



Systematic Review of Patient-Centered Needs Assessments Performed by Free Health Clinics

Daniel J Arenas^{1,2}; Rommell Noche^{2,3,*}; Arthur Thomas^{1,2,*}; Dania Hallak^{2,3}; Swathi Raman^{2,3}

¹Perelman School of Medicine, University of Pennsylvania, Pennsylvania, USA

²United Community Clinic, Pennsylvania, USA

³College of Arts and Sciences, University of Pennsylvania, Pennsylvania, USA

*Contributed equally

Corresponding Author: Daniel J Arenas; email: daniel.arenas@uphs.upenn.edu

Published: June 30, 2019

Abstract

Background: Free clinics, such as student-run clinics (SRCs), aim to improve healthcare for underserved populations. These populations, which include homeless individuals, low-income citizens, immigrants, and other marginalized groups, have different needs that can also vary by location. It is thus important that SRCs strive to know their patient populations. Needs assessments (NAs) are a tool to achieve this goal. To further develop NAs by SRCs, we sought to synthesize the state of published NAs by free clinics. This manuscript is meant to encourage these clinics to perform more NAs.

Methods: We conducted a systematic review of manuscripts containing the concepts “student clinic” and “needs assessment”. We searched PubMed, Embase, Scopus, Web of Science, and Google Scholar. Manuscripts were included in the review if they 1) were peer-reviewed, 2) described a free-of-charge clinic, 3) performed a NA, and 4) the NA investigated needs or concerns of patients and/or the community. NAs were defined as an approach to gather information about a patient population with the goal of improving their healthcare.

Results: The initial search yielded 94 manuscripts; 18 manuscripts met inclusion criteria and were retained for full examination. The NAs showed a plethora of different purposes, methodologies, and useful results. From the analysis, we also present suggestions for future NAs.

Conclusions: The existing peer-reviewed and published NAs by student-run clinics show the immense utility and potential of this tool. There is ample opportunity to publish and expand more NAs.

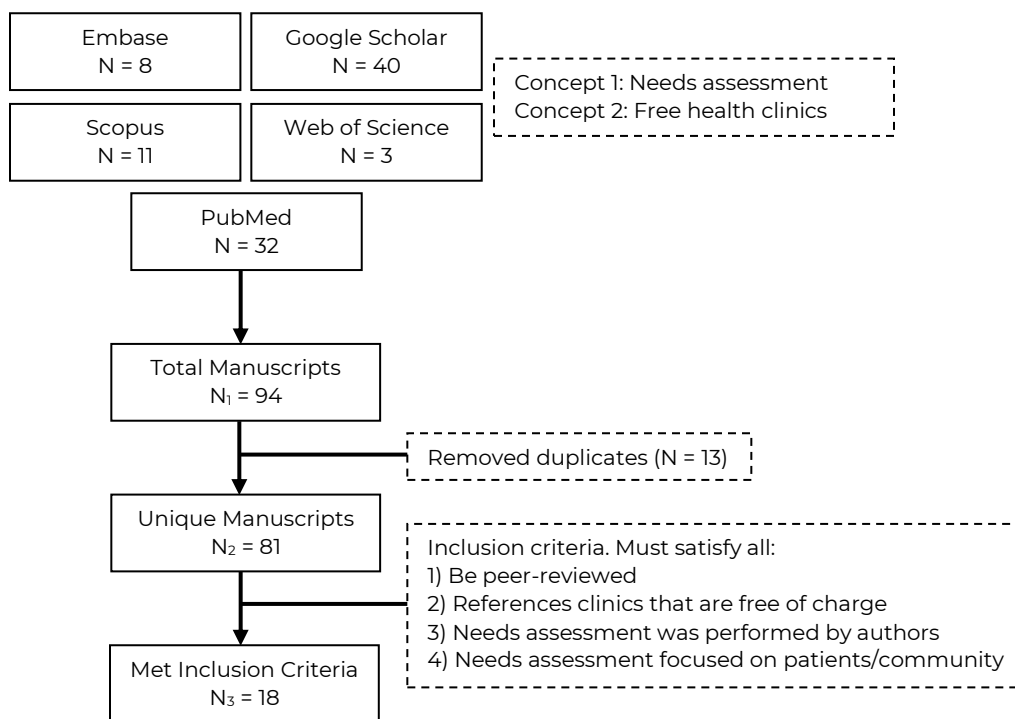
Background

One of the major goals of free clinics is the improvement of healthcare delivery to medically underserved populations. Free clinics commonly exist in the form of student-run clinics. Student-run clinics (SRC) are often large, interdisciplinary efforts between nursing, medical, social work, dental, pharmacy, podiatry, physical therapy, optometry, undergraduate, and other schools that aim to make healthcare more accessible and affordable.¹ They result in high patient and provider satisfaction, and their interventions have significant health and economic impacts.²⁻⁶ Other free clinic models include resident-run clinics,

professional clinics, and mobile health clinics. Free clinics aim to eliminate health disparities by improving healthcare for minorities, those under the poverty line, and those in areas remote from healthcare providers.^{1,7,8} Improving healthcare delivery to underserved populations certainly requires that clinics accurately align their services to meet the needs of the patients and current non-patients that encompass these communities. One method to do so is through the use of needs assessments.

Needs assessments (NAs) are a tool to guide the prioritization and creation of medical services. NAs are systematic approaches used to identify under-recognized patient and

Figure 1. Flow of identification of manuscripts for the systematic review.



community needs. Several studies show that NAs improve healthcare in private practices, improve utilization of mental health services, help understand the needs of communities affected by natural disasters, and help understand the health needs of marginalized patients.⁹⁻¹³

Despite the growing prevalence of free clinics in the United States (US) and around the world, there are few peer-reviewed NA studies in the literature that focus on the health needs of patient populations served by free clinics. In general, the work done by SRCs is still under-reported in the literature. As we will discuss here, only a small percentage of existing clinics have begun to report the utility of NA studies. Therefore, there is ample opportunity and necessity to perform and develop more NAs. To continue to improve this aspect of free clinics, it is imperative to synthesize the current state of published literature on NAs.

The purpose of this review is to analyze all published NA studies performed by free health clinics to date and to synthesize the purpose, methodologies, and significant results from these manuscripts. It is our goal that this review increases the

pool of knowledge on the important yet complex mission of reaching underserved populations and that it will encourage and guide innovative healthcare providers to publish their NAs.

Methods

Database Searches

Figure 1 shows the general methodology of the systematic review. First, we searched the PubMed, Embase, Web of Science, and Scopus databases for manuscripts that contained the two concepts: 'needs assessment' and 'free health clinic'. Different search terminology for each concept was used in different databases. Table 1 shows the search terms used for the PubMed database, and the terms for the other databases are shown in the Online Appendix. The search was augmented by using Google Scholar as a database with the specific terms "student-run clinic" and "needs assessment". The search was conducted on October 28th, 2017.

Table 1. Search terminology for PubMed.

PubMed (N = 32)	
Concept 1: Needs Assessment (N = 361,721)	Concept 2: Free Clinics (N = 738)
Needs Assessment	Clinic, Student Run
Determination of Health Care Needs	Clinics, Student Run
Determination of Healthcare Needs	Run Clinic, Student
Assessment of Healthcare Needs	Run Clinics, Student
Needs Assessment, Healthcare	Student Run Clinics
Needs Assessments, Healthcare	Resident Run Clinic
Assessment of Health Care Needs	Clinic, Resident Run
Health Status Indicator	Clinics, Resident Run
Indicator, Health Status	Resident Run Clinics
Indicators, Health Status	Run Clinic, Resident
Health Status Indexes	Run Clinics, Resident
Indexes, Health Status	Student-Run Free Clinic
Health Status Index	Clinic, Student-Run Free
Health Status Indices	Clinics, Student-Run Free
Index, Health Status	Free Clinic, Student-Run
Indices, Health Status	Free Clinics, Student-Run
Health Risk Appraisal	Student Run Free Clinic
Appraisal, Health Risk	Student-Run Free Clinics
Appraisals, Health Risk	Free Urban Clinics
Health Risk Appraisals	Free Rural Clinics
Risk Appraisal, Health	Pro Bono Clinics
Risk Appraisals, Health	

The table shows the search terminology used for the needs assessment and free clinic concepts and the number of manuscripts retrieved. For example, 738 manuscripts were related to free clinics and 32 manuscripts in PubMed had both concepts.

Study Selection

Each manuscript was deemed relevant if it satisfied all the following properties: 1) It was peer-reviewed; 2) It was performed by a clinic that is free-of-charge to patients; 3) A NA was performed by the authors; and 4) The NA investigated needs or concerns of patients and/or the community. Since NAs are incredibly versatile, here we will broadly define a NA as a structured attempt to find information about the patient population with the goal of improving their healthcare. Studies that only explored training or satisfaction of providers were not included, as they are more consistent with quality improvement studies. NAs performed in the community around the clinics were kept and will be referred as community needs assessments (CNAs). All healthcare specialties were included; therefore, we retained

articles for optometry/ophthalmology, physical therapy, dentistry, and others. All articles were included regardless of country of origin. All publication dates were accepted.

Four raters reviewed each article and assigned an “approve” or “deny” rating. Articles rated as not relevant by all four raters were automatically discarded. The authors met to discuss each article with conflicts in ratings. Inter-rater analysis was carried by calculating the Fleiss kappa, and the analysis yielded a kappa of 0.42 (95% confidence interval [CI]: 0.34-0.52).¹⁴ Free software, and a discussion on the inter-rater reliability theory, is presented elsewhere.¹⁵

Data Extraction

Four authors independently reviewed each eligible manuscript and extracted information

about the type of clinic, the clinic's location, the purpose for conducting the NA, the methodology, and the major results obtained. Studies were labeled quantitative if original numerical data were the focus of their analyses. Otherwise, they were labeled qualitative.

Results

Ninety-four manuscripts were identified through the database searches. After removing duplicates, 81 manuscripts remained. Fifty articles were rated as not relevant by all four raters and were automatically discarded. Five articles were deemed by all raters to be relevant. After discussion, a total of eighteen articles were approved (Figure 1). Table 2 shows descriptions for each of the 18 studies. All articles were in the English language.

Description of the Clinics Performing the NAs

All clinics were affiliated with authors from academic institutions. The majority of the NAs came from clinics described as SRCs.^{8,17,20,22-24,28,30,32} Three were from health or academic organizations partnered with a conglomerate of free clinics, and some were from free clinics led by faculty members that involved students.^{8,17-19,20,22-25,27-32} Three were from a nursing mobile health clinic, an immunization clinic, and an outreach vision program.^{16,21,26} No NAs from resident-run clinics were found.

The majority of reviewed clinics were located throughout the US, while four were located outside the US. Two NAs focused on rural populations, while most focused on urban and inner-city communities.^{8,16-21,24,26-31} Patient populations of these clinics varied. The majority served the general low-income, uninsured population in the geographic area, and some serviced the homeless population.^{8,17,23} Some focused on specific ethnic groups such as Latinos.¹⁸

The services also varied. Most clinics provided primary care services to their patients.^{8,16,17,19,20,22,23,25,27-31} Two clinics focused solely on preventive medicine interventions, one in ophthalmology services, and two were geared toward physical therapy.^{18,21,24,26,32} Table 3 summarizes these findings.

Purposes and Methodologies of the NAs

This systematic review identified NAs with a multitude of purposes and scopes. The most common reason for performing a NA was to better understand community needs and to develop operational plans in preparation for the opening of a new clinic. Of the eighteen papers reviewed, seven studies performed NAs prior to opening a new clinic, while one performed a NA shortly after opening.^{8,16,17,19,22-24,30} Performing a NA prior to the formation of a new clinic helped providers understand how they could best help the community that they planned to serve.

Three studies used paper surveys that were completed by patients, and four studies had surveys completed by an interviewer.^{19-21,25,27,29,32} The four CNAs involved interviews with community members.^{16,18,28,30} Seven studies used chart review as part of their methods: five analyzing internal patient chart data and two reviewing outside data.^{8,18,22-24,26,31}

Eight NAs were performed by existing free clinics or organizations with the goal of assessing the health needs and prevalence of certain health conditions in a community or clinic population.^{8,16,17,20,26,28,29,32} Five NAs surveyed health risks such as tobacco use and alcohol misuse.^{8,18,19,25,32} Six manuscripts presented data on patient's accessibility issues such as insurance and operation hours.^{8,18,22-24,27} One study focused on access to cancer screenings.¹⁸ Baker and colleagues (2007) were the only authors to assess patient knowledge and used their assessment of mothers' knowledge of child immunizations to improve their existing intervention strategies.²¹ Three NAs were done with the purpose of improving existing services or programs, while one study focused on the creation of a new program.^{21,25,27,28}

Main Results from the NAs

Quantification of Disease Prevalence

To understand their target population, some clinics quantified the prevalence of certain diseases. In 2001, providers at a SRC in Buffalo, New York observed rates of asthma, anxiety, diabetes, and depression that were higher than the regional and national rates.²⁰ Similarly, a SRC in New York City showed high rates of chronic health problems in its homeless population.⁸ In 2015, Dotan et al. published epidemiologic data

Table 2. Relevant manuscripts obtained from the systematic review.

Year	Authors	Patient Population	NA Purpose	NA Methodology	Results of NA
1993	Parkinson et al. ¹⁶	San Jose, Honduras. Colonias around major city.	Mobile health clinics. Start new sites. Assess health needs.	Qualitative. CNA. Interview of community members in the homes of local women.	Patients desired a clinic with respectful providers and high accessibility.
2006	Moskowitz et al. ¹⁷	Seattle, WA. Transitional housing facility.	SRC. Assess residents' interests and needs for new clinic.	Qualitative. Visited different community organizations.	Results not specified.
2006	Kreling et al. ¹⁸	Washington, DC. Latin American patients.	Organization tied to free clinics. Assess accessibility to cancer screenings.	Quantitative. CNA: Interviews. NA: Review of medical records. <i>N</i> = 1010.	High prevalence of poor knowledge about cancer screening.
2007	Scariati et al. ¹⁹	Rural southwest Virginia. General population.	Free Clinic. NA after opening. Assess health risks.	Quantitative. 43-question survey of patients attending the clinic. <i>N</i> = 186.	Most significant modifiable health risks included tobacco use.
2007	Cadzow et al. ²⁰	Buffalo, NY. Patients 20 years and older.	SRC. Existing clinic. Assess health conditions in patient population.	Quantitative. Survey of patients who attend the clinic. <i>N</i> = 469.	Identified high rates of anxiety, obesity, and other disorders.
2007	Baker et al. ²¹	Detroit, MI. Mothers of young children.	Existing Immunization clinic. Improve immunizations adherence.	Quantitative. 20-minute survey of mothers. <i>N</i> = 15.	Most caregivers are not aware of required vaccinations.
2008	Jimenez et al. ²²	New Brunswick, NJ. Clients at a local soup kitchen.	SRC. Develop operational plans for new clinic. Assess accessibility after clinic opened.	Quantitative. Patient survey after clinic was opened. <i>N</i> = 42.	Patient needs included convenient clinic hours and affordable medication.
2009	Batra et al. ⁸	New York City, NY. Homeless population of West Harlem.	SRC. Evaluate potential clinic spaces. Assessed health risks after clinic opened.	Quantitative. Relevant patient chart data gathered for internal clinic review. <i>N</i> = 189.	Identified major health problems such as substance abuse.
2009	Bishop et al. ²³	Charlottesville, VA. Recently homeless population.	SRC. Develop operational plans for new clinic.	Qualitative. Researched existing NA data from existing community shelters and hospitals.	Creation of "navigator" positions: care managers who ease health access.
2011	Palombaro et al. ²⁴	Chester, PA. Patients in local hospital network.	Physical therapy clinic, SRC. Develop operational plans for new clinic.	Qualitative. Researched data from local major hospital. Also surveyed local physical therapy clinics.	Identified large need for PT clinic, especially for uninsured patients.
2012	Pockey et al. ²⁵	Patients at several free clinics across North Carolina.	Existing free clinics. Assess and improve intervention on tobacco cessation.	Quantitative. 15-minute patient exit interviews. <i>N</i> = 158.	Identified high tobacco use and second-hand exposure to children.

2015	Dotan et al. ²⁶	Philadelphia, PA. Urban children.	Ongoing annual outreach program. Assess prevalence of ophthalmic conditions.	Quantitative. Assessed registration forms from participating patients. <i>N</i> = 924.	Identified high need for corrective glasses and referrals.
2015	Rondet et al. ²⁷	Paris, France. Recruited from healthcare centers and public transit system.	Existing free clinic. Improve interventions on depression.	Quantitative. 62-question survey of clinic patients. <i>N</i> = 250.	Identified accessibility issues for patients with mental health issues.
2016	Goldwaser et al. ²⁸	Camden, NJ. General population.	Existing SRC. Develop a program for treatment of chronic conditions like hypertension.	Qualitative. CNA: Focus groups. Quantitative. NA: Review of medical records. <i>N</i> = 21.	Preliminary success of a BP lowering intervention.
2016	Cheffers et al. ²⁹	Tijuana, Mexico. Low-income population.	Existing free clinics. Identify disease burden and areas for intervention.	Quantitative. Original survey presented to patients visiting the free clinic. <i>N</i> = 116.	Identified diabetes and hypertension as major health problems.
2016	Thorgrimson et al. ³⁰	Thunder Bay, Canada. General population.	SRC. Assess community needs for new clinic.	Qualitative. CNA. Focus group of providers and patients.	Patients suggested areas of improvements for the SRC.
2017	Robertson-James et al. ³¹	Philadelphia, PA. Clinics focused on girls, women, and their families.	Existing outreach program with ties to free clinics. Identify needs.	Qualitative. Reviewed progress reports from clinics and 30-minute interviews with community liaisons.	Identified areas of intervention such as nutrition counseling.
2017	Creps et al. ³²	Flint, MI. General population.	Existing physical therapy SRC. Assess health conditions of patient population.	Quantitative. 47-question survey of patients. <i>N</i> = 29.	Identified high prevalence of chronic health conditions.

Brief notes on the need assessment (NA) purpose, methodologies, and results are presented. The lengths of survey, and the number of subjects (N), are shown for manuscripts that presented the information.

CAN: community needs assessment; WA: Washington; DC: District of Columbia; NY: New York; MI: Michigan; NJ: New Jersey; VA: Virginia; PA: Pennsylvania

Table 3. Brief summary of the characteristics of the clinics conducting the needs assessments (NAs) and the methodologies and purposes.

Clinic Location	N	Main Service Offered by Clinic	N
US: Urban/inner-city populations	13	Primary Care	13
US: Rural	1	Preventive medicine	2
Outside US	4	Physical therapy	2
		Ophthalmology	1
NA Methods	N	NA Purposes	N
Qualitative methods	7	Development of operational plans	7
Quantitative methods	11	Assess health conditions	8
Surveys-Interview	4	Assess health risks	5
Surveys-Paper	3	Study accessibility issues	6
Interviews with community members	4	Cancer screening accessibility	1
Chart review-Internal data	5	Immunization adherence	1
Chart review-Outside data	2		

US: United States

from a vision outreach program that demonstrated high rates of myopia and strabismus.²⁶ Similarly, data from a physical therapy clinic in Michigan observed high rates of obesity and self-reported depression history.³²

Identification of Health Risks

In 2007, a rural free clinic in Virginia identified smoking and alcohol misuse as the top two health risks in their patient population.¹⁹ The pervasive prevalence of tobacco as a health risk was also shown in a clinic serving the homeless and a free-clinic coalition in North Carolina serving the uninsured.^{8,25} These studies found ~50% prevalence of smoking in their target populations.^{8,25}

Adherence and Knowledge of Preventive Medicine Interventions

Only one NA study from free clinics has studied the adherence of their patients to cancer screenings. Unfortunately, this study had a significant percentage of charts which had missing information about the screenings, so the conclusions about adherence are difficult to interpret.¹⁸

Finally, there are no NA studies from SRCs that study the vaccination rates of their patient population. The only study found focuses on health literacy of caretakers who bring their children to the clinic.²¹ The authors showed that surveyed

caretakers had very poor health literacy about the immunization guidelines.²¹

Patient Requests, Concerns, and Suffered Injustices

Inaccessibility to proper medical care has been studied by a few clinics. The earliest attempt, in 2007, was a NA performed by Charlottesville Health Access which demonstrated inadequate healthcare access and navigation for their homeless patient population.²³ Unfortunately, the details of the NA methodology and results were not presented.²³ A later NA performed by Promise Clinic showed high rates of unemployment in their patient population and also identified clinic hours as an important consideration to improve accessibility.²² In 2011, a physical therapy free clinic showed that about 25% of their target population was uninsured. They also demonstrated their potential impact by showing that many of these patients had prematurely ended previous physical therapy prescriptions due to poor healthcare access.²⁴

In 2015, Dotan et al. analyzed registration forms of patients attending Give Kids Sight Day (GKSD), a vision outreach fair, in Philadelphia, Pennsylvania, and they showed that the uninsured rate among patients was high (>25%).²⁶ They also elucidated the fact that these families attended the

fair because it circumvented hurdles such as having to take time off work, not knowing where to go, and difficulty in scheduling simultaneous appointments for multiple kids.²⁶ Finally, another publication in NAs was a CNA by Thorgrimson et al.³⁰ The CNA was qualitative, performed with semi-structured interviews, and showed that patients consistently cited barriers and gaps in their health services. These studies are therefore an important step in systematically trying to align the services of the free clinics with the needs of the community.

Implementation of New Policies or Programs

The Camden Community Health Center published an innovative study where a NA guided their decision to implement a hypertension intervention program.²⁸ This study was important because it was the only one found to publish preliminary results on an intervention; after working with 21 patients, they showed a decrease in the average blood pressure (BP) of the patients.²⁸

Discussion

Importance of the Current Published NAs

This systematic review shows that there is a wide variation in the methodologies, purposes, and scopes of NAs performed by free health clinics. This synthesis of NAs should encourage future researchers to conduct their own needs assessments, as well as provide prototypes for those needs assessments.

One of the purposes common in the published NAs is the quantification of the prevalence of certain diseases such as diabetes and hypertension.^{8,20,32} These studies are important since patients who attend free clinics may have different health needs than those of the general population.³³ This information could be crucial for deciding what health interventions to offer. Also, the disease prevalence should be measured and not simply assumed, since assumptions may be counterproductive to resource allocation.³³ Furthermore, some SRC studies have shown that epidemiologic data is useful even if it is not relevant to the intervention that the clinic specializes in. This was demonstrated in the study by Creps, Kaartinen, and Diebold, where a physical therapy clinic identified other medical needs in their

population and subsequently began collaboration with other clinics to help bridge gaps in healthcare.³²

Other important manuscripts include those that explored health risks that result in significant future health consequences such as tobacco use and alcohol misuse. Knowing how to measure and mitigate these risks offer SRCs and other free clinics the opportunity to prevent significant negative impact.^{8,19,25} Previous research has shown that due to the immense morbidity of tobacco, interventions with low success rates, such as physician counseling on tobacco-cessation, still result in significant health and economic impact.³ For example, in an SRC with ~500 patients a year, these interventions would save society hundreds of thousands of dollars in the future.³

Manuscripts that focus on accessibility to health care access are also paramount to the SRC and free health clinic field. Mitigating health disparities has been one of the major motivators of starting and developing SRCs, and it is reasonable to hypothesize that many providers had suspected accessibility was a major barrier. We now have evidence that scheduling and insurance are indeed an important issue for a significant proportion of patients in some SRCs.^{1,22,26} And similarly, current SRC studies have begun to show the gaps in health services of their target population and which subgroups are more at risk.³⁰

Need for More CNAs

CNAs are a tool to ensure that there are no gaps in the services needed by those who visit clinics and those in the community. Our systematic review identified only three qualitative CNAs and one quantitative CNA, so there is opportunity and need to develop quantitative CNAs.^{16,18,28,30} Such CNAs could gather information on the prevalence of disease and health risks, and statistical analyses could then elucidate whether the results are different in the clinic population from the nearby community. Furthermore, a CNA could also yield information on awareness and attitudes of the community towards the clinic.

Opportunity for Follow-up Publications

Only one manuscript in the review had longitudinal data on the effect of an intervention.²⁸ This is not surprising since longitudinal studies

are difficult to perform in SRCs due to the frequent turnover in leadership and patients. It is not reasonable to demand that the leadership conducts a NA, repeats it years later, and then publishes the results. Therefore, it would be advantageous for clinics to have their NAs peer-reviewed and presented to the community; then, clinic leaders of later generations can conduct a NA and publish the follow-up. Good examples of studies with potentially useful follow-up publications are those by Scariati and Williams, where health risks in their population are quantified, and the study by Goldwasser et al., where BP is longitudinally treated in the clinic.^{19,28}

Possible Future Directions for NAs

The manuscripts described in this systematic review are extremely valuable for future NAs, as they provide examples for reproduction and modification. This review also shows that there are many potential future directions. As discussed above, there are very few CNAs and therefore plentiful opportunities for new ideas. For example, future CNAs could gather information about the perception of the free clinic by those in the surrounding area. What does the community like or dislike about the services offered? How would they like to see the clinic change? Additionally, open interviewing and quantitative surveying of the community are potential tools for discovering or implementing new programs. Examples of new programs include nicotine cessation assistance or anticipatory guidance for safety concerning bike helmets, toddler car seats, guns at home, etc.

There are also ample opportunities to perform NAs for patients who visit the clinic. NAs could be designed to ask patients what type of social resources they would like to have access to. For example, is there a large need for housing or nutrition information? Barriers to seek medical care could also be explored. Are childcare responsibilities a barrier for the caretaker to seek medical care? NAs could also be invaluable to keep up with sudden and emergent issues; the effects of the constantly changing immigration landscape, the US Immigration and Customs Enforcement raids, as well as other factors on the demand for healthcare, could be evaluated.

There is additional patient information that could improve the clinic's operation. Predicting the times of the year for which the clinic has the largest demand would be useful in optimizing clinic hours and provider volume in order to serve the greatest number of patients. The possibilities for quality improvement initiatives are broad, and this is exemplified by the many initiatives offered by Medicaid in helping states perform these types of quality improvement projects.³⁴

Suggestions for Future Practices

In this section, it is not our goal to limit the methodology of the NAs to certain prototypes but to provide general suggestions that could increase the reproducibility of future NAs. A few of the NA studies offered little description about their methodology.^{16,23} This is probably because the manuscript's main focus was not the NA. Nonetheless, since the definition of a NA can be broad, it is important to offer details so that the results can be properly interpreted. Although not relevant to every reader of the manuscript, some readers would benefit from seeing NA details such as: 1) whose information was collected (patients attending the clinic, community members, community leaders, etc.) and 2) how this information was collected (surveys, structured interviews, informal interviews, community meetings, etc.). Furthermore, most of the manuscripts examined would have benefited from having the surveys and original results presented in their supplementary documents. This could also help future NA conductors by providing skeletons that could then be reproduced or modified.

For some studies, simple descriptive statistics such as the average and standard deviation can be sufficient. Confidence intervals may provide further utility because the data of NAs by free clinics can result in powerful conclusions. For example, we analyzed the data in the study by Cadzow et al., on the frequency of obesity of the clinic's population.²⁰ Using two outcomes, "obese" or "non-obese", a binomial distribution analysis showed that the 95% CI is 36% to 44%. This is significantly higher than the 18 % national average. Conversely, similar analysis would show that their high cholesterol prevalence CI is within the national average.

Similarly, we performed statistical analysis on the results of the NA on the GKSD vision fair.²⁶ The analysis showed that the prevalence of strabismus in their population was higher than that in the general population.³⁵ Finally, the results from the BP reduction initiative in the work by Goldwasser et al. did not report information about standard deviation.²⁸ The work is important and promising, but future work could benefit from further statistical analysis.

Limitations

The most important limitation of this systematic review is the scope of the search. In four databases, PubMed, Scopus, Web of Science, and Embase, the search was designed to be sensitive by using as many keywords as possible (e.g. SRC, resident-run clinic, pro-bono clinic, etc.). This is possible since the number of results from these databases was in the decade's order of magnitude. However, in Google Scholar, a similar search with broad terms resulted in several hundred hits. Unlike other systematic reviews, where only the abstracts are investigated for exclusion purposes, we had to read the entirety of every manuscript since NAs were not always the main purpose of the study and were often not present in the abstract. Therefore, we decided to use a specific term for Google Scholar and chose "student-run clinic" (see Online Appendix). The use of Google Scholar is particularly useful since it returned newer journals that may not be indexed in PubMed. This review strategy could be expanded by performing a review of specific clinics such as immunization clinics, physical therapy clinics, and others. These future studies could improve sensitivity by using Google Scholar searches, and they could obtain a reasonable number of manuscripts by searching for specific clinics in mind (e.g. "podiatry" and "needs assessment").

Another potential limitation of this systematic review could be the inclusion of community needs assessments taking place in both US and international settings. The inclusion of assessments increases the translatability of results across a broader population, as it covers a diversity of trends in utilization of preventive medicine, insurance coverage, and community health. However, inclusion of non-US settings may also limit the specificity of conclusions that can be

drawn from these needs assessments as differences in medical insurance access exist between US and non-US settings.

Conclusions

A systematic review of the literature shows that needs assessments performed by free clinics provide useful information about their patient populations. We have synthesized the various purposes, methodologies, and important results from the existing NA studies which could provide blueprints for future NAs. Results from NA studies have highlighted unaddressed health problems, encouraged the implementation of new programs, and confirmed the ongoing need of existing programs. Still, there is plenty of room for growth and development in conducting needs assessments.

It is very likely that many SRCs conduct NAs for internal purposes that were not published. It is our hope that this review will encourage these clinics, when possible, to disseminate their work and increase publications about NAs. Published NAs are especially useful for those who are opening new clinics, as it allows future healthcare providers to better understand community needs, develop operations plans, and see what was and was not effective of developed clinics. Additionally, published NAs also may assist existing clinics in developing new interventions or conducting longitudinal studies.

Acknowledgements

Special thanks to Sara Zhou and Lanair Lett for useful discussions. DJA would like to thank the Gamble Scholarship for support.

Disclosures

The authors have no conflicts of interest to disclose.

References

1. Simpson SA, Long JA. Medical student-run health clinics: important contributors to patient care and medical education. *J Gen Intern Med.* 2007 Mar;22(3): 352–356. [LINK](#)
2. Ellett JD, Campbell JA, Gonsalves WC. Patient satisfaction in a student-run free medical clinic. *Fam Med.* 2010 Jan;42(1): 16–18. [LINK](#)
3. Arenas DJ, Lett LA, Klusaritz H, Teitelman AM. A Monte Carlo simulation approach for estimating the health and economic impact of interventions provided at a student-run clinic. *PLoS One.* 2017 Dec;12(12): e0189718. [LINK](#)

4. Oriol NE, Cote PJ, Vavasis AP, et al. Calculating the return on investment of mobile healthcare. *BMC Med.* 2009 Jun;7: 27. [LINK](#)
5. Maciosek MV, Coffield AB, Flottemesch TJ, et al. Greater use of preventive services in US health care could save lives at little or no cost. *Health Aff (Millwood).* 2010 Sep;29(9): 1656–1660. [LINK](#)
6. Maciosek MV, Coffield AB, Edwards NM, et al. Priorities among effective clinical preventive services. *Am J Prev Med.* 2006 Jul;31(1): 90–96. [LINK](#)
7. Porterfield DS, Konrad TR, Porter CQ, et al. Caring for the underserved: current practice of alumni of the National Health Service Corps. *J Health Care Poor Underserved.* 2003 May;14(2): 256–271. [LINK](#)
8. Batra P, Chertok JS, Fisher CE, et al. The Columbia-Harlem Homeless Medical Partnership: a new model for learning in the service of those in medical need. *J Urban Health.* 2009 Sep;86(5): 781–790. [LINK](#)
9. Murray SA, Graham LJ. Practice based health needs assessment: use of four methods in a small neighbourhood. *BMJ.* 1995 Jun;310(6992): 1443–1448. [LINK](#)
10. Murray SA. Experiences with “rapid appraisal” in primary care: involving the public in assessing health needs, orientating staff, and educating medical students. *BMJ.* 1999 Feb;318(7181): 440–444. [LINK](#)
11. Hyun JK, Quinn BC, Madon T, Lustig S. Graduate student mental health: needs assessment and utilization of counseling services. *J Coll Stud Dev.* 2006 May-June;47(3): 247–266. [LINK](#)
12. Guha-Sapir D, Lechat MF. Information systems and needs assessment in natural disasters: an approach for better disaster relief management. *Disasters.* 1986 Sep;10(3): 232–237. [LINK](#)
13. Kenagy GP. Transgender health: findings from two needs assessment studies in Philadelphia. *Health Soc Work.* 2005 Feb;30(1): 19–26. [LINK](#)
14. Fleiss JL, Nee JC, Landis JR. Large sample variance of kappa in the case of different sets of raters. *Psychol Bull.* 1979; 86(5): 974–977. [LINK](#)
15. Arenas DJ. Inter-Rater: software for analysis of inter-rater reliability by permutating pairs of multiple users. *ArXiv Prepr.* 2018 Sep: ArXiv180905731. [LINK](#)
16. Parkinson J. Community health workers and primary health care in Honduras. *J Am Acad Nurse Pract.* 1993 Sep-Oct;5(5): 219–225. [LINK](#)
17. Moskowitz D, Glasco J, Johnson B, Wang G. Students in the community: an interprofessional student-run free clinic. *J Interprof Care.* 2006 Jun;20(3): 254–259. [LINK](#)
18. Kreling BA, Cañar J, Catipon E, et al. Latin American Cancer Research Coalition. Community primary care/academic partnership model for cancer control. *Cancer.* 2006 Oct;107(8 Suppl): 2015–2022. [LINK](#)
19. Scariati PD, Williams C. The utility of a health risk assessment in providing care for a rural free clinic population. *Osteopath Med Prim Care.* 2007 Mar;1: 8. [LINK](#)
20. Cadzow RB, Servoss TJ, Fox CH. The health status of patients of a student-run free medical clinic in inner-city Buffalo, NY. *J Am Board Fam Med.* 2007 Nov-Dec;20(6): 572–580. [LINK](#)
21. Baker LM, Wilson FL, Nordstrom CK, Legwand C. Mothers’ knowledge and information needs relating to childhood immunizations. *Issues Compr Pediatr Nurs.* 2007 Jan-Jun;30(1-2): 39–53. [LINK](#)
22. Jimenez M, Tan-Billet J, Babineau J, et al. The promise clinic: a service learning approach to increasing access to health care. *J Health Care Poor Underserved.* 2008 Aug; 19(3): 935–943. [LINK](#)
23. Bishop SE, Edwards JM, Nadkarni M. Charlottesville Health Access: a locality-based model of health care navigation for the homeless. *J Health Care Poor Underserved.* 2009 Nov;20(4): 958–963. [LINK](#)
24. Palombaro KM, Dole RL, Lattanzi JB. A case report of a student-led pro bono clinic: a proposed model for meeting student and community needs in a sustainable manner. *Phys Ther.* 2011 Nov;91(11): 1627–1635. [LINK](#)
25. Pockey JR, Song EY, Sutfin EL, et al. The need for tobacco cessation in a free clinic population. *Addict Behav.* 2012 Dec;37(12): 1299–1302. [LINK](#)
26. Dotan G, Truong B, Snitzer M, et al. Outcomes of an inner-city vision outreach program: give kids sight day. *JAMA Ophthalmol.* 2015 May;133(5): 527–532. [LINK](#)
27. Rondet C, Parizot I, Cadwallader JS, et al. Why underserved patients do not consult their general practitioner for depression: results of a qualitative and a quantitative survey at a free outpatient clinic in Paris, France. *BMC Fam Pract.* 2015 May;16: 57. [LINK](#)
28. Goldwaser E, Bibber B, Eckert K, et al. A chronic disease management program at the Rowan School of Osteopathic Medicine’s student-run free clinic. *J Stud Run Clin.* 2016 Sep;2(2): 1-6. [LINK](#)
29. Cheffers M, Wang J, Okada A, et al. Determinants of health among the border population in three neighborhoods of Tijuana, Mexico. *Ann Glob Health.* 2016;82(3): 334. [LINK](#)
30. Thorgrimson J, Doble D, Balfour-Boehm J, et al. Going beyond good intentions: needs assessment for student-led health outreach in Northern Ontario. *J Stud Run Clin.* 2016 Sep;2(2): 1-6. [LINK](#)
31. Robertson-James C, Sawyer L, Núñez A, et al. Promoting policy development through community participatory approaches to health promotion: The Philadelphia Ujima experience. *Womens Health Issues.* 2017 Oct;27 Suppl 1: S29–S37. [LINK](#)
32. Creps J, Kaartinen M, Diebold K. Examination of demographics and chronic health condition management in an underserved population at a pro bono physical therapy clinic. *J Stud Run Clin.* 2017 Jul;3(1): 1-5. [LINK](#)
33. Wright J, Williams R, Wilkinson JR. Development and importance of health needs assessment. *BMJ.* 1998 Apr;316(7140): 1310–1313. [LINK](#)
34. Centers for Medicare & Medicaid Services. Quality Improvement Initiatives [Internet]. Baltimore (MD): Centers for Medicare & Medicaid Services; [cited 2018 Jul 29]. Available from: <https://www.medicare.gov/medicaid/quality-of-care/improvement-initiatives>. [LINK](#)
35. Multi-ethnic Pediatric Eye Disease Study Group. Prevalence of amblyopia and strabismus in African American and Hispanic children ages 6 to 72 months: the Multi-ethnic Pediatric Eye Disease Study. *Ophthalmology.* 2008 Jul;115(7): 1229–1236. [LINK](#)