Physician Productivity in Specialty Care

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PREFACE

The VA Evidence Synthesis Program (ESP) was established in 2007 to conduct timely, rigorous, and independent systematic reviews to support VA clinicians, program leadership, and policymakers improve the health of Veterans. ESP reviews have been used to develop evidence-informed clinical policies, practice guidelines, and performance measures; to guide implementation of programs and services that improve Veterans' health and wellbeing; and to set the direction of research to close important evidence gaps. Four ESP Centers are located across the US. Centers are led by recognized experts in evidence synthesis, often with roles as practicing VA clinicians. The Coordinating Center, located in Portland, Oregon, manages program operations, ensures methodological consistency and quality of products, engages with stakeholders, and addresses urgent evidence synthesis needs.

Nominations of review topics are solicited several times each year and submitted via the ESP website. Topics are selected based on the availability of relevant evidence and the likelihood that a review on the topic would be feasible and have broad utility across the VA system. If selected, topics are refined with input from Operational Partners (below), ESP staff, and additional subject matter experts. Draft ESP reviews undergo external peer review to ensure they are methodologically sound, unbiased, and include all important evidence on the topic. Peer reviewers must disclose any relevant financial or non-financial conflicts of interest. In seeking broad expertise and perspectives during review development, conflicting viewpoints are common and often result in productive scientific discourse that improves the relevance and rigor of the review. The ESP works to balance divergent views and to manage or mitigate potential conflicts of interest.

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Operational Partners

Operational partners are system-level stakeholders who help ensure relevance of the review topic to the VA, contribute to the development of and approve final project scope and timeframe for completion, provide feedback on the draft report, and provide consultation on strategies for dissemination of the report to the field and relevant groups.

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DISCLOSURES

This report was prepared by the ESP Center located at the **VA Portland Health Care System,** directed by Katherine Mackey, MD, MPP, and funded by the Department of Veterans Affairs, Veterans Health Administration, Health Systems Research.

The findings and conclusions in this document are those of the author(s) who are responsible for its contents and do not necessarily represent the views of the Department of Veterans Affairs or the United States government. Therefore, no statement in this article should be construed as an official position of the Department of Veterans Affairs. The final research questions, methodology, and/or conclusions may not necessarily represent the views of contributing operational and content experts. No investigators have affiliations or financial involvement (eg, employment, consultancies, honoraria, stock ownership or options, expert testimony, grants or patents received or pending, or royalties) that conflict with material presented in the report.

Executive Summary

KEY FINDINGS

- Few studies have evaluated alternatives to volume-based physician productivity measures for outpatient medicine specialties.
- Two observational studies of cardiology practices proposed modifications to work input measures but still used volume-based measures for work output. A third observational study developed a promising a new productivity model using VHA primary care data that integrates clinic-level inputs with important patient outcomes including quality, access, and patient experience as outputs.
- As a learning health care system that is not dependent on wRVUs for payment, VHA is ideally positioned to develop and test innovative models to measure physician productivity. Two of the 3 studies identified were conducted within VHA, suggesting that VHA already has the data and expertise to advance this field.

Productivity is a term used across many industries, including health care, to describe the ratio of work outputs to work inputs. While physician productivity lacks a standard measurement, most US health care systems including the Veterans Health Administration (VHA) currently use work relative value units (wRVUs) as a surrogate measure to approximate physician work output given the lack of another standard measure. Originally developed for Medicare payments, wRVUs have been widely adopted as a billing tool by state Medicaid programs and commercial payers. Many health care systems use data based on wRVUs, such as total annual wRVUs, to set physician productivity standards (or benchmarks), design physician payment and incentive plans, and assess staffing needs.

However, despite widespread use, physicians across multiple specialties have expressed concerns about the mismatch between wRVU data and actual physician work, which involves many clinical activities that take place outside of a billable patient visit, and the chronic undervaluation of non-procedural clinical services. Productivity metrics based on wRVUs also reward health care volume, rather than value, and do not incorporate patient-important outcomes.

CURRENT REVIEW

The purpose of this report was to review the available evidence on physician productivity measures. This report was requested by the Specialty Care Services and Chiefs of Medicine Field Advisory Board and therefore focused on medical specialty physicians delivering care in the outpatient setting. Given an interest in understanding the size, range, and characteristics of available evidence, we conducted a scoping review, which is a type of systematic review that identifies main themes across a body of literature.

Our search of the selected databases from inception through December 2024 identified 174 potentially relevant articles after deduplication and title and abstract screening. Of these, 3 observational studies met eligibility criteria. Two studies of cardiology clinics evaluated ways to modify measures for work input while continuing to use a volume-based measure (patient visits) for work output. One study adjusted their work input measure to account for shared practice resources, while the other used an alternative measure for clinical time instead of FTE. Both studies found that modifying their measures for work input resulted in a more accurate and fair calculation for individual physician productivity.

The most robust new model of physician productivity reconceptualized what information should be used to calculate both work outputs and work inputs. A strength of this model, which was based on VHA data and informed by an evidence review and stakeholder panel input, is that it ties clinic-level productivity to patient outcomes. In this way, the model offers a distinct departure from wRVU or volume-based productivity measures and would seem to be a better fit with the overall VHA approach to care which prioritizes patient-centeredness, quality, access, and cost containment. While designed for primary care clinics and not yet tested in practice, the model could be modified for specialty medicine clinics and other types of outpatient practice settings.

An overview of included studies is presented in the table below.

ES Table. Overview of Included Studies

Study	N	Study Aim	Work Output Measure	Work Input Measure
Butala 2019	56 cardiologists	Develop a method to measure individual physician outpatient clinical productivity accounting for shared practice resources	Completed patient visits per half-day per week	Individual effort adjusted for shared resources
Saeed 2024	654 cardiology or orthopedics providers in 32 VHA clinics	Propose a new work input measure ("clinical time") to replace FTE in productivity calculations	Patients per effective clinic day[a]	Clinical time[b]
Tran 2024	703 VHA primary care clinics	Develop and test a multi-dimensional measure of primary care clinic productivity	Quality, access, patient experience, number of patients served	Interprofessional clinical time

Notes. [a]Defined as "clinical time" in days; [b]Defined as "the amount of time between the start of the first appointment of the day and the estimated end time of the last appointment of the day for each provider."
Abbreviations. FTE=full time equivalency; VHA=Veterans Health Administration.

CONCLUSIONS

As a learning health care system, VHA is uniquely positioned to develop and test innovative models to measure physician productivity that are aligned with the goal of delivering high-value care. Although few in number, existing studies have demonstrated that productivity measures can be updated to better align with contemporary physician practice. Two of the 3 studies we identified were conducted within VHA, suggesting that VHA already has the data and expertise to advance this field.

Main Report

Evidence Synthesis Program

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ABBREVIATIONS TABLE

Abbreviation	Definition
AMA	American Medical Association
CMS	Centers for Medicare and Medicaid Services
CPT	Current procedural terminology
DEA	Data envelopment analysis
FTE	Full-time equivalent
GEE	Generalized estimating equivalents
MGMA	Medical Group Management Association
OLS	Ordinary least squares
OPES	Office of Productivity, Efficiency, and Staffing
RUC	Relative Value Scale Update Committee
SHEP	Survey of Healthcare Experience of Patients
VA	Veterans Affairs
VHA	Veterans Health Administration
VISN	Veterans Integrated Service Network
RVU	Relative value unit
RBRVS	Resource-based relative value scale
wRVU	Work relative value unit

BACKGROUND

Productivity is a term used in the health care context to refer to the work output from physicians and other clinical staff relative to the time and other resources available to complete that work. How to measure physician productivity accurately and fairly has been a perennial topic of debate. In the current era, most US health systems use work relative value units (wRVUs) as a surrogate measure to approximate physician work output given the lack of another standard measure. Representing 1 component of the 3-component resource-based relative value scale (RBRVS), which also accounts for practice expenses and malpractice insurance costs, wRVUs assign a numerical value to physician work output according to current procedural terminology (CPT) codes applied to a patient visit or procedure.[1] Although wRVUs were first used in 1992 by the Health Care Financing Administration (now the Centers for Medicare & Medicaid Services [CMS]) for the purposes of standardizing a Medicare fee schedule, the wRVU system of valuing clinical services has been widely adopted by state Medicaid programs and commercial payers.[2] Therefore, across the range of clinical services provided in the US, most are coded according to CPT and assigned value via wRVUs, making wRVUs a readily available source of information to estimate physician work output. Many health care systems use metrics based on wRVUs, such as total annual wRVUs, to set physician productivity standards (or benchmarks), design physician payment and incentive plans, and allocate resources across clinical services. Use of electronic health records (EHRs) also facilitates use of wRVU data, given that CPT codes are typically part of clinical encounter documentation.

However, despite the widespread use of wRVU-based metrics in health care management decisions, physicians across multiple specialties have expressed concerns about how clinical services are valued in the RBRVS system, the implications of valuing (and therefore charging higher prices for) certain services more than others, and the downstream implications of using wRVUs as a stand-alone measure to assess physician work output.[3,4]

The American Medical Association (AMA) maintains CPT codes, which became the national coding standard for physician and other health care professional services and procedures under the Health Insurance Portability and Accountability Act (HIPAA) in 2020.[5] The AMA also makes annual recommendations to CMS on fee schedule changes based on input from a Relative Value Scale Update Committee (RUC) that meets throughout the year but conducts its deliberations privately (*ie,* outside of public view).[6] According to the AMA, CMS typically accepts more than 90% of the RUC's recommendations.[6] A long-standing critique of this arrangement, by which CMS seems to have largely outsourced decision-making regarding Medicare fee schedules to the AMA, is that higher-cost, resource-intensive clinical services, such as procedures, are preferentially valued over evaluation and management services, the so-called "cognitive services" in which the resource being used is the physician's time and clinical judgement.[1,7–9] In addition to primary care, internal medicine subspecialties with an outpatient focus including rheumatology, endocrinology, infectious diseases, and pulmonary care are impacted by this chronic undervaluation.[9]

The initial framework of the RBRVS was designed to be applied to procedural services; cognitive services were incorporated later in the process.[10] Part of this legacy is that a small number of CPT codes exist for evaluation and management services compared to an expansive list of CPT codes for procedural-based services. Physicians providing evaluation and management services have limited choice of CPT codes to assign to an increasingly broad spectrum of outpatient service complexity, which disadvantages physicians in cognitive specialties and contributes to the undervaluation of their clinical services. While many procedures and diagnostic tests have become more efficient and less

time intensive over time due to technology improvements, outpatient medicine has become more complex and more time intensive as the population ages and has a higher burden of chronic diseases.[11] Yet CPT codes and associated wRVUs have not evolved along with these trends. Moreover, CPT codes do not capture work that is completed outside of a patient encounter, such as reviewing records, refilling medications, communicating lab and imaging results, responding to patient messages, coordinating care across services, and managing population health.[12] The time required to complete these non-billable "asynchronous" clinical work activities has been trending up over time and sharply increased with the onset of the COVID-19 pandemic and a shift away from face-to-face patient care.[13,14] These asynchronous clinical work activities are a core component of outpatient medical care but are often "not observable or not observed" and therefore not captured in wRVU-based metrics, even though these activities improve care quality and reduce costs.[15]

Although VHA operates as a capitated health care system based on the distribution of Congressionally appropriated funds across Veterans Integrated Service Networks (VISNs) and therefore does not depend on wRVUs as a primary means of payment (although it does bill third-party payers for some health care services), wRVUs are still used by VHA decision-makers as a surrogate measure for physician work output. According to VHA Directive 1065,[16] specialty group practice productivity is defined as clinical work completed (the group's total wRVUs) divided by the time available to do that work (the group's total clinical time, full-time equivalent [FTE]). The range of acceptable productivity falls within the interquartile range (25th to 75th percentile) of the comparator. In past years, specialty group practice productivity has been compared to historical VHA performance, but as of fiscal year 2026 (FY26) the VHA will be primarily using Medical Group Management Association (MGMA) academic median benchmarks to determine productivity standards.[17] The Office of Productivity, Efficiency & Staffing (OPES) "assists VHA leadership in developing effective management tools, systems, and studies to optimize clinical productivity and efficiency so that informed staffing decisions are made."[18] Underperforming groups identified with OPES management tools may be referred to the VISN Director for review and development of performance improvement plans.

Although VHA's reasons for using wRVU-based metrics primarily relate to staffing rather than billing, the same concerns about using wRVUs as a surrogate for physician work output in non-VA health care settings apply to the VHA context. The purpose of this report is to review the available evidence on physician productivity measures to identify potential alternatives to wRVU-based metrics. This report was requested by the Specialty Care Services and Chiefs of Medicine Field Advisory Board and therefore focuses on medical specialty physicians delivering care in the outpatient setting. Given an interest in understanding the size, range, and characteristics of available evidence, we opted to conduct a scoping review, which is a type of systematic review that identifies main themes across a body of literature.[19] The findings of this report may inform VHA activities related to measuring physician productivity.

METHODS

REGISTRATION AND REVIEW

A preregistered protocol for this review can be found on the PROSPERO international prospective register of systematic reviews (CRD42024622073). A draft version of this report was reviewed by external peer reviewers; their comments and author responses are in the Appendix.

KEY QUESTIONS AND ELIGIBILITY CRITERIA

The following key question was the focus of this review:

- *Key Question 1 (KQ1)*: What measures and models have been evaluated to assess medical specialty physician productivity in ambulatory settings (including time and effort spent in indirect clinical activities such as population health management and care coordination)?

Study eligibility criteria are shown in the table below.

Domain	Eligibility Criteria
Population	Physicians, prioritizing medicine specialty physicians but including studies of primary care physicians if studies otherwise meet eligibility criteria
Intervention	Physician clinical productivity measures or models implemented or tested with real-world data
Comparator	Any
Outcomes	Productivity outcomes, health care quality outcomes, patient-reported outcomes, cost, care coordination outcomes, or unintended consequences
Setting	Ambulatory care, including care delivered via telehealth
Study Design	Any, but may prioritize studies to fit timeline based on a best-evidence approach

For the purposes of this report, we used the following definitions for key terms based our reading of background literature.

Term	Definition Used in this Report
Productivity	Work output divided by time and/or other resources to complete that work
Workload	Total quantity and/or type of work tasks that must be completed in a given timeframe
Efficiency	Work output divided by the cost (*ie,* time or effort) of completing that work
Value	Quality divided by cost (*ie,* time or effort)

SEARCHING AND SCREENING

To identify articles relevant to the key question, a research librarian searched MEDLINE (Ovid), Cochrane, and Scopus databases from inception through December 2024 using terms for *productivity* and *workload* (see Appendix for complete search strategies). Additional citations were identified from hand-searching reference lists and consultation with content experts. English-language titles, abstracts,

and full-text articles were independently screened by 2 reviewers, and disagreements were resolved by consensus.

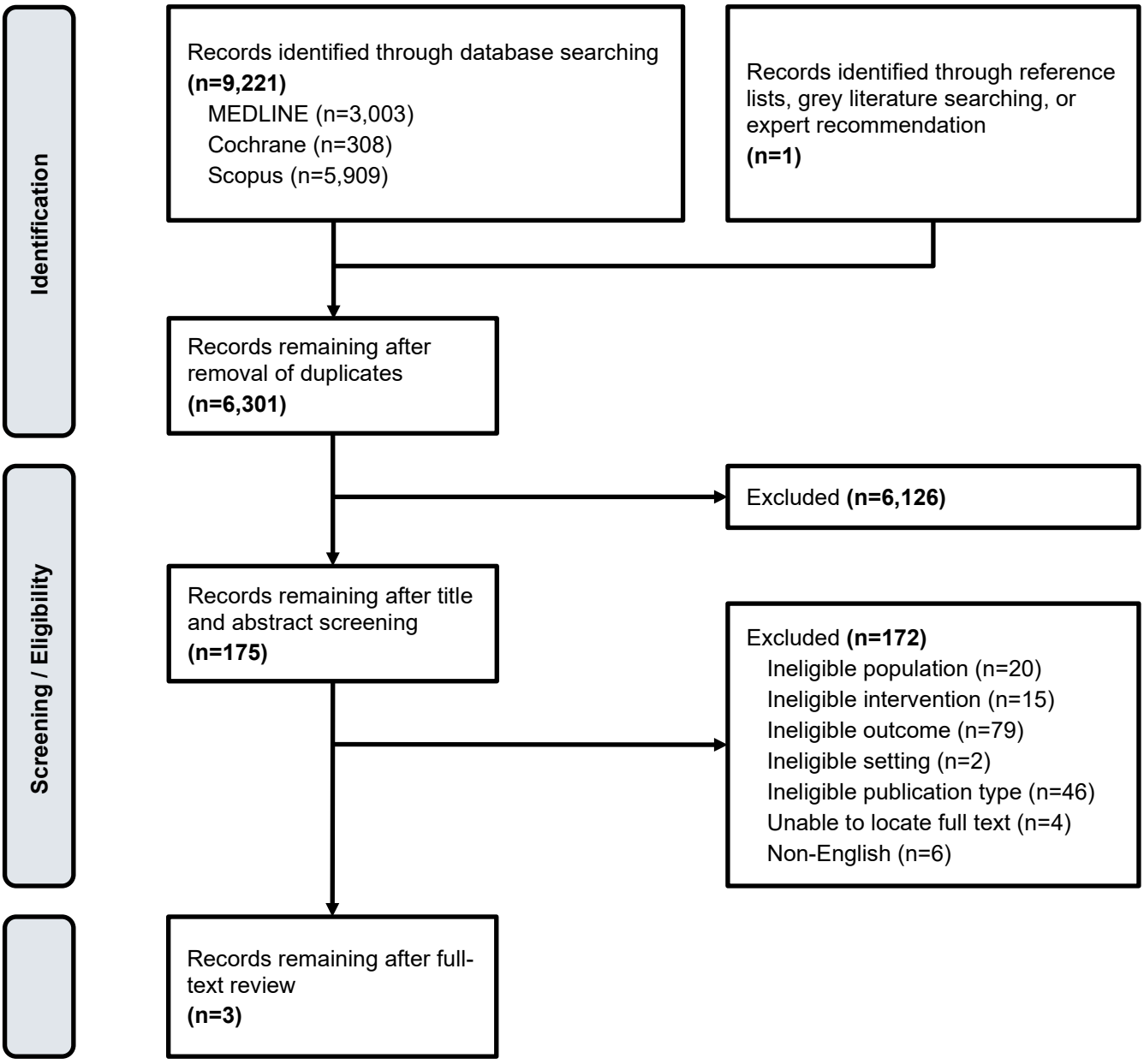
DATA ABSTRACTION AND SYNTHESIS

One reviewer abstracted population, intervention, comparator characteristics, and outcome information from all included studies. Data were checked by another reviewer and disagreements were resolved by consensus. We present themes across the available evidence but did not formally assess risk of bias of individual studies or assess the strength of the body of evidence for a given outcome. This approach is consistent with scoping review methods.[19]

RESULTS

LITERATURE FLOW DIAGRAM

The literature flow diagram summarizes the results of the study selection process. A full list of excluded studies is provided in the Appendix.



OVERVIEW OF INCLUDED STUDIES

Our search identified 174 potentially relevant articles after deduplication and title and abstract screening. Of these, 3 observational studies[20–22] met eligibility criteria. All 3 were conducted in the US and 2 were conducted in VHA settings. Two studies evaluated productivity measures for specialty physicians and 1 developed a productivity model for primary care. Study characteristics are presented in Table 1.

Table 1. Characteristics of Included Studies

Study	N	Setting	Study Aim	Data Source	Statistical Method(s)
Butala 2019	56 cardiologists	Cardiology practice at an academic medical center	Develop a method to measure individual physician outpatient clinical productivity accounting for shared practice resources	Administrative scheduling and hospital data and conversations with practice staff	Compared sequential mixed effects models to GEE and DEA models
Saeed 2024	654 providers in 32 clinics	VHA cardiology and orthopedics clinics	Propose a new work input measure ("clinical time") to replace FTE in productivity calculations	VA Corporate Data Warehouse	Used OLS regression models to validate measures using wait time as an outcome
Tran 2024	703 clinics	VHA community-based outpatient (primary care) clinics	Develop and test a multi-dimensional measure of primary care clinic productivity	Healthcare Effectiveness Data and Information Set, VHA Survey of Healthcare Experience of Patients, and VA Corporate Data Warehouse	Used DEA to calculate efficiency scores measuring the degree to which clinics maximized primary care outputs given available FTE

Abbreviations. DEA=data envelopment analysis; FTE=full time equivalency; GEE=generalized estimating equations; OLS=ordinary least squares; VHA=Veterans Health Administration.

Two studies[20,21] of specialty clinics evaluated methods to calculate individual physician productivity by adjusting the measure for work inputs (the denominator in the "output/input = productivity" equation), and 1 study[22] of primary care clinics introduced a new model to evaluate clinic-level productivity with novel measures for both work outputs and inputs.

One of the specialty clinic studies, an observational study[20] based on 2015-2016 data from 56 cardiologists at an academic medical center, used a mixed-effects model to calculate individual physician productivity after adjusting for the effect of shared practice resources (such as exam rooms) and team-based care (nurse practitioner, fellow, and secretarial FTEs). Rather than wRVUs, the study used completed patient visits per half-day per week as the work output measure (the numerator in the "output/input = productivity" equation). By sequentially evaluating 3 mixed-effects models, authors found that adjusting for shared practice resources reduced variation among individual physicians by more than half, representing a way to evaluate productivity more fairly.

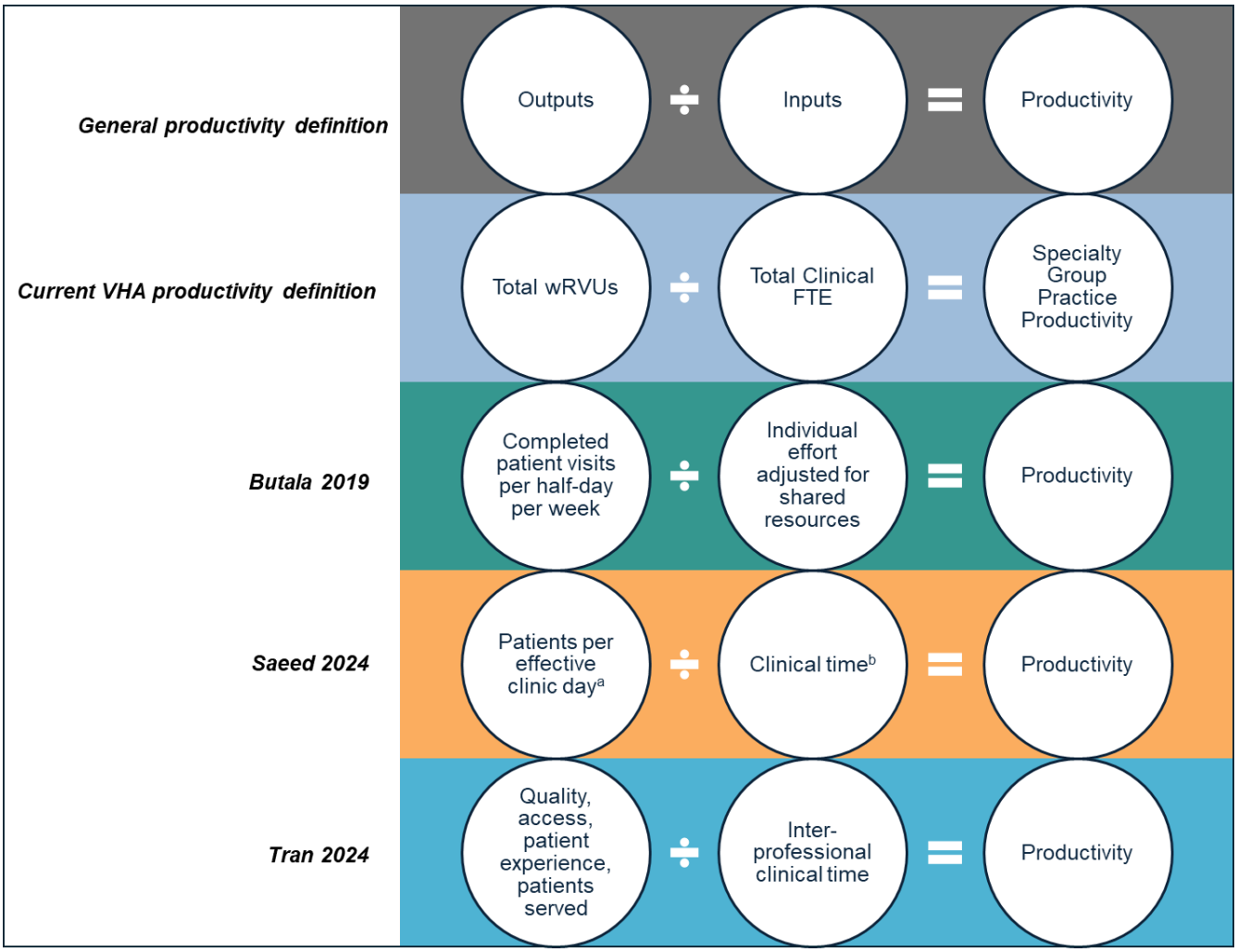
A second specialty clinic study[21] used 2018–2020 data from 32 VHA cardiology and orthopedics clinics representing 654 providers to compare productivity calculations using FTE as the measure of

work input to a new measure called "clinical time," defined as "the amount of time between the start of the first appointment of the day and the estimated end time of the last appointment of the day for each provider." This value in minutes was then divided by 8 hours to calculate clinical time in days, or "effective clinical time." The authors' reasoning for devising this new "clinical time" measure was based on the observation that FTE information is typically self-reported and lacks a consensus definition. While some health systems or clinics may define clinical FTE as a proportion of a 40-hour work week, others may use a different standard or incorporate nonbillable clinical time. Moreover, self-reported FTE information is typically updated infrequently, while "clinic time" can be updated closer to real time using administrative data. The study used patient visits per "effective clinic day" as the work output measure and found that this measure provided a more accurate prediction of clinic access than patients per day per FTE.

A third observational study based on FY19 VHA data from 703 community-based outpatient (primary care) clinics developed a novel metric with the aim of linking investments in team-based primary care to multiple value-based primary care products. In this model, productivity inputs consisted of interprofessional clinical time calculated according to the sum of FTE for all members of the patient care team. Productivity outputs consisted of: 1) *clinical quality* based data from the Healthcare Effectiveness Data and Information Set; 2) *access* using a validated composite measure using VA's Survey of Healthcare Experience of Patients (SHEP); 3) *patient experience* based on SHEP data; and 4) *number of patients served* by each clinic based on VHA administrative data adjusted for patients aged 70 or older and the percent expected to have higher-than-average costs. Inputs and outputs were used to calculate a technical efficiency score reflecting the degree to which clinics maximized outputs given their available inputs. Authors propose that these efficiency scores could be used to meaningfully guide productivity improvements that align with value (not volume)-based outcomes important to patients and physicians.

An overview of how these 3 observational studies defined measures of work input and output compared to VHA's current productivity definition is presented in Figure 1.

Figure 1. Productivity Definitions in VHA and Included Studies



Notes. [a] Defined as "clinical time" in days; [b] Defined as "the amount of time between the start of the first appointment of the day and the estimated end time of the last appointment of the day for each provider."

DISCUSSION

The purpose of this scoping review was to describe the size, range, and characteristics of available evidence on measures of specialty medicine physician productivity. We found that the existing literature base on this topic is small with a limited range. Studies included cardiology clinics but lack data from other medicine specialties.

The 3 observational studies we identified all aimed to improve upon wRVU-based productivity measures but differed in their approach. Two studies[20,21] of cardiology clinics evaluated ways to modify measures for work input (the denominator in the "output/input = productivity" equation) while continuing to use a volume-based measure (patient visits) for work output. One study adjusted their work input measure to account for shared practice resources, while the other used an alternative measure for clinical time instead of FTE. Both studies found that modifying their measures for work input resulted in a more accurate and fair calculation for individual physician productivity.

The most robust new model of physician productivity reconceptualized what information should be used to calculate both work outputs and work inputs.[22] Strengths of this model, which was based on VHA data and informed by an evidence review and stakeholder panel input,[23] are that it incorporates patient-important outcomes such as quality, access, and experience and removes volume-based measures from the productivity equation. In this way, the model offers a distinctly different method to measure productivity that would seem to be a better fit with the overall VHA approach to care, which prioritizes patient-centeredness, quality, access, and cost containment. While designed for primary care clinics, this model could be modified for specialty medicine clinics and other types of outpatient practice settings.

The varied aims and approaches of the 3 studies included in this review illustrate how productivity measures can serve multiple different purposes depending on why they are being used and the problem they are trying to solve. For example, Butala et al[20] used their analysis of productivity adjusted for shared resources to create standard expectations for nurse practitioner to physician ratios and use of clinic rooms. Saeed et al[21] found that their revised definition of clinical time was a better predictor of wait times than measures based on FTE and could be used to evaluate clinic access. Tran et al[22] suggested that their productivity model would better account for the interprofessional teamwork hours that generate clinic outputs, and therefore fit better with the primary care "value proposition" than wRVU or volume-based metrics. As VHA continues to evolve its productivity standards, decision-makers may consider using the example of these studies to directly link efforts to increase physician productivity to the specific VHA problem trying to be solved.

LIMITATIONS

Available evidence regarding specialty medicine physician productivity measures has several limitations. First, the overall size of the literature base is small and of limited range. Data from cardiology practices are included, but other medicine subspecialties are not. While study findings may be applicable to general outpatient practice, some medicine subspecialty practice settings may have unique factors to consider when designing appropriate measures for their work output and input. Second, despite widespread concern that wRVU-based productivity metrics do not capture clinical work outside of patient encounters and therefore do not capture the scope of physician work output, no study directly proposed a measure or model to overcome this problem. Researchers with OPES have used VHA primary care data to develop proxy measures for unobserved workload and create a primary

care case-mix algorithm,[15] but the issue of underestimating actual workload in current VHA productivity calculations remains. Third, while we expected to find relevant studies conducted in non-US settings with applicability to VHA such as the United Kingdom, we did not. Given the small number of US studies that we identified, it is possible that no relevant studies have been conducted in countries with comparable integrated health care systems. If so, this finding highlights another evidence gap.

Limitations of this review include the subjective nature by which we operationalized definitions for *productivity* and other relevant terms such as efficiency. These terms lack standard definitions and are sometimes used interchangeably. We opted to include studies based on whether their aim to was to update some aspect of the "output/input = productivity" equation. We made this decision so that study findings could be compared to the VHA's current productivity definition, which is a version of the "output/input = productivity" equation. Other reviewers may have used a different approach, which could have resulted in different decisions regarding eligible studies.

FUTURE RESEARCH

VHA is unique among US health care systems in terms of its mission, funding, and accountability to Congress and American taxpayers. An argument could be made that VHA's unique status requires a unique approach to evaluating physician productivity, as well as the other metrics driving health care management decisions. Certain aspects of VHA care make overreliance on wRVU-based metrics particularly problematic. For example, increasing use of community care (health care paid for by VHA but delivered by non-VHA providers in the community) has required VHA physicians to spend more time on care coordination activities,[24] but this work usually takes place outside of patient encounters and is therefore not counted as productive according to the VHA's current definition.

In the short term, a risk of using a flawed measure (wRVUs) to assess physician work output is misjudging staffing needs and not providing VHA facilities with the resources that they need to meet patient demand. In the long term, continued reliance on wRVUs as a foundational aspect of US health care including VHA care presents threats to cost containment, as procedures and other services that generate more wRVUs are typically also more expensive to provide.[25] Similarly, sustaining a balanced physician workforce will become increasingly more difficult as fewer physicians will elect to enter specialties that are undervalued and lower paid yet still essential for patient care.[26]

As a learning health care system that is not dependent on wRVUs for payment, VHA is ideally positioned to develop and test innovative models to measure physician productivity that are aligned with the goal of delivering high-value patient-centered care. Although few in number, existing studies have demonstrated that productivity measures can be reimagined. Moreover, 2 of the 3 studies we identified were conducted within VHA, suggesting that VHA already has the data and expertise to advance this field.

Specific ways that VHA could improve upon current measures of physician productivity include:

- Adapting the model developed by Tran et al[22], which uses a holistic approach to measure clinic-level productivity, to evaluate specialty clinic settings. Using this kind of model to measure productivity would be more consistent with VHA's approach to care than a simple work output/input equation and could be used to improve clinic efficiency (how well clinics maximize outputs based on available inputs in terms of time and effort).

- Creating and testing a new measure set for asynchronous clinical work, perhaps one in which various work tasks completed outside of patient encounters are categorized and ranked according to cognitive effort and time requirements, and then applying this new measure set to physician productivity calculations.
- Ensuring that new models or measures developed for physician and clinic-level productivity calculations are based on available, accessible, and timely data and are therefore feasible to implement in practice.

CONCLUSIONS

We found that available evidence on specialty medicine physician productivity measures is limited. Two observational studies proposed modifications to work input measures but still used volume-based measures for work output. A third observational study described a promising new model developed using VHA primary care data that ties clinic-level productivity to patient outcomes. Important evidence gaps exist, including how to measure clinical work that is completed outside of patient encounters. As a learning health care system, VHA is uniquely positioned to implement and study alternatives to volume-based productivity metrics that align with the value-based outcomes that are important to patients, physicians, and society at large.

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16. Department of Veterans Affairs. VHA Directive 1065: Productivity and Staffing Guidance for Specialty Provider Group Practice. 2023.

17. Department of Veterans Affairs. Memorandum: READY-SET-GO Campaign for Updated Productivity Targets. 2025.

18. Department of Veterans Affairs. Meet the OPES Team. Accessed April 10, 2025. https://dvagov.sharepoint.com/sites/VHAOPES/SitePages/Meet-the-team.aspx

19. Tricco AC, Lillie E, Zarin W, et al. PRISMA Extension for Scoping Reviews (PRISMA-ScR): Checklist and Explanation. *Ann Intern Med*. 2018;169(7):467-473. doi:10.7326/M18-0850

20. Butala NM, Hidrue MK, Swersey AJ, et al. Measuring individual physician clinical productivity in an era of consolidated group practices. *Healthcare*. 2019;7(4). doi:10.1016/j.hjdsi.2019.02.001

21. Saeed I, Barr K, Palani S, Shafer P, Pizer S. Comparison of Full-Time Equivalent and Clinic Time Labor Input Measures in Productivity Metrics. *J Healthc Manage*. 2024;69(3):178-189. doi:10.1097/JHM-D-23-00106

22. Tran LD, Wagner TH, Shekelle P, et al. Assessing and Improving Productivity in Primary Care: Proof of Concept Results for a Novel Value-Based Metric. *J Gen Intern Med*. 2024;39(12):2317-2323. doi:10.1007/s11606-024-08710-0

23. Hempel S, Curtis I, Fihn SD, et al. Primary Care Productivity: Findings from the Literature and Perspectives from a Stakeholder Panel. *RAND Corporation*. Published online 2021.

24. Apaydin EA, Rose DE, McClean MR, et al. Association between care coordination tasks with non-VA community care and VA PCP burnout: an analysis of a national, cross-sectional survey. *BMC Health Serv Res*. 2021;21(1):809. doi:10.1186/s12913-021-06769-7

25. Goodson JD. Unintended Consequences of Resource-Based Relative Value Scale Reimbursement. *JAMA*. 2007;298(19):2308. doi:10.1001/jama.298.19.2308

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Appendices

SEARCH STRATEGIES

MEDLINE (OVID)

#	Search Statement	Results
1	((clinician* or doctor* or physician* or practitioner* or provider*) adj3 (effort* or productivit* or workload* or bookability or (bookable adj1 (hour* or time)) or clinical encounter* or ((labor or labour or time) adj3 (map or mapping* or maps)) or (valu* adj2 work*))).ti,ab,kf.	6178
2	exp Models, Economic/ or Models, Statistical/ or Models, Theoretical/ or (benchmark* or evaluat* or model* or measur* or metric*).ti,ab,kf.	111091630
3	Relative Value Scale/ or ((relative value adj1 (scale* or schedule* or unit*)) or rvu or rvus or wrvu or wrvus).ti,ab,kf.	2927
4	2 or 3	11093335
5	1 and 4	3003
	Total	3003
	Total after deduplication	6300

Search date: 12/10/2024

COCHRANE (WILEY)

#	Search Statement	Results
1	((clinician* or doctor* or physician* or practitioner* or provider*) NEAR/3 (effort* or productivit* or workload* or bookability or (bookable NEAR/1 (hour* or time)) or "clinical encounter" or "clinical encounters" or ((labor or labour or time) NEAR/3 (map or mapping* or maps)) or (valu* NEAR/2 work*))):ti,ab	438
2	MeSH descriptor: [Models, Economic] explode all trees	690
3	MeSH descriptor: [Models, Statistical] this term only	2310
4	MeSH descriptor: [Models, Theoretical] this term only	1152
5	(benchmark* or evaluat* or model* or measur* or metric*):ti,ab	1099713
6	{or #2-#5}	1100372
7	MeSH descriptor: [Relative Value Scales] this term only	11
8	((relative value NEAR/1 (scale* or schedule* or unit*)) or rvu or rvus or wrvu or wrvus):ti,ab	55
9	#7 or #8	59
10	#6 or #8	1100387
11	#1 and #11	308
	Total	308
	Total after deduplication	6300

Search date: 12/10/2024

SCOPUS (ELSEVIER)

#	Search Statement	Results
1	TITLE-ABS-KEY((clinician* or doctor* or physician* or practitioner* or provider*) adj3 (effort* or productivit* or workload* or bookability or (bookable adj1 (hour* or time)) or clinical encounter* or ((labor or labour or time) adj3 (map or mapping* or maps)) or (valu* adj2 work*)))	12806
2	TITLE-ABS-KEY(benchmark* or evaluat* or model* or measur* or metric*)	34280209
3	TITLE-ABS-KEY((“relative value” adj1 (scale* or schedule* or unit*)) or rvu or rvus or wrvu or wrvus)	3293
4	2 or 3	34281991
5	1 and 4	5909
	Total	5909
	Total after deduplication	6300

Search date: 12/10/2024

STUDIES EXCLUDED DURING FULL-TEXT SCREENING

Citation	Exclude Reason
How is physician productivity measured? Managed Care Interface. 2002;15(9):62-63.	Wrong publication type
Encourage desired physician behavior, improve productivity through performance measures. Healthcare Strateg Manage. 2006;24(8):10-11.	Wrong publication type
Abecassis M, Pearson T. Fee-for-value and wRVU-based physician productivity-an emerging paradox. American journal of transplantation : official journal of the American Society of Transplantation and the American Society of Transplant Surgeons. 2015;15(3):579-80. doi:https://dx.doi.org/10.1111/ajt.13112	Wrong publication type
Adida E, Dai T. Impact of Physician Payment Scheme on Diagnostic Effort and Testing. Manage Sci. 2024;70(8):5408-5425. doi:10.1287/mnsc.2023.4937	Wrong outcomes
Alexandraki I, Palacio C, House J, Catalano C, Mooradian AD. Resource-based relative value scale analysis between teaching and nonteaching hospitalist services. The health care manager. 2009;28(1):81-5. doi:https://dx.doi.org/10.1097/HCM.0b013e318196de91	Wrong outcomes
Alies-Patin A, Bai-Grenier F, Debeugny G, Khelifa A. Methodological proposals for overhauling the surgical part of the physician's procedural index. J ECON MED. 1995;13(2):75-82.	Non-English
Andreae MC, Freed GL. A new paradigm in academic health centers: productivity-based physician compensation. Medical group management journal. 2001;48(3):44-54	Wrong patient population
Andreae MC, Freed GL. Using a productivity-based physician compensation program at an academic health center: a case study. Academic medicine : journal of the Association of American Medical Colleges. 2002;77(9):894-9. doi:https://dx.doi.org/10.1097/00001888-200209000-00019	Wrong patient population
Anjum O, Yadav K, Chhabra S, et al. Definitions and factors associated with emergency physician productivity: a scoping review. CJEM. 2023;25(4):314-325. doi:https://dx.doi.org/10.1007/s43678-023-00479-1	Wrong publication type
Anonymous. Boost physician productivity with performance data. Data strategies & benchmarks : the monthly advisory for health care executives. 1997;1(2):17-21.	Wrong publication type
Anonymous. Harness contracting clout by tracking physician productivity. Capitation management report. 1997;4(12):194-7.	No full text available
Arndt B, Tuan W-J, White J, Schumacher J. Panel workload assessment in US primary care: accounting for non-face-to-face panel management activities. Journal of the American Board of Family Medicine : JABFM. 2014;27(4):530-7. doi:https://dx.doi.org/10.3122/jabfm.2014.04.130236	Wrong outcomes
Bansal VV, Witmer HDD, Childers CP, Su DG, Turaga KK. When Benchmarks Fail Us: A Case Study in Cytoreductive Surgery. Annals of surgical oncology. 2024;(b9r, 9420840)doi:https://dx.doi.org/10.1245/s10434-024-16191-y	Wrong outcomes
Baymon DE, Shappell E, Park YS, et al. Measuring Emergency Department Workload Perception Using Electronic Medical Record Measures of Patient Volume and Acuity. The Journal of emergency medicine. 2024;66(3):e374-e380. doi:https://dx.doi.org/10.1016/j.jemermed.2023.10.004	Wrong outcomes

Citation	Exclude Reason
Becker ER, Hall K. Physician services in an academic neurology department: using the resource-based relative-value scale to examine physician activities. Journal of health care finance. 2001;27(4):79-91.	Wrong outcomes
Benda NC, Blumenthal HJ, Hettinger AZ, et al. Human Factors Design in the Clinical Environment: Development and Assessment of an Interface for Visualizing Emergency Medicine Clinician Workload. IISE Trans Occup Ergon Hum Factors. 2018;6(3-4):225-237. doi:10.1080/24725838.2018.1522392	Wrong outcomes
Bertrand F, Martinez P, Thiercelin D, et al. Physician's workload in the emergency department: Quantitative or qualitative problem? About the emergency physicians's serenity. Reanim Urgences. 2000;9(7):492-497. doi:10.1016/s1164-6756(00)90054-9	Non-English
Blalock J, Mackowiak PA. A resource-allocation model to enhance productivity of academic physicians. Academic medicine : journal of the Association of American Medical Colleges. 1998;73(10):1062-6. doi:https://dx.doi.org/10.1097/00001888-199810000-00013	Wrong outcomes
Bonfim D, Pereira MJB, Pierantoni CR, Haddad AE, Gaidzinski RR. Tool to measure workload of health professionals in Primary Health Care: development and validation. Revista da Escola de Enfermagem da U S P. 2015;49 Spec No(rss, 0242726):25-34. doi:https://dx.doi.org/10.1590/S0080-623420150000800004	Wrong patient population
Burden M, Gundareddy VP, Kauffman R, et al. Assessing the impact of workload and clinician experience on patient throughput: A multicenter study. Journal of hospital medicine. 2024;(101271025)doi:https://dx.doi.org/10.1002/jhm.13555	Wrong outcomes
Calvitti A, Hochheiser H, Ashfaq S, et al. Physician activity during outpatient visits and subjective workload. Journal of biomedical informatics. 2017;69(100970413, d2m):135-149. doi:https://dx.doi.org/10.1016/j.jbi.2017.03.011	Wrong outcomes
Camiat F, Restrepo MI, Chauny J-M, Lahrichi N, Rousseau L-M. Productivity-driven physician scheduling in emergency departments. Health systems (Basingstoke, England). 2019;10(2):104-117. doi:https://dx.doi.org/10.1080/20476965.2019.1666036	Wrong outcomes
Carlson ER. Academic Relative Value Units: A Proposal for Faculty Development in Oral and Maxillofacial Surgery. Journal of oral and maxillofacial surgery : official journal of the American Association of Oral and Maxillofacial Surgeons. 2021;79(1):36.e1-36.e13. doi:https://dx.doi.org/10.1016/j.joms.2020.09.036	Wrong outcomes
Chakiryan NH, Jiang DD, Gillis KA, Chen Y, Acevedo AM, Sajadi KP. Relative Value Units do Not Adequately Account for Operative Time of Urological Surgery. The Journal of urology. 2020;203(5):1003-1007. doi:https://dx.doi.org/10.1097/JU.0000000000000619	Wrong outcomes
Chandrasekar T, Han TM, Glick L, et al. Setting the Standards: Examining Research Productivity Among Academic Urologists in the USA and Canada in 2019. Eur Urol Focus. 2021;7(2):489-496. doi:10.1016/j.euf.2020.02.003	Wrong outcomes
Coleman DL, Moran E, Serfilippi D, et al. Measuring physicians' productivity in a Veterans Affairs Medical Center. *Acad Med*. 2003;78(7):682-689. doi:10.1097/00001888-200307000-00007	Wrong outcomes
Collier DA, Collier CE, Kelly TM. Benchmarking physician performance, Part 1. The Journal of medical practice management : MPM. 2006;21(4):185-9.	Wrong publication type

Citation	Exclude Reason
Conlon M, Tharani Z. The implementation of a physician workload system in an academic health care setting: The Physician Activity Information System (PhAIS). Br Columbia Med J. 2008;50(10):565-570.	Wrong intervention
Conrad DA, Sales A, Liang S-Y, et al. The impact of financial incentives on physician productivity in medical groups. Health services research. 2002;37(4):885-906. doi:https://dx.doi.org/10.1034/j.1600-0560.2002.57.x	Wrong intervention
Das J, Sohnesen TP. Variations in doctor effort: evidence from Paraguay. Health affairs (Project Hope). 2007;26(3):w324-37. doi:https://dx.doi.org/10.1377/hlthaff.26.3.w324	Wrong outcomes
Davis A, Hardy CT. New compensation model improves physician productivity. Healthcare financial management : journal of the Healthcare Financial Management Association. 1999;53(7):46-9.	Wrong outcomes
Davis PL. Assessing the potential versus the actual earnings of academic radiologists: effects of unequal duty service assignments. Academic radiology. 2001;8(8):782-91. doi:https://dx.doi.org/10.1016/S1076-6332(03)80587-1	Wrong patient population
Dawson EL, Speelman C. Productivity measurement in psychology and neuropsychology: Existing standards and alternative suggestions. The Clinical neuropsychologist. 2023;37(8):1569-1583. doi:https://dx.doi.org/10.1080/13854046.2023.2192419	Wrong publication type
Deguchi JJ, Inui TS, Martin DP. Measuring provider productivity in ambulatory care. The Journal of ambulatory care management. 1984;7(2):29-38. doi:https://dx.doi.org/10.1097/00004479-198405000-00006	Wrong intervention
Dent T. Masters in medicine: Part III. Performance measurements of primary care physicians in managed care. Dis Mon. 1998;44(8):400-420. doi:10.1016/S0011-5029(98)90007-4	Wrong publication type
Didzbalis CJ, Avery Cohen D, Herzog I, Park J, Weisberger J, Lee ES. The Relative Citation Ratio: A Modern Approach to Assessing Academic Productivity within Plastic Surgery. Plastic and reconstructive surgery Global open. 2022;10(11):e4564. doi:https://dx.doi.org/10.1097/GOX.0000000000004564	Wrong outcomes
Dubinsky I. Emergency physician workload modeling. CJEM. 2012;14(4):215-20. doi:https://dx.doi.org/10.2310/8000.2012.120532	Wrong patient population
Dunn D, Hsiao WC, Ketcham TR, Braun P. A Method for Estimating the Preservice and Postservice Work of Physicians' Services. JAMA. 1988;260(16):2371-2378. doi:10.1001/jama.1988.03410160045006	Wrong outcomes
Dupree JM, Coward RM, Hsieh T-C, et al. The Impact of Physician Productivity Models on Access to Subspecialty Care: A White Paper From the Society for the Study of Male Reproduction and the Society for Male Reproduction and Urology. Urology. 2021;153(wsy, 0366151):28-34. doi:https://dx.doi.org/10.1016/j.urology.2021.01.016	Wrong publication type
Duszak R, Jr., Muroff LR. Measuring and managing radiologist productivity, part 2: beyond the clinical numbers. Journal of the American College of Radiology : JACR. 2010;7(7):482-9. doi:https://dx.doi.org/10.1016/j.jacr.2010.01.025	Wrong publication type
Duszak R, Jr., Muroff LR. Measuring and managing radiologist productivity, part 1: clinical metrics and benchmarks. Journal of the American College of Radiology : JACR. 2010;7(6):452-8. doi:https://dx.doi.org/10.1016/j.jacr.2010.01.026	Wrong publication type

Citation	Exclude Reason
Ekeroma AJ, Shulruf B, McCowan L, Hill AG, Kenealy T. Development and use of a research productivity assessment tool for clinicians in low-resource settings in the Pacific Islands: A Delphi study. Health Res Policy Syst. 2016;14(1)doi:10.1186/s12961-016-0077-4	Wrong outcomes
Erus B, Hatipoglu O. Physician payment schemes and physician productivity: Analysis of Turkish healthcare reforms. Health policy (Amsterdam, Netherlands). 2017;121(5):553-557. doi:https://dx.doi.org/10.1016/j.healthpol.2017.02.012	Wrong outcomes
Evans Iii JH, Kim K, Nagarajan NJ, Patro S. Nonfinancial performance measures and physician compensation. J Manage Account Res. 2010;22(1):31-56. doi:10.2308/jmar.2010.22.1.31	Wrong publication type
Fetter RB, Averill RF, Lichtenstein JL, Freeman JL. Ambulatory visit groups: A framework for measuring productivity in ambulatory care. *HEALTH SERV RES*. 1984;19(4):415-437.	Wrong publication type
Filler G, Burkoski V, Tithecott G. Measuring physicians' productivity: a three-year study to evaluate a new remuneration system. Academic medicine : journal of the Association of American Medical Colleges. 2014;89(1):144-52. doi:https://dx.doi.org/10.1097/ACM.0000000000000058	Wrong patient population
Fishbein D, Nambiar S, McKenzie K, et al. Objective measures of workload in healthcare: a narrative review. International journal of health care quality assurance. 2019;33(1):1-17. doi:https://dx.doi.org/10.1108/IJHCQA-12-2018-0288	Wrong publication type
Fisher C. Multifactor productivity in physicians' offices: an exploratory analysis. Health care financing review. 2008;29(2):15-32.	Wrong publication type
Forootan S, Hajebrahimi S, Janati A, Najafi B, Asghari-Jafarabadi M. Development of a local model for measuring the work of surgeons. Turk J Surg. 2021;37(4):371-378. doi:10.47717/turkjsurg.2021.5473	Wrong patient population
Freeman P. Measuring emergency physician productivity and work patterns. Emergency medicine Australasia : EMA. 2023;35(4):687-690. doi:https://dx.doi.org/10.1111/1742-6723.14208	Wrong publication type
Friedman EL, Guidi TU. Measuring Physician Productivity: Taking the Pulse of a Practice. Oncol Issues. 2005;20(1):38-41. doi:10.1080/10463356.2005.11883234	Wrong publication type
Gan ZS, Wood CM, Hayon S, et al. Correlation of Relative Value Units With Surgical Complexity and Physician Workload in Urology. Urology. 2020;139(wsy, 0366151):71-77. doi:https://dx.doi.org/10.1016/j.urology.2019.12.044	Wrong outcomes
Gao J, Moran E, Schwartz A, Ruser C. Case-mix for assessing primary care value (CPCV). *Health Serv Manage Res*. 2020;33(4):200-206. doi:10.1177/0951484820931063	Wrong outcomes
Giacoma T, Ayvaci MUS, Gaston RS, Mejia A, Tanriover B. Transplant physician and surgeon compensation: A sample framework accounting for nonbillable and value-based work. American journal of transplantation : official journal of the American Society of Transplantation and the American Society of Transplant Surgeons. 2020;20(3):641-652. doi:https://dx.doi.org/10.1111/ajt.15625	Wrong publication type
Glass KP, Anderson JR. Relative value units and productivity: Part 2 of 4. The Journal of medical practice management : MPM. 2002;17(6):285-90.	Wrong publication type
Greenfield AR. Physician productivity: a managerial challenge. The Journal of ambulatory care management. 1989;12(1):6-10. doi:https://dx.doi.org/10.1097/00004479-198902000-00004	Wrong publication type

Citation	Exclude Reason
Grogan D, Reddy V, Gupta A, Chang Y-F, Fields D, Agarwal N. Trends in Academic Spine Neurosurgeon Productivity as Measured by the Relative Citation Ratio. World neurosurgery. 2021;147(101528275):e40-e46. doi:https://dx.doi.org/10.1016/j.wneu.2020.11.097	Wrong outcomes
Groningen NV, Prasad PA, Najafi N, Rajkomar A, Khanna RR, Fang MC. Electronic Order Volume as a Meaningful Component in Estimating Patient Complexity and Resident Physician Workload. Journal of hospital medicine. 2018;13(12):829-835. doi:https://dx.doi.org/10.12788/jhm.3069	Wrong outcomes
Gui XH, Wang HB, Liu H, Yang YF. Construction of Incentive Salary Model Based on Family Doctor Services System. Chin Gen Pract. 2018;21(25):3038-3043. doi:10.12114/j.issn.1007-9572.2018.25.003	Non-English
Haeuser L, Cone EB, Cole AP, Marchese M, Trinh Q-D. Are work relative value units correlated with operative duration of common surgical procedures? The American journal of managed care. 2022;28(4):148-151. doi:https://dx.doi.org/10.37765/ajmc.2022.88858	Wrong outcomes
Haidar YM, Moshtaghi O, Mahboubi H, et al. Association Between Electronic Medical Record Implementation and Otolaryngologist Productivity in the Ambulatory Setting. JAMA otolaryngology-- head & neck surgery. 2017;143(1):20-24. doi:https://dx.doi.org/10.1001/jamaoto.2016.2528	Wrong intervention
Hao J, Yao H, Kong L, Liu Y. The work relative value estimation assessment in China: an empirical research for common surgical procedures. Frontiers in public health. 2024;12(101616579):1385616. doi:https://dx.doi.org/10.3389/fpubh.2024.1385616	Wrong outcomes
Harolds JA. Productivity of nuclear medicine physicians and radiologists. Clin Nucl Med. 2011;36(1):32-33. doi:10.1097/RLU.0b013e3181ffecb6	Wrong publication type
Hayon S, Deal A, Tan H-J, et al. Is the relative value of surgeon effort equal across surgical specialties? Surgery. 2020;168(3):365-370. doi:https://dx.doi.org/10.1016/j.surg.2020.04.018	Wrong patient population
Henderson WS. Benchmarking the neurology practice. Neurologic clinics. 2010;28(2):365-84. doi:https://dx.doi.org/10.1016/j.ncl.2009.11.003	Wrong publication type
Hickey M, Ichter JT. Promoting physician productivity through a variable compensation system. Healthcare financial management : journal of the Healthcare Financial Management Association. 1997;51(8):38-40.	Wrong outcomes
Hill RG, Jr., Sears LM, Melanson SW. 4000 clicks: a productivity analysis of electronic medical records in a community hospital ED. The American journal of emergency medicine. 2013;31(11):1591-4. doi:https://dx.doi.org/10.1016/j.ajem.2013.06.028	Wrong intervention
Howell TG, Jr. Primary Care Productivity and Patient Satisfaction in Community Practice: What is the Relationship? Patient Exp J. 2024;11(2):27-35. doi:10.35680/2372-0247.1948	Wrong outcomes
Hysong SJ, Amspoker AB, Petersen LA. A Novel Method for Assessing Task Complexity in Outpatient Clinical-Performance Measures. J Gen Intern Med. 2016;31:28-35. doi:10.1007/s11606-015-3568-z	Wrong outcomes
Innes GD, Stenstrom R, Grafstein E, Christenson JM. Prospective time study derivation of emergency physician workload predictors. CJEM. 2005;7(5):299-308. doi:https://dx.doi.org/10.1017/s1481803500014482	Wrong patient population
Jacob J, Wan F, Jin A. Is telemedicine worth the effort? A study on the impact of effort cost on healthcare platform with heterogeneous preferences. Comput Ind Eng. 2024;188doi:10.1016/j.cie.2023.109854	Wrong outcomes

Citation	Exclude Reason
Jacobs JP, Lahey SJ, Nichols FC, et al. How Is Physician Work Valued? The Annals of thoracic surgery. 2017;103(2):373-380. doi:https://dx.doi.org/10.1016/j.athoracsur.2016.11.059	Wrong publication type
Jiang Y, Huang Y-L, Watral A, Blocker RC, Rushlow DR. Predicting Provider Workload Using Predicted Patient Risk Score and Social Determinants of Health in Primary Care Setting. Applied clinical informatics. 2024;15(3):511-527. doi:https://dx.doi.org/10.1055/s-0044-1787647	Wrong outcomes
Johannessen KA, Kittelsen SAC, Hagen TP. Assessing physician productivity following Norwegian hospital reform: A panel and data envelopment analysis. Social science & medicine (1982). 2017;175(ut9, 8303205):117-126. doi:https://dx.doi.org/10.1016/j.socscimed.2017.01.008	Wrong outcomes
Johnson SE, Newton WP. Resource-based relative value units: a primer for academic family physicians. Family medicine. 2002;34(3):172-6.	Wrong publication type
Johnsson J. Software measures provider productivity through clinical data. Contract healthcare. 1988;(9883667, dr6):26-7.	No full text available
Joseph JW, Davis S, Wilker EH, et al. Modelling attending physician productivity in the emergency department: a multicentre study. Emergency medicine journal : EMJ. 2018;35(5):317-322. doi:https://dx.doi.org/10.1136/emermed-2017-207194	Wrong intervention
Kachhal SK, Bronken T, McCarthy B, Schramm W, Isken N. Performance measurement for primary care physicians. IIE; 1996:179-188.	No full text available
Kahan JP, Morton SC, Farris HH, Kominski GF, Donovan AJ. Panel processes for revising relative values of physician work a pilot study. Med Care. 1994;32(11):1069-1085. doi:10.1097/00005650-199411000-00001	Wrong publication type
Kalmar CL, Patel VA, Golinko MS. Surgical Complexity and Physician Workload in Craniofacial Surgery: Do RVUs Need to be Adjusted? The Journal of craniofacial surgery. 2024;(a3j, 9010410)doi:https://dx.doi.org/10.1097/SCS.0000000000009989	Wrong outcomes
Kantarevic J, Kralj B, Weinkauf D. Enhanced fee-for-service model and physician productivity: evidence from Family Health Groups in Ontario. Journal of health economics. 2011;30(1):99-111. doi:https://dx.doi.org/10.1016/j.jhealeco.2010.10.005	Wrong outcomes
Kaplan PE, Granger CV, Pease WS, Arnett JA, Huba JC. Development of an academic productivity scale for departments of physical medicine and rehabilitation. Archives of physical medicine and rehabilitation. 1997;78(9):938-41. doi:https://dx.doi.org/10.1016/s0003-9993(97)90053-8	Wrong outcomes
Kaplan SH, Griffith JL, Price LL, Pawlson LG, Greenfield S. Improving the reliability of physician performance assessment: identifying the "physician effect" on quality and creating composite measures. Medical care. 2009;47(4):378-87. doi:https://dx.doi.org/10.1097/MLR.0b013e31818dce07	Wrong outcomes
Kee F, Wilson RH, Harper C, et al. Influence of hospital and clinician workload on survival from colorectal cancer: cohort study. BMJ (Clinical research ed). 1999;318(7195):1381-5. doi:https://dx.doi.org/10.1136/bmj.318.7195.1381	Wrong outcomes
Kentros C, Barbato C. Using normalized RVU reporting to evaluate physician productivity. Healthcare financial management : journal of the Healthcare Financial Management Association. 2013;67(8):98-105.	Wrong patient population
Khalifa M. Developing an Emergency Physician Productivity Index Using Descriptive Health Analytics. Studies in health technology and informatics. 2015;213(ck1, 9214582):167-70.	Wrong patient population

Citation	Exclude Reason
Kidd VD, Liu JH, Reamer-Yu A, Wang JH, Deng M. The development of a visual dashboard report to assess physician assistant and nurse practitioner financial and clinical productivity. BMC health services research. 2022;22(1):882. doi:https://dx.doi.org/10.1186/s12913-022-08216-7	Wrong patient population
Kimbell LJ, Lorant JH. Physician productivity and returns to scale. Health services research. 1977;12(4):367-79.	Wrong outcomes
King JJC, Powell-Jackson T, Hargreaves J, Makungu C, Goodman C. Does increased provider effort improve quality of care? Evidence from a standardised patient study on correct and unnecessary treatment. BMC health services research. 2023;23(1):190. doi:https://dx.doi.org/10.1186/s12913-023-09149-5	Wrong outcomes
Lagasse P, Jr. Physician productivity measurement, methodology and implementation. Journal of the Society for Health Systems. 1996;5(2):41-9.	Wrong patient population
Lagasse P. Physician productivity measurement, application & results. IIE; 1996:198-207.	No full text available
Lamba R, Schapira MM, Singh S, Fletcher KE. Defining and measuring the effort needed for inpatient medicine work. Journal of hospital medicine. 2012;7(5):426-30. doi:https://dx.doi.org/10.1002/jhm.1004	Wrong patient population
Landauer TE, Gans DN, Brierly Golin C. Medical practice management trends: New methods of measuring physician productivity. J MED PRACT MANAGE. 1988;3(4):245-248.	Wrong publication type
Lazarus SS, Krill MA, Gans DN, Bergstrom A. Physician productivity measurement and comparison. The Journal of ambulatory care management. 1989;12(1):38-51. doi:https://dx.doi.org/10.1097/00004479-198902000-00007	Wrong publication type
Ledoux B, Riou F, Jarno P, Pinel JF, Le Beux P, Chaperon J. Measuring physician's workload when caring for stroke patients in the neurological ward of a University Hospital. J Econ Med. 2003;21(4):239-251.	Non-English
Lee S, Bain PA, Musa AJ, Li J. A Markov chain model for analysis of physician workflow in primary care clinics. Health care management science. 2021;24(1):72-91. doi:https://dx.doi.org/10.1007/s10729-020-09517-1	Wrong outcomes
Leung S. Is it Right to Measure the Productivity of Senior Clinician/Educators by Relative Value Units? Journal of graduate medical education. 2011;3(1):9. doi:https://dx.doi.org/10.4300/JGME-D-10-00214.1	Wrong publication type
Levin LS, Gustave L. Aligning incentives in health care: physician practice and health system partnership. Clinical orthopaedics and related research. 2013;471(6):1824-31. doi:https://dx.doi.org/10.1007/s11999-012-2775-8	Wrong patient population
Levin S, France DJ, Hemphill R, et al. Tracking workload in the emergency department. Human factors. 2006;48(3):526-39. doi:https://dx.doi.org/10.1518/001872006778606903	Wrong outcomes
Li D, Hu Y, Liu S, et al. Developing an Integrated Evaluation Model for Physician Comprehensive Workload Tethered to Outpatient Practice: An Empirical Study From China. Frontiers in public health. 2022;10(101616579):847613. doi:https://dx.doi.org/10.3389/fpubh.2022.847613	Wrong outcomes
Liu CC. Measuring the productivity of physicians and evaluating the factors that influence such productivity in Taiwan. J Med Sci (Pakistan). 2006;6(4):577-584. doi:10.3923/jms.2006.577.584	Wrong outcomes
Lovett KM, Liang BA. Quality care opportunities: refining physician performance measurement in ambulatory care. The American journal of managed care. 2012;18(6):e212-6.	Wrong publication type

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Maia Barreto JO. Pay-for-performance in health care services: A review of the best evidence available. Cienc Saude Coletiva. 2015;20(5):1497-1514. doi:10.1590/1413-81232015205.01652014	Non-English
Malouin JM. Physician productivity and reimbursement. Clin Fam Pract. 2003;5(4):991-1007. doi:10.1016/S1522-5720(03)00082-5	Wrong publication type
Manning C. Optimizing physician productivity in an employed physician model. Curr Orthop Pract. 2017;28(4):444-445. doi:10.1097/BCO.0000000000000533	Wrong publication type
Mayer AM, Dahlin C, Seidenschmidt L, et al. Palliative Care: A Survey of Program Benchmarking for Productivity and Compensation. The American journal of hospice & palliative care. 2022;39(11):1298-1303. doi:https://dx.doi.org/10.1177/10499091221077878	Wrong patient population
McNassor R, Grits D, Said TM, Burkhart RJ, Acuna AJ, Kamath AF. Correlation of Relative Value Units With Surgical Complexity and Physician Workload: A Contemporary Nationwide Analysis of Orthopaedic Procedures. The Journal of the American Academy of Orthopaedic Surgeons. 2023;31(8):413-420. doi:https://dx.doi.org/10.5435/JAAOS-D-22-00866	Wrong outcomes
Meeks SL, Shang MH, Willoughby TR, Kelly P, Shah AP. Research productivity of radiation therapy physics faculty in the United States. Journal of applied clinical medical physics. 2021;22(11):185-195. doi:https://dx.doi.org/10.1002/acm2.13456	Wrong setting
Melnick ER, Fong A, Nath B, et al. Analysis of Electronic Health Record Use and Clinical Productivity and Their Association With Physician Turnover. JAMA network open. 2021;4(10):e2128790. doi:https://dx.doi.org/10.1001/jamanetworkopen.2021.28790	Wrong intervention
Melnick ER, Harry E, Sinsky CA, et al. Perceived Electronic Health Record Usability as a Predictor of Task Load and Burnout Among US Physicians: Mediation Analysis. Journal of medical Internet research. 2020;22(12):e23382. doi:https://dx.doi.org/10.2196/23382	Wrong outcomes
Menachemi N, Yeager VA, Welty E, Manzella B. Are physician productivity and quality of care related? Journal for healthcare quality : official publication of the National Association for Healthcare Quality. 2015;37(2):93-101. doi:https://dx.doi.org/10.1111/jhq.12038	Wrong patient population
Michtalik HJ, Pronovost PJ, Marsteller JA, Spetz J, Brotman DJ. Developing a model for attending physician workload and outcomes. JAMA internal medicine. 2013;173(11):1026-8. doi:https://dx.doi.org/10.1001/jamainternmed.2013.405	Wrong outcomes
Miller TP, Brennan TA, Milstein A. How can we make more progress in measuring physicians' performance to improve the value of care? Health Aff. 2009;28(5):1429-1437. doi:10.1377/hlthaff.28.5.1429	Wrong outcomes
Molloy IB, Yong TM, Keswani AH, Werth PM, Gitajn IL, Jevsevar DS. Does Productivity-Based Physician Compensation Affect Surgical Rates for Elective Arthroplasty Surgery? The Journal of arthroplasty. 2020;35(12):3445-3451.e1. doi:https://dx.doi.org/10.1016/j.arth.2020.06.066	Wrong outcomes
Morton SC, Kominski GF, Kahan JP. An examination of the Resource-Based Relative Value Scale cross-specialty linkage method. Medical care. 1994;32(1):25-39. doi:https://dx.doi.org/10.1097/00005650-199401000-00003	Wrong outcomes

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Mrak RE, Parslow TG, Ducatman BS. Benchmarking Subspecialty Practice in Academic Anatomic Pathology: The 2017 Association of Pathology Chairs Survey. Academic pathology. 2018;5(101698648):2374289518798556. doi:https://dx.doi.org/10.1177/2374289518798556	Wrong outcomes
Newhouse JP, Sinaiko AD. Estimates of physician productivity: an evaluation. Health care financing review. 2008;29(2):33-9.	Wrong publication type
Newhouse JP, Sinaiko AD. Productivity adjustment in the Medicare physician fee schedule update. Health care financing review. 2008;29(2):5-14.	Wrong publication type
Ogunfiditimi F, Takis L, Paige VJ, Wyman JF, Marlow E. Assessing the productivity of advanced practice providers using a time and motion study. Journal of healthcare management / American College of Healthcare Executives. 2013;58(3):173-6.	Wrong intervention
Orav EJ, Wright EA, Palmer RH, Hargraves JL. Issues of variability and bias affecting multisite measurement of quality of care. Medical care. 1996;34(9 Suppl):SS87-101. doi:https://dx.doi.org/10.1097/00005650-199609002-00009	Wrong intervention
Pan D, Gu C, Cao W, et al. Development of an Incentive Model for General Practitioners in Fengxian District of Shanghai Based on Herzberg's Motivation-hygiene Theory. Chin Gen Pract. 2022;25(7):837-845. doi:10.12114/j.issn.1007-9572.2021.00.343	Non-English
Pauly MV. Hospital characteristics and physician productivity and fee levels. Advances in health economics and health services research. 1982;3(8206631, 2m4):1-54.	Wrong publication type
Perez-Villadoniga MJ, Rodriguez-Alvarez A, Roibas D. The contribution of resident physicians to hospital productivity. The European journal of health economics : HEPAC : health economics in prevention and care. 2022;23(2):301-312. doi:https://dx.doi.org/10.1007/s10198-021-01368-z	Wrong intervention
Phairas D. Use objective measures to incentivize midlevel providers for increased productivity. Medical economics. 2014;91(7):31-3.	Wrong publication type
Rajagopalan S, Tong C. Payment Models to Coordinate Healthcare Providers with Partial Attribution of Outcome Costs. Manuf Serv Oper Manage. 2022;24(1):600-616. doi:10.1287/msom.2020.0928	Wrong intervention
Rayburn B, Huxtable E. A physician productivity system that works. The Journal of medical practice management : MPM. 2005;21(1):16-20.	Wrong publication type
Reitblat O, Lerman TT, Dadon J, Zlatkin R, Bahar I, Sella R. Academic Productivity in Ophthalmology and Its Correlation to National Economic Indicators Among the OECD Countries: A Bibliometric Analysis. Ophthalmic epidemiology. 2024;(cg6, 9435674):1-9. doi:https://dx.doi.org/10.1080/09286586.2024.2343728	Wrong outcomes
Reschovsky J, Hadley J. Physician financial incentives: use of quality incentives inches up, but productivity still dominates. Issue brief (Center for Studying Health System Change). 2007;(108):1-4.	Wrong outcomes
Rhein RW, Jr. Measuring physicians' productivity. Medical world news. 1979;20(8):37-4.	Wrong publication type
Rosati S, Valeri F, Borchiellini A, Gianfreda CM, Balestra G. Characterization of Physicians Workload in a Reference Center for the Treatment of Thrombotic and Bleeding Disorders. Institute of Electrical and Electronics Engineers Inc.; 2019:1359-1362.	Wrong outcomes
Sapienza AM. Measuring productivity in an ambulatory setting. Hosp Med Staff. 1980;9(4):2-9.	Wrong publication type

Citation	Exclude Reason
Sarangarm D, Lamb G, Weiss S, Ernst A, Hewitt L. Implementation of electronic charting is not associated with significant change in physician productivity in an academic emergency department. JAMIA open. 2018;1(2):227-232. doi:https://dx.doi.org/10.1093/jamiaopen/ooy022	Wrong outcomes
Sarata AK. Health care quality: Enhancing provider accountability through payment incentives and public reporting. Nova Science Publishers, Inc.; 2013:1-23.	Wrong publication type
Scholle SH, Roski J, Dunn DL, et al. Availability of data for measuring physician quality performance. The American journal of managed care. 2009;15(1):67-72.	Wrong outcomes
Sebro R. Leveraging the electronic health record to evaluate the validity of the current RVU system for radiologists. Clinical imaging. 2021;78(cim, 8911831):286-292. doi:https://dx.doi.org/10.1016/j.clinimag.2021.02.007	Wrong patient population
Shah M, De Arrigunaga S, Forman LS, West M, Rowe SG, Mishuris RG. Cumulated time to chart closure: a novel electronic health record-derived metric associated with clinician burnout. JAMIA open. 2024;7(1):ooae009. doi:https://dx.doi.org/10.1093/jamiaopen/ooae009	Wrong outcomes
Shamsunder MG, Sheckter CC, Sheinin A, et al. Variation in Payment per Work Relative Value Unit for Breast Reconstruction and Nonbreast Microsurgical Reconstruction: An All-Payer Claims Database Analysis. Plastic and reconstructive surgery. 2021;147(3):505-513. doi:https://dx.doi.org/10.1097/PRS.0000000000007679	Wrong outcomes
Shirom A, Nirel N, Vinokur AD. Overload, autonomy, and burnout as predictors of physicians' quality of care. J Occup Health Psychol. 2006;11(4):328-342. doi:10.1037/1076-8998.11.4.328	Wrong outcomes
Shirom A, Nirel N, Vinokur AD. Work hours and caseload as predictors of physician burnout: The Mediating Effects by Perceived Workload and by Autonomy. Appl Psychol. 2010;59(4):539-565. doi:10.1111/j.1464-0597.2009.00411.x	Wrong outcomes
Simcox T, Becker J, Kreinces J, Islam S, Grossman M, Gould J. Are Orthopaedic Trauma Surgeons Adequately Compensated for Longer Procedures? An Analysis of Relative Value Units and Operative Times From the American College of Surgeons National Surgical Quality Improvement Program Database. Journal of orthopaedic trauma. 2021;35(12):e458-e462. doi:https://dx.doi.org/10.1097/BOT.0000000000002105	Wrong outcomes
Simcox T, Kreinces J, Tarazona D, Zouzias I, Grossman M. Current Relative Value Unit Scale Does Not Appropriately Compensate for Longer Orthopedic Sports Surgeries. Arthroscopy, sports medicine, and rehabilitation. 2021;3(6):e1913-e1920. doi:https://dx.doi.org/10.1016/j.asmr.2021.09.009	Wrong outcomes
Simmons NC, Kuys SS. Trial of an allied health workload allocation model. Aust Health Rev. 2011;35(2):168-175. doi:10.1071/AH09860	Wrong patient population
Slater BJ, Collings AT, Corvin C, Kandel JJ. Value-based surgery physician compensation model: Review of the literature. Journal of pediatric surgery. 2022;57(9):118-123.	Wrong publication type
Smith DM, Martin DK, Langefeld CD, Miller ME, Freedman JA. Primary care physician productivity: the physician factor. Journal of general internal medicine. 1995;10(9):495-503. doi:https://dx.doi.org/10.1007/BF02602400	Wrong outcomes
Speer AB, Schwendeman MG, Reich CC, Tenbrink AP, Siver SR. Investigating the Construct Validity of Performance Comments: Creation of the Great Eight Narrative Dictionary. J Bus Psychol. 2019;34(6):747-767. doi:10.1007/s10869-018-9599-9	Wrong setting

Citation	Exclude Reason
Stefos T, Carey K, Shen M-L, Poe S, Oh DH, Moran E. The Effect of Telehealth Services on Provider Productivity. Medical care. 2021;59(5):456-460. doi:https://dx.doi.org/10.1097/MLR.0000000000001529	Wrong outcomes
Stewart FM, Wasserman RL, Bloomfield CD, et al. Benchmarks in clinical productivity: A National Comprehensive Cancer Network survey. *J Oncol Pract*. 2007;3(1):2-8. doi:10.1200/JOP.0712001	Wrong outcomes
Stites S, Steffen P, Turner S, Pingleton S. Aligning clinical compensation with clinical productivity: Design and implementation of the financial value unit (FVU) system in an academic department of internal medicine. Acad Med. 2013;88(7):946-951. doi:10.1097/ACM.0b013e3182959df9	Wrong outcomes
Tai-Seale M, Olson CW, Li J, et al. Electronic Health Record Logs Indicate That Physicians Split Time Evenly Between Seeing Patients And Desktop Medicine. Health affairs (Project Hope). 2017;36(4):655-662. doi:https://dx.doi.org/10.1377/hlthaff.2016.0811	Wrong outcomes
Tariq MB, Meier T, Suh JH, et al. Departmental Workload and Physician Errors in Radiation Oncology. Journal of patient safety. 2020;16(3):e131-e135. doi:https://dx.doi.org/10.1097/PTS.0000000000000278	Wrong outcomes
Temte JL, Beasley JW, Holden RJ, et al. Relationship between number of health problems addressed during a primary care patient visit and clinician workload. Applied ergonomics. 2020;84(cyz, 0261412):103035. doi:https://dx.doi.org/10.1016/j.apergo.2019.103035	Wrong outcomes
Thomas K, Birch S, Milner P, Nicholl J, Westlake L, Williams B. Estimates of general practitioner workload: a review. The Journal of the Royal College of General Practitioners. 1989;39(329):509-13.	Wrong publication type
Tsai MH, Huynh TT, Breidenstein MW, O'Donnell SE, Ehrenfeld JM, Urman RD. A System-Wide Approach to Physician Efficiency and Utilization Rates for Non-Operating Room Anesthesia Sites. Journal of medical systems. 2017;41(7):112. doi:https://dx.doi.org/10.1007/s10916-017-0754-z	Wrong intervention
Turk J, Odorizzi S, Dewhirst S, Maher J, Landreville JM. Describing resident physician productivity in a Canadian academic emergency department. CJEM. 2024;26(12):890-896. doi:https://dx.doi.org/10.1007/s43678-024-00781-6	Wrong outcomes
Venta K, Baker E, Fidopiastis C, Stanney K. The value of EHR-based assessment of physician competency: An investigative effort with internal medicine physicians. Int J Med Informatics. 2017;108:169-174. doi:10.1016/j.ijmedinf.2017.08.003	Wrong outcomes
Verrilli DK, Dunn DL, Sulvetta MB. The measurement of physician work and alternative uses of the resource based relative value scale. The Journal of ambulatory care management. 1996;19(4):40-8. doi:https://dx.doi.org/10.1097/00004479-199610000-00007	Wrong publication type
Vilendrer SM, Asch SM, Anzai Y, Maggio P. An Incentive to Innovate: Improving Health Care Value and Restoring Physician Autonomy Through Physician-Directed Reinvestment. Academic medicine : journal of the Association of American Medical Colleges. 2020;95(11):1702-1706. doi:https://dx.doi.org/10.1097/ACM.0000000000003650	Wrong publication type
Vogt WF. Physician clinical productivity--a comparison of university-based and private multispecialty medical groups. College review (Denver, Colo). 1987;4(1):63-83.	Wrong outcomes
Wahls TL, Futz DN. The master clinician project. The Journal of ambulatory care management. 2000;23(4):9-21. doi:https://dx.doi.org/10.1097/00004479-200010000-00003	Wrong outcomes

Citation	Exclude Reason
Walker DL. Physician compensation: rewarding productivity of the knowledge worker. The Journal of ambulatory care management. 2000;23(4):48-59. doi:https://dx.doi.org/10.1097/00004479-200010000-00007	Wrong publication type
Wan TH, Cooper PL. A structural equation model of physician productivity. Journal of health care marketing. 1988;8(4):37-45.	Wrong patient population
Wang D, Schierman BA, Cheng EM, Sanders AE, Dubinsky RM. Practical steps for implementing quality measurement in practice. Neurology Clinical practice. 2014;4(5):447-453. doi:https://dx.doi.org/10.1212/CPJ.0000000000000076	Wrong publication type
Wang X, Blumenthal HJ, Hoffman D, et al. Modeling patient-related workload in the emergency department using electronic health record data. International journal of medical informatics. 2021;150(ct4, 9711057):104451. doi:https://dx.doi.org/10.1016/j.ijmedinf.2021.104451	Wrong intervention
Weiss M, Marx G, Iber T. Generalizable items and modular structure for computerised physician staffing calculation on intensive care units. World journal of critical care medicine. 2017;6(3):153-163. doi:https://dx.doi.org/10.5492/wjccm.v6.i3.153	Wrong intervention
Willis DR, Kelton GM, Saywell RM, Jr., Kiovsky RD. An incentive compensation system that rewards individual and corporate productivity. Family medicine. 2004;36(4):270-8.	Wrong outcomes
Wilson MS, Joiner KA, Inzucchi SE, et al. Improving clinical productivity in the academic setting: a novel incentive plan based on utility theory. Academic medicine : journal of the Association of American Medical Colleges. 2006;81(4):306-13. doi:https://dx.doi.org/10.1097/00001888-200604000-00003	Wrong outcomes
Wood GC, Spahr R, Gerdes J, Daar ZS, Hutchison R, Stewart WF. Patient satisfaction and physician productivity: complementary or mutually exclusive? American journal of medical quality : the official journal of the American College of Medical Quality. 2009;24(6):498-504. doi:https://dx.doi.org/10.1177/1062860609338869	Wrong outcomes
Woodward RS, Warren-Boulton F. Physician productivity and remuneration method. HEALTH CARE FINANC CONF PROC. 1981;Aug.:115-134.	Wrong publication type
Wrede J, Wrede H, Behringer W. Emergency Department Mean Physician Time per Patient and Workload Predictors ED-MPTPP. Journal of clinical medicine. 2020;9(11)doi:https://dx.doi.org/10.3390/jcm9113725	Wrong outcomes
Wu SJ, Ma Q, Martin P, DeVries A. Finding the value in value-designation: Evidence and opportunity in the united states. Managed Care. 2016;2016(NOV):1-1.	Wrong intervention
Yeh MM, Cahill DF. Quantifying physician teaching productivity using clinical relative value units. Journal of general internal medicine. 1999;14(10):617-21. doi:https://dx.doi.org/10.1046/j.1525-1497.1999.01029.x	Wrong outcomes

PEER REVIEW COMMENTS AND RESPONSES

Are the objectives, scope, and methods for this review clearly described?

Comment #	Reviewer #	Comment	Author Response
1	1	Yes	*None*
2	2	Yes	*None*
3	3	Yes	*None*
4	4	Yes	*None*
5	5	Yes	*None*

Is there any indication of bias in our synthesis of the evidence?

Comment #	Reviewer #	Comment	Author Response
6	1	No	*None*
7	2	No	*None*
8	3	No	*None*
9	4	No	*None*
10	5	No	*None*

Are there any published or unpublished studies that we may have overlooked?

Comment #	Reviewer #	Comment	Author Response
11	1	Yes - The article below tests the Saeed productivity measure in a wider variety of VA specialties. Yee, Christine and Palani, Sivagaminathan and Barr, Kyle and Pizer, Steven D., Provider Supply and Access to Specialty Care. Available at SSRN: https://ssrn.com/abstract=4291717 or http://dx.doi.org/10.2139/ssrn.4291717	*Thank you for bringing this unpublished (preprint) study to our attention. We appreciate that the measure used to calculate work outputs in this study is the same as in Saeed 2024 (included in this review). We identified a related published study by the same authors (https://doi.org/10.1002/hec.4482) in our literature search. However, the aim of these studies (to estimate the effect of clinician supply on new patient wait times) is outside of the scope of this review and therefore neither study is included.*
12	2	No	*None*

Comment #	Reviewer #	Comment	Author Response
13	3	No	*None*
14	4	No	*None*
15	5	No	*None*

Additional suggestions or comments can be provided below.

Comment #	Reviewer #	Comment	Author Response
16	1	This is an excellent summary of the current literature and thinking on productivity measures for potential use in public delivery systems like the VA. One issue that the authors should consider is the practicality of measurements for management purposes. Some of the measures reviewed can be constructed entirely from administrative data, which implies that they can be calculated at a high frequency and granularity, allowing specific clinics to be tracked at high frequency (like by pay period). Other measures rely on survey data, which is collected much less frequently (like annually) and with much smaller samples. These data limitations make them difficult or impossible to operationalize for management purposes.	*Thank you. We added text to the Future Research section to highlight the importance of ensuring that measures used to develop productivity calculations are available, accessible, and timely so that they are feasible to adopt in practice.*
17	1	Page vi, line 8: "priorities" should be "prioritizes"	*Revised*
18	1	Page 4, lines 53-55: This sentence should be rephrased. As is, it suggests that procedural services are historically undervalued compared to cognitive services, which is backwards.	*Thank you for identifying this error. We revised the text for clarity.*
19	1	Page 5, line 20: "although does" should be "although it does"	*Revised*
20	1	Page 12, line 28: "priorities" again	*Revised*
21	1	Page 12, line 38: "that" should be "than"	*Revised*
22	2	I would recommend expansion of your definition of productivity. Figure 1 could be updated to show the flow of inputs to the outputs. I find the "output/input" concept to be too reductive. The idea of productivity is how organizations use inputs to make outputs. An organization is producing efficiently when it maximizes its production of outputs with its currently available inputs and knowledge.	*Thank you for this comment. We aligned our approach to this review with the VHA's current definition of productivity, which is based on an output/input equation. We agree that a productivity model that incorporates measures of efficiency would be more holistic, and arguably more appropriate. We added text to highlight this point in the Future Research section.*

Comment #	Reviewer #	Comment	Author Response
23	4	Looks like we are limited in recommendations. We could suggest alternatives that don't exist yet. For example While the use of clinic time offers improvements over traditional FTE measures by providing a more standardized view of labor input, it still may not fully capture the broad range of clinical activities performed by modern physicians. An alternative approach could be to adopt a Weighted Clinical Engagement Unit (WCEU) system, where a variety of physician tasks—such as in-person visits, telehealth encounters, e-consultations, care coordination activities, and teaching responsibilities—are assigned standardized unit values based on cognitive effort, patient impact, and time requirements. This method would allow healthcare systems to measure physician productivity more holistically, fairly recognizing contributions beyond face-to-face clinic encounters. Implementing WCEUs would require careful calibration and reliable activity tracking but could better align productivity assessments with the evolving nature of clinical practice, interdisciplinary care, and patient-centered outcomes.	*Thank you for this comment. We added to the Future Research section by suggesting a role for new measure development, including measures aligned with specific physician tasks as you suggest.*
24	5	Page i: Abbreviations list incomplete: AMA, MGMA, RBRVU, RUC, OPES, GEE, DEA, OLS, SHEP, VA are missing.	*Revised*
25	5	Page 5, Line 9 and page 13 Line 47: You cannot conclude organizational "interest" BUT could say "data and expertise".	*Revised*
26	5	Page v Line 48 and page 6 Line 52: suggest you add start date not just end date (Dec 2024).	*We have added “from inception” to clarify the search start dates.*
27	5	Page. vi, Line 8 "Priorities" should be "prioritizes"	*Revised*