicians to rural areas. *The virtual mentor : VM.* 2011;13(5):304-309.
- Mbemba G, Gagnon MP, Pare G, Cote J. Interventions for supporting nurse retention in rural and remote areas: an umbrella review. *Human resources for health.* 2013;11:44.
- Meyer D. Technology, job satisfaction, and retention: rural mental health practitioners. *The Journal of rural health : official journal of the American Rural Health Association and the National Rural Health Care Association.* 2006;22(2):158-163.
- Mullan F, Frehywot S, Jolley LJ. Aging, primary care, and self-sufficiency: health care workforce challenges ahead. *The Journal of law, medicine & ethics : a journal of the American Society of Law, Medicine & Ethics.* 2008;36(4):703-708, 608.
- Murphy KL. Alaska health care workforce shortages : impact of state legislation. 2011:ix, 74 leaves ; 28 cm. Dissertation: Thesis (M.Public Health)--University of Alaska Anchorage, 2011.
- Nakayama DK, Hughes TG. Issues That Face Rural Surgery in the United States. *Journal of the American College of Surgeons.* 2014;219(4):814-818.
- Nance ML, Carr BG, Branas CC. Access to pediatric trauma care in the United States. *Archives of pediatrics & adolescent medicine.* 2009;163(6):512-518.
- Ortiz J, Bushy A, Zhou Y, Zhang H. Accountable care organizations: benefits and barriers as perceived by Rural Health Clinic management. *Rural and remote health.* 2013;13(2):2417.
- Palmer RT. Exploring online community among rural medical education students: A case study. Dissertation Abstracts International Section A: Humanities and Social Sciences. 2014;75(1-A(E)).
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- Pathman DE, Fryer GE, Jr., Phillips RL, Smucny J, Miyoshi T, Green LA. National Health Service Corps staffing and the growth of the local rural non-NHSC primary care physician workforce. *The Journal of rural health : official journal of the American Rural Health Association and the National Rural Health Care Association.* 2006;22(4):285-293.
- Patterson DG, Keppel G, Skillman SM, Berry C, Daniel C, Doescher MP. Recruitment of Non-U.S. Citizen Physicians to Rural and Underserved Areas through Conrad State 30 J-1 Visa Waiver Programs. Final Report #148, April 2015. Seattle, WA: WWAMI Rural Health Research Center, University of Washington;2015.
- Patterson DG, Longenecker R, Schmitz D, Skillman SM, Doescher MP. January 2011 Policy Brief: Training Physicians for Rural Practice: Capitalizing on Local Expertise to Strengthen Rural Primary Care. 2011; https://www.raconline.org/rtt/pdf/policybrief_jan11.pdf. Accessed 8/20/2015.

Patterson DG, Longenecker R, Schmitz D, et al. January 2012 Policy Brief: Rural Residency Training for Family Medicine Physicians: Graduate Early-Career Outcomes. 2012; <https://www.raconline.org/rtt/pdf/rural-family-medicine-training-early-career-outcomes-2012.pdf>. Accessed 8/20/2015.

Peterson LE, Bazemore A, Bragg EJ, Xierali I, Warshaw GA. Rural-urban distribution of the U.S. Geriatrics physician workforce. *Journal of the American Geriatrics Society*. 2011;59(4):699-703.

Philipp DL, Wright DL. Recruiting healthcare professionals to rural areas. *Radiology management*. 2005;27(6):44-50.

Price J. The National Health Service Corps--a critical component of provider recruitment in North Carolina's rural and underserved communities. *North Carolina medical journal*. 2010;71(3):251.

Quarry WA. A research study outlining the key issues and strategies needed to improve recruitment and retention among primary care physicians in rural communities. 2012.

Rabinowitz HK. AM last page. Truths about the rural physician supply. *Academic medicine : journal of the Association of American Medical Colleges*. 2011;86(2):272.

Rabinowitz HK, Diamond JJ, Markham FW, Rabinowitz C. Long-term retention of graduates from a program to increase the supply of rural family physicians. *Academic medicine : journal of the Association of American Medical Colleges*. 2005;80(8):728-732.

Rabinowitz HK, Diamond JJ, Markham FW, Santana AJ. Increasing the supply of women physicians in rural areas: outcomes of a medical school rural program. *Journal of the American Board of Family Medicine : JABFM*. 2011;24(6):740-744.

Rabinowitz HK, Diamond JJ, Markham FW, Santana AJ. The relationship between matriculating medical students' planned specialties and eventual rural practice outcomes. *Academic medicine : journal of the Association of American Medical Colleges*. 2012;87(8):1086-1090.

Rabinowitz HK, Diamond JJ, Markham FW, Wortman JR. Medical school programs to increase the rural physician supply: a systematic review and projected impact of widespread replication. *Academic medicine : journal of the Association of American Medical Colleges*. 2008;83(3):235-243.

Ricketts TC. Workforce issues in rural areas: A focus on policy equity. *Am. J. Public Health*. 2005;95(1):42-48.

Roh CY, Moon MJ. Nearby, but not wanted? The bypassing of rural hospitals and policy implications for rural health care systems. *Policy Stud. J*. 2005;33(3):377-394.

Rosenblatt RA, Andrilla CH, Curtin T, Hart LG. Shortages of medical personnel at community health centers: implications for planned expansion. *Jama*. 2006;295(9):1042-1049.

Schmitz DF, Baker E, Nukui A, Epperly T. Idaho rural family physician workforce study: the Community Apgar Questionnaire. *Rural and remote health*. 2011;11(3):1769.

Seligson RW, Highsmith PP. North Carolina Medical Society Foundation's Community Practitioner Program. *North Carolina medical journal*. 2006;67(1):83-85.

Staton FS, Bhosle MJ, Camacho FT, Feldman SR, Balkrishnan R. How PAs improve access to care for the underserved. *JAAPA : official journal of the American Academy of Physician Assistants*. 2007;20(6):32, 34, 36 passim.

Stempniak M. The hiring headache. Rural hospitals band together to lure physicians. *Hospitals & health networks / AHA*. 2012;86(12):18-19.

Thompson MJ, Hagopian A, Fordyce M, Hart LG. Do international medical graduates (IMGs) "fill the gap" in rural primary care in the United States? A national study. *The Journal of rural health : official journal of the American Rural Health Association and the National Rural Health Care Association*. 2009;25(2):124-134.

Thompson MJ, Lynge DC, Larson EH, Tachawachira P, Hart LG. Characterizing the general surgery workforce in rural America. *Archives of surgery (Chicago, Ill. : 1960)*. 2005;140(1):74-79.

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APPENDIX 3. RISK OF BIAS ASSESSMENT

KQ1 STUDIES

ID	Data source reporting	External validity
Branch, 2014 ⁴⁷	Low risk	Low risk
Camargo, 2008 ⁵⁶	Low risk	Low risk
Ghosh, 2011 ⁵¹	Low risk	Low risk
Hendryx, 2008 ⁵⁴	Low risk	Low risk
Maizel, 2009 ⁴⁸	Low risk	Unclear
Rayburn, 2012 ⁵²	Low risk	Unclear
Rosenblatt, 2010 ¹	Low risk	Low risk
Stewart, 2013 ⁴⁹	Low risk	Low risk
Thomas, 2009 ⁵⁰	Low risk	Unclear
Williams, 2011 ⁵³	Low risk	Low risk
Wilson, 2011 ⁵⁵	Low risk	Low risk

KQ2 STUDIES

ID	Response rate	Confounding variables	Other limitations
Chen, 2010 ⁵⁷	Unclear	High risk	
DHHS, 2006 ⁶⁶	Unclear	High risk	
Duffrin, 2014 ⁶⁷	High risk	High risk	
Fordyce, 2012 ⁵⁸	Unclear	High risk	
Glasser, 2010 ⁶⁸	Low risk	High risk	
Hancock, 2009 ⁶⁹	High risk	High risk	Recall bias and small sample size with likely selection bias
Helland, 2010 ⁷⁰	Low risk	High risk	
Heneghan, 2005 ⁷¹	High risk	High risk	Selection bias, response bias, did not address non-responders
Henry, 2007 ⁶⁵	High risk	High risk	Qualitative results only
Hughes, 2005 ⁷²	Unclear	High risk	
Jarman, 2009 ⁷³	High risk	High risk	
Kimball, 2007 ⁷⁴	Low risk	High risk	Qualitative study with selection bias
MacDowell, 2013 ¹⁰⁵	Unclear	High risk	
Mason, 2012 ⁶³	Unclear	Unclear	
Pepper, 2010 ⁷⁵	Low risk	High risk	
Phillips, 2009 ⁶⁰	Unclear	Low risk	

Phillips, 2013 ⁸⁹	Low risk	High risk	
Rabinowitz, 2012 ⁶¹	Low risk	High risk	
Renner, 2010 ⁶²	Low risk	Unclear	
Schiff, 2012 ⁷⁷	Low risk	High risk	
Shannon, 2011 ⁷⁸	Unclear	Low risk	Use of self-reported data, limited sample size, and limited external validity
Smith, 2012 ⁶⁴	High risk	High risk	
Snyder, 2014 ⁷⁹	High risk	High risk	
Stenger, 2008 ⁸⁰	Low risk	Unclear	Self-reported data, selection bias
Whitacre, 2010 ⁸¹	Unclear	Low risk	
Zink, 2010 ⁸²	Unclear	Unclear	

KQ3 AND KQ4 STUDIES

ID	Selection bias	Performance bias	Attrition bias	Detection bias	Other bias
Kahn, 2010 ⁸³	High risk	Low risk	Low risk	Low risk	N/A
No Author, 2007 ⁸⁵	High risk	Low risk	Low risk	Low risk	N/A
Renner, 2010 ⁶²	High risk	Unclear	Low risk	Low risk	N/A
Wheeler, 2009 ⁸⁴	High risk	Low risk	Low risk	Low risk	N/A
Wheeler, 2013 ⁸⁶	High risk	Unclear	Unclear	Unclear	Recruitment data no denominator, retention data not stratified by program

KQ5 STUDIES

ID	Selection bias
Antonenko, 2009 ⁹⁶	High risk
Baker, 2012 ¹⁰¹	Unclear
Bonham, 2014 ⁸⁸	High risk
Crane, 2014 ¹⁰²	High risk
Crump, 2013 ¹⁰³	Unclear
Deutchman, 2013 ⁹⁸	High risk
Deveney, 2009 ^{29,97}	High risk
Glasser, 2008 ^{88,104}	High risk
Kallail, 2010 ¹⁰⁶	High risk
Mason, 2012 ⁶³	High risk
Nash, 2008 ⁹³	High risk
Patterson, 2013 ⁹⁹	Unclear

Phillips,2009 ⁶⁰	Low risk
Phillips, 2013 ⁸⁹	Unclear
Quinn, 2011 ⁹²	Low risk
Rabinowitz, 2011 ⁹⁰	Low risk
Rabinowitz, 2012 ⁹¹	Low risk
Rabinowitz, 2013 ¹⁰⁸	Low risk
Ross, 2013 ¹¹⁰	High risk
Shipman, 2013 ¹⁰⁰	Low risk
Talley, 2011 ⁸⁷	Low risk
Whitacre, 2010 ⁸¹	High risk
Zink, 2010 ⁸²	Unclear

APPENDIX 4. PEER REVIEW COMMENTS/AUTHOR RESPONSES

Comments	Response
Appears comprehensive and very useful.	Thank you
Very thorough and complete.	Thank you
Missing studies: Phillips RL; Doodoo MS; Petterson S; et al. Specialty and Geographic Distribution of the Physician Workforce: What Influences Medical Student and Resident Choices? Robert Graham Center: Policy Studies in Family Medicine and Primary Care, Washington, DC, 2009.	The study is included in the final report.
It appears VA studies on Workforce were not including in this synthesis. Was this by design?	We have limited this systematic review to studies in the public domain and applied this inclusion criterion consistently.
Aren't there unpublished data on VA health care workforce supply and demand?	Please see above
Specifically retention studies for National Health Service Corps program completers and reports from Community Health Centers regarding retention patterns would be helpful. That CHCs and RHCs were not included as part of the study should be further explained and clarified for readers since these sites are supported by federal rural workforce investments.	We have added more detail regarding completers as suggested. Inclusion criteria specified provider specialties, rather than types of healthcare delivery centers but we have added rural health clinics as one of the examples why the provider groups were selected.
In my opinion this report is outstanding! The authors did an excellent job of identifying the problem and evaluating the scientific rigour of the studies. Just a few suggestions: - page 7, line 43 "Study Selection" - I would recommend that the authors provide more detail on how disagreements were resolved (e.g., consensus, third reviewer, etc.).	Added as suggested
- Page 13, line 28 "Technical Expert Panel". Please change Bureau of Health Professions to Bureau of Health Workforce. We had a merger last year and with it came the name change.	Revised as suggested
- Page 70, line 51 - "Limitations" The HRSA workforce projections covered many more specialties than psychologists and pharmacists. Would suggest changing to various health providers or health professions.	We have revised the sentence slightly to address this point.
- Page 71, line 10-11 "Research Gaps/Future Research" While the supply and demand microsimulation models used by HRSA are complex, they have been updated and do include the effect of the ACA in the calculations. The effect of the ACA in the HRSA model and other models indicates about a 2% effect in demand due to the ACA. HRSA has also put out supply and demand numbers for many health professionals other than physicians (e.g., allied health professions, dentists, nurses, etc). While we have identified numbers of providers needed these estimates are based on current delivery models and this is an area that needs future research. Identifying a metric for upcoming delivery models will improve the estimates of providers needed (e.g., team-based care, PCMH, ACOs, etc.). Further, another area of research that is needed is not only identifying outputs of providers needed, but what skills are needed by the providers. I think it might be helpful to mention in this section that there is a need to identify the skills and competencies needed in the existing and new workforce. How do we go about training the existing workforce to work in the new delivery models such as team-based care, PCMH, ACO's etc.	Thank you for this suggestion, we have added this point.

<p>- Page 71, line 26/27 - "Research Gaps/Future Research" The HRSA demand model does account for the effect of the ACA. To date, the HRSA model and other existing models, have only found the ACA to have approximately a 2% effect on the demand of health professionals.</p>	<p>We have revised the paragraph to avoid misinterpretation of the sentence.</p>
<p>- Page 71, line 32 - "Research Gaps/Future Research" One of the difficulties with comparing training programs across health professions is that there are so many differences in the time of training, locations used for clinical training and providing training in rural settings. Most medical schools are still training using the acute care setting and rarely have a rural track for students. I think that is where research needs to occur in the shift of training from acute care to rural/primary care settings.</p>	<p>Added as suggested</p>
<p>This report is well written, carefully done, and nicely demonstrates the complexity and nuance of rural healthcare need, the determinants of provider's geographic choices, and the many issues around provider recruitment and retention. With the exception of my comments regarding the lens of "place," the discussion, limitations, and research gaps are well-written, thorough and justified by the review. My comments regarding the conclusions of the review are listed at the end of this review document. Methods: I only have one question regarding the selection criteria. How was it determined that a particular study was relevant to CBOC's and CAH's? Were there explicit criteria other than specialty?</p>	<p>We have addressed this point in the limitation section and added more detail on the decision.</p>
<p>Comments regarding the key study questions: KQ1: What are the current versus projected healthcare provider needs by numbers and disciplines in the next 20 years in rural areas? I find it interesting that the studies of general surgery use a somewhat arbitrary ratio of general surgeons/100,000 population, when the general surgeon in a rural community has a very different scope of practice, potentially underestimating the need. A general surgeon in an urban area has other specialty surgeons who can take up the slack. The same can be said about family physicians practicing in rural communities, where specialists are underrepresented relative to urban places and where generalists practice a wider scope. All of this complicates the question of provider need.</p>	<p>Thank you for this thoughtful comment. To at least partially address this point we have elaborated more on the definition of need in the discussion.</p>
<p>KQ2: What factors influence healthcare providers' geographic choices for practice? Macy Foundation Graham Center Report 2009, not peer-reviewed in the usual sense, but a well- done research study and report, vetted by experts: Phillips et al, 2009.</p>	<p>Please see above</p>
<p>This report nicely demonstrates the relative importance of the predictor variables, and identifies location of medical school as the strongest independent predictor, i.e. the geography of education and training, an even stronger factor than growing up in a rural place – the factor which this review concludes is the most consistent factor. This is one of the few studies to use multivariate analysis across a large number of variables. The Pepper study from Wyoming is an exception and found no association with place of training. Unfortunately, residency training programs in that region do not vary much by the usual measures of rurality. The Rabinowitz study in Philadelphia has the opposite problem, occurring primarily in an urban place with a region characterized by an intricate patchwork of rural and urban.</p>	<p>We agree with this observation and have expanded on the discussion.</p>
<p>There is growing evidence that the place of education and training (the context) is as important if not more important than either individual characteristics or the program (often described in this review as "educational effort" or content). The difficulty is that the geography question has not been asked in most studies nor have research studies generally been addressed through that lens. Generally success under question KQ5 is attributed to the "training," not the duration and "place" of training experiences. This represents a significant cognitive framing bias among researchers in many studies.</p>	<p>Very interesting point; we have added it to the future research section.</p>



<p>The fact that the Majority of rural providers did not grow up in small town^{61,76}, stems from the reality that, although growing up in a rural area is associated with a propensity for rural practice, there are too few such students even entering medical school, and of those who do, the majority still end up in urban practice. A modest percentage of a small number is an even smaller number. Therefore the selective admissions of individuals is unlikely by itself to address workforce needs, further supporting the importance of <u>both</u> developing effective educational interventions and identifying effective contexts.</p> <p>In addition, although frequently articulated as conventional wisdom repeated in this report that “the choice to select a school with a rural track is likely to be influenced by an affinity to rural healthcare,” to my knowledge this statement has not been proven to be true. Given the adverse odds of medical school admission for many applicants, choice of medical school is often limited by where an individual gets admitted. Many applicants may have chosen to go elsewhere if they had been able to freely choose, but many do not have that luxury. The most frequently cited example of this, whether true or not, is among osteopathic students, some of whom admit they would have preferred to go to an allopathic institution and yet many go into rural practice.</p>	<p>Very insightful comment. We have added more detail to the type of study that should be conducted in the future research needs section to at least partially address this point.</p>
<p>This review also lends support for scaling up efforts such as those reported by Patterson et al, that seek to follow unit record data over a career and use geography (GIS; geocoding of education and training experiences, as well as “lived experience” in a rural place – building a web of relationships, i.e. experiential place integration) as an examined factor in career decisions and retention in practice over time. The qualitative study by Hancock et al (Evidence Table 3) is the only study I found in your references that addresses this in any depth. Unfortunately, that study does not address specific interventions, such as deliberate rural placement in education and training. If it’s not too late, here is an important addition to the literature that is relevant to KQ2: Wendling AL; Phillips J; Short W; Fahey C; Mavis B. Thirty Years Training Rural Physicians: Outcomes From the Michigan State University College of Human Medicine Rural Physician Program, <i>Academic Medicine</i>, just published ahead of print September 2015.</p>	<p>The article by Wendling was published after the search date for our systematic review; however, for the interested reader we have added a reference to the paper to the discussion section.</p>
<p>KQ3: What interventions have been shown to increase rural healthcare provider recruitment? KQ4: What interventions have been shown to increase rural healthcare provider retention? Unless geography (“place”-ment) is considered an intervention (see discussion above), I agree that the evidence base for any one intervention in recruitment and retention is painfully limited. One question that needs to be answered is, “For those loan repayment individuals who remained in a rural place, is there evidence for the effect of duration in a rural place independent of other predictive factors?”</p>	<p>We have added this interesting point to the future research section.</p>
<p>I was surprised that Community Apgar did not make it into the review. The Community Apgar project is specifically designed to answer KQ3 and KQ4, and I am curious as to why it was excluded. It does identify modifiable factors important to recruitment and retention. Although published in the international <i>J Rural & Remote Health</i>, it clearly reports on work in Idaho. This instrument has now been used successfully in multiple States to identify factors that increase retention. Unfortunately, although presented in multiple forums over the past 4 years, I am unaware that these more recent results have yet been published in the peer-reviewed literature. Schmitz D; Baker E; Nukui; Epperly T. Idaho rural family physician workforce study: the Community Apgar Questionnaire. <i>Rural Remote Health</i> 2011;11(3):1769. Epub 2011 Jul 25.</p>	<p>We restricted the review to evaluations of specific interventions and the reference is an analytic study assessing individual variables. We have added the study to the future research section for suggestions for potentially promising interventions that should be tested.</p>



<p>KQ5: What is the efficacy of current rural-specific resident and healthcare professions' student training and education efforts? I'm not sure why this article was excluded from KQ5, because it does compare RTT programs with the other family medicine residencies in NM: M. Pacheco, D. Weiss, K. Vaillant, S. Bachofer, B. Garrett, W. H. Dodson, 3rd, C. Urbina, B. Umland, D. Derksen, W. Heffron and A. Kaufman. The impact on rural New Mexico of a family medicine residency. Acad Med. 2005; 80:739-44</p>	<p>The study was outside the scope of the intervention because it reported on data before 2005.</p>
<p>There is a lack of comparative studies across a variety of settings or even all settings, and across medical students or residents in any one region or in any one specialty. It is very important that comparative effectiveness be demonstrated, and unfortunately, studies using case-control methods and/or multivariate analyses are difficult to find. The database from which to run such queries is still quite limited in capacity and attention to geography. Encouraging developments in this regard are (1) the "RTT Masterfile" referenced in Patterson et al and (1) the NRHA Rural Medical Educator group's developing project with the Data Commons, both of which seek to create a database of unit record data, including place of education that should be able to address questions of comparative effectiveness. The accrediting bodies of both medical school and residency have not generally kept geographically relevant data, choosing with regard to their database structure, whether by intention or simply omission, to be agnostic of place.</p>	<p>To address this comment we have highlighted this in the future research section.</p>
<p>CONCLUSIONS (From the end of the report) •All included studies reported current unmet provider needs that worsen with increasing rurality. The small number of studies estimating future need also predicted unmet provider needs that worsen with increasing rurality. Justified. •Growing up in a rural community is the most consistent factor associated with practice location choice. More research into the relative importance of factors is needed. Except for context of education and training – that seems to be the most consistent factor across KQ2 through KQ5, and is explicitly identified in multiple studies (e.g. Hancock, Patterson)</p>	<p>We have expanded the conclusion section and provided more detail to address this comment.</p>
<p>•More research is needed to evaluate healthcare provider recruitment interventions for rural healthcare. Justified. •There is a lack of evidence regarding interventions to support healthcare provider retention in rural healthcare. Justified. •Current evaluations of rural training programs for medical students and residents suggest a median success rate of 53%. Hidden in the median statistic is the variability associated with duration of education and training in a rural place (the lens of geography and place, as opposed to educational program or effort). As well as the intensity of training (multiple rural locations over years of training compared to a single 4 week experience,) and its broad impact. Although the meta-analysis has not been done, and the data is incomplete (geocoding is not a strength of medical school or residency data), there is a consistent theme among studies across KQ2 through KQ5 that warrants further exploration.</p>	<p>To address this point we have added an analysis stratified by intensity operationalized as more than 6 months cumulative time spent in rural locations.</p>
<p>Except for the 3 references noted above (one of which has only appeared in the past month), I commend the team for identifying and appropriately vetting a comprehensive list of relevant literature.</p>	<p>Thank you.</p>



<p>This is comprehensive and needed report on the state of rural healthcare with respect to provider demand, provider geographic choices, strategies to increase provider recruitment and retention, and the success of approaches to increase students choosing to practice in rural areas. Unfortunately, the synthesis did not reveal a large body of evidence in these areas, pointing to the need for targeted research examining successful approaches and specific workforce projections.</p> <p>I find it very interesting that the strongest association with rural practice is growing up in a rural community, measured by various proxies. One wonders if interventions to attract and retain other providers are futile given the fact that rural practice may be in part of one's psyche. Targeting providers from all disciplines who have spent early years in rural settings seems a logical approach (e.g., pipelines from colleges and universities in rural communities to professional schools with rural emphases, pipeline programs for high school students in rural schools). As the report notes in its Research Gaps/Future Research section on page 71, multi-variate analyses which simultaneously study the effects of personal background (e.g., rural upbringing, gender, SES), training needs and interventions are needed to determine the relative importance of different factors.</p> <p>Another glaring gap noted by the report is the need for studies examining factors associated with non-physicians practicing and staying in rural practice. There is a small body of literature pointing to the need for professional communities of practice, continuing professional education, and mentoring programs which are not addressed by distance education. Rural providers have reported that they leave rural practice because of isolation and lack of professional colleagues.</p>	<p>Thank you, very insightful comments.</p>
<p>The report also reveals the need for VA-specific studies as currently none exist. However, I would draw your attention to the Tumosa et al. paper noted above, Health care workforce development in rural america: when geriatrics expertise is 100 miles away. The VA Office of Rural Health supports the Geriatric Scholars Program, a multi-modal education intervention aimed at bringing geriatrics knowledge and skills to rural VA providers. The program has found to have impacted geriatric competencies pre and post-education. I think the review would be remiss not to refer to this program.</p>	<p>This is an interesting paper but does not report on our outcomes of interest; we have added the reference to the discussion on provider satisfaction with programs.</p>
<p>I guess it is the nature of an evidence-based synthesis, but the paper, while a strong technical piece, lacks some texture in that it does not draw on published work on rural practice and the challenges of rural practice. For instance, there is an excellent manuscript by Chipp et al (#31 in the reference list of the report) which reflects on challenges of rural practice through the voices of practitioners. If possible, some of this qualitative data in the summary or introduction would give this generally excellent review a bit more "life" and underscore the need and challenges of rural practice.</p>	<p>We have added some more detail to the introduction and the discussion to highlight the challenges faced by rural practitioners.</p>
<p>Specific comments: P. 2, line 42: the tense needs to be changed from future to past tense</p>	<p>Corrected</p>
<p>P. 3, line 6: perhaps there should be a bit of background on the GRADE approach for readers unfamiliar with this method</p>	<p>We have expanded the description and added a reference</p>
<p>P. 6, line 40: please define "contemporary context"</p>	<p>Added as suggested</p>
<p>P. 7, Topic Development: Who determined the synthesis' key questions?</p>	<p>Added as suggested</p>
<p>Title of report should be ' Rural Healthcare Workforce: A Systematic Review'.</p>	<p>Thank you so this suggestion, we agree and have added the term</p>
<p>Page 1, line 13 change to " increase rural provider";</p>	<p>Changed</p>
<p>Page 4 line 3 can you elaborate on type of sponsoring facility?</p>	<p>We have added more information but the information in the original article was very limited.</p>



page 11, line 7 "what qualifies as a training site?";	We have added a definition to the methods section
page 23 page 8 why did you not included unpublished VA data on workforce?	Please see above
page 68 line 6 "what constitutes small?" provide number of studies;	Added
page 68 line 59 - spell out HRSA;	Revised
page 6 lines 6-8 can this point be elaborated in discussion?	Added as suggested
Page 5 lines 51 -53 can the international literature be elaborated on further? Those approaches could work in VA.	The existing studies are described in detail in the discussion (page 69-70)
Page 6 lines 26-28 can the new research recently published be further elaborated?	These are the studies included in our report. They are described under key question 5, evidence table 6.
Page 71 - Future research - gaps - Can we specifically say we need further research on the following: 1). Factors impacting rural workforce in VA. 2). Simpler models to predict supply and demand for a range of health professions in a given geographic area, 3) How US and state policies affect supply and demand of health professionals, 4) How and where technology can best ameliorate shortages of providers, 5) how and where new models of care can best ameliorate shortage of providers;	Thank you for these suggestions, we have added points 1, and 3-5 to the section; regarding 3) we are not sure that simpler models are possible; as shown, there are a number of factors contributing to predictions
Page 71 line 32, can this be elaborated? how easy access to CME opportunities, e- consults with specialists, mini residencies, provider education and consult networks impact retention of primary care providers in rural	Without empirical evidence it is difficult to speculate; to address this point w have added the topics to the future research section.
Since many if not most of the readers of this report will only read the executive summary, it's important to explicitly state what has been found by this very well done, thorough review of the literature. The Discussion section should be expanded to state explicitly what has been found by the review. It's probably true that more research would be helpful, but as a policy maker, that does not help determine where to put resources in 2016. The stated findings and conclusions should point to what the current literature--the known body of evidence--points us to, especially where possible enhancement of policies appear to be helpful (e.g. rural training tracks vs loan repayment programs) to make a difference in this decade.	We have expanded the discussion as suggested
International interventions are mentioned but without reference, and in fact in Discussion by Key Question Section, for KQ3, international references make up most of the discussion for KQ3. Should explain use/non-use of international references/models.	The discussion section places the identified research in context of the international literature.
(not all publications have been received at the time of the draft report) Presumably these publications will have minor impact, but would be useful to know which ones were not included in the analysis.	The studies have been added to the final report.
ES, KQ1: It seems reasonable that this is the main finding, yet the lead sentence defines a limitation	Duly noted but given the scope of KQ1 this seems justified
Again, it seems that the important finding of the literature review is that ALL reports state that supply is not met, and that with increasing rurality the demand increases. It would also seem reasonable to choose a metric to compare current or anticipated need, e.g. physicians/population or providers/county, etc.	We have added information on the variability of the reported metrics to address this comment.



ES, KQ2: I didn't see any cited studies that programs did NOT improve likelihood. Seems reasonable to make a stronger declarative statement that is supported by a large # of studies, rather than couching as "seems to increase likelihood."	We have added a discussion of the study limitations to the discussion section to address this point
It would be helpful to quantify the number of physicians. Less than half completed and of those are large percentage stayed longer: How many and how much longer? This is important because the J-1 visa program is well known and policy makers need to know more about its impact.	Added
Can you define the difference between recipients and program completers?	Added as suggested
May point to an important policy issue that needs further discussion, which is that there has not been high quality research conducted about provider retention. Retention is obviously a priority the need to understand retention factors is also a priority. How about NHSC retention rates as a model?	Thank you for this interesting comment.
It would be helpful for the authors to expand this discussion for uninformed readers as to why rural healthcare needs are more complex than metropolitan or urban needs. What are the factors that determine complexity? Am not clear on why the discussion focuses mostly on what is not included in this very thorough review rather than on what the literature demonstrates.	We have revised the wording and expanded the introduction to address this point
Conclusion KQ1: I think you mean population needs	We have reworded the sentence to make it clearer that studies reported unmet healthcare provider needs
Conclusion KQ3: With the average U.S. medical school graduation rate of entering rural practice at about 5%, (even the AAMC (Shipman) study of new schools it peaks at only 8+%), there appears to me that there is good evidence as cited in bullet #5 that rural training programs are successful. Though more research may be needed, there are findings that could be highlighted, e.g. the rather poor success of J-1 visa programs, and +/- success of loan programs that have been somewhat central in recruitment/retention efforts over last several decades.	We acknowledge the point but to address it we have expanded the discussion regarding the lack of comparative effectiveness studies to provide more information regarding the interpretation of results.
Would be helpful to compare/contrast what the literature shows for these 3 interventions, e.g. in a table format.	To address this point we have highlighted that Table 5 provides an overview of studies and evaluated programs
Introduction normative, coercive, utilitarian: An interesting way to sort the strategies. Not evident, based on discussion and conclusions, that this approach was used in the analysis or conclusions.	The small number of provider interventions unfortunately did not allow meaningful stratification
Intro, Evidence syntheses are sparse and care environment has changed: Not sure what this means	Reworded for clarification
Intro, AAMC call for 30% increase:-Is there evidence that increased production of medical graduates has focused on increasing rural education?	Only one included study assessed this question and it concluded that despite expansion, the characteristics of matriculating medical students changed little, except at new schools.
The Methods section is very nicely done and self-explanatory. Clearly written. The quality assessment exercises and rating the body of evidence are particularly helpful.	Thank you.
KQ1, we did not identify studies reporting on the same provider group: Please clarify. Unclear what this means.	Revised to clarify
Evidence tables: These tables are very helpful to understand the content of the literature as well as the review process. Table 4: This table is very useful in understanding and synthesizing the strength of the literature.	Thank you

KQ2, most rural healthcare providers did not grow up in a rural community: It would be helpful to at least postulate, not necessarily in the results, but possibly in the discussion section, what factors may be at play that influenced those from non-rural backgrounds to choose a rural practice career.	Added as suggested
It seemed as though a number of the recruitment publications also include retention information, e.g. Rabinowitz, 2013 who assessed “PSAP” graduates from 1978 – 1986 to assess continuation of rural practice. Unclear why the inclusion criteria for this KQ is limited to studies that only include retention data, or why retention data cannot be gleaned from studies that incorporate both recruitment and retention intervention outcomes. That the only finding for this KQ relates to the J-1 program is surprising and limits the effectiveness of the report.	To address this point we have clarified throughout that we didn't find interventions that focused on retention in fully trained providers practicing in rural care (rather than trainees). We have also added information on retention reported in studies addressing students.
The referenced figure (not shown in this Word version due to formatting incompatibility), needs clarification. Axes are not well labeled...Is the Y axis # of studies or interventions? Is the X axis the number of participants or school graduates? A helpful table would be to report %/# entering rural practice of intervention group c/w %/# without intervention.	We have added a note section to the figure to address this point
Would be helpful to cite comparison percentage from slow/low growth schools.	Added as suggested
This statement seems to contradict prior statement. “Hence it is difficult to make specific evidence statements for the number of healthcare providers needed across the studies.” Doesn't the statement that there is a shortage imply a known or estimated quantity/metric that would alleviate the shortage?	We have clarified the wording to address this point
The review is thorough and the data extraction, along with quality assessments are very nicely done. My concern is that the report itself has not synthesized the information so that the reader comes away with new knowledge about what has been described and reported in the literature. Concluding that the problem is “complex” and more research is needed is in all likelihood accurate, however after reviewing almost 450 publications and thoroughly extracting 56, I would expect more declarative statements that include what the extracted information tells us.	More declarative statements are hampered by the number of studies contributing to some of the KQs and limitations in study designs; we feel we have made our statement as strong as the evidence will support.
p. 4, line 30: Is this report only targeting MDs? what about nursing, pharmacists, psychologists, etc.? It appears other professions are not really mentioned throughout the report.	Nurse practitioners and physician assistants were also included but not pharmacist or psychologists; we have added this point to the limitation section
p. 10, line 18: Acronym should be spelled out when first mentioned as opposed to later in the document.	Revised
p.24, line 55: Is there not more data or information to include here to support this statement?	No, abstracted as reported