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Short communication

A scalable approach to determine cervical cancer screening needs among emergency department patients in the United States

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ABSTRACT

The emergency department patient population is disproportionately under-screened for cancer, making it an optimal environment to promote cancer screening among hard-to-reach populations and those without routine access to primary care. The first step in a cancer screening process is identifying screening eligibility (e.g. age, sex) and need (i.e. due or past due). In an effort to support the scalability of an emergency department (ED)-based cervical cancer screening intervention, we examined the performance of a low-resource approach of determining cervical cancer screening needs among ED patients. A convenience sample of ED patients (N = 2807) was randomized to (a) an in-person interview with human subjects research staff or, (b) a self-administered, tablet computer-based survey for determining cervical cancer eligibility and need. Patients were recruited from a high-volume urban ED in Rochester, NY and a low-volume rural ED in Dansville, NY between December 2020 and December 2022. Results of these approaches were compared for equivalence of method for determining adherence status with screening guidelines and under/over-reporting of screening activity. Nearly identical reported rates of non-adherence with screening were identified across conditions (1.7% absolute difference; $X^2_1 = 0.96$, $p = 0.33$). Our results demonstrate that a low-resource approach of using a tablet-based self-administered survey to determine cervical cancer screening needs is equivalent to a labor intensive in-person interview approach conducted by trained research staff among ED patients.

1. Introduction

Cervical cancer screening aims to identify precancerous lesions that can be treated prior to the development of cancer. Unfortunately, according to the CDC's 2019 data, only 73.5% of US women aged 21 – 65 years were up-to-date with screening (National Cancer Institute Cancer Trends Progress Report, 2022). Concerningly, this rate of adherence was comparable to screening rates in the late 1980 s with notable disparities in screening coverage based on socioeconomic factors including race, level of education, and access to care, with less than 60% of uninsured women up-to-date with screening (Suk et al., 2022). These risk factors for non-adherence with cervical cancer screening recommendations are over-represented among emergency department (ED) patients (Sabatino et al., 2015; Brown et al., 2014). According to the CDC, people who use the ED as their usual source of care are the most likely to be under-screened (Sabatino et al., 2015); making the ED setting ideal for identifying under-screened patients and intervening to promote screening uptake. However, prior to the initiation of the screening process, it must first be determined if a patient meets the eligibility criteria (i.e. age 21–65 for most women) and also whether the individual is already up-to-date with screening recommendations. This step in the cervical cancer screening process is deceptively challenging among individuals that are not engaged with primary care services, yet is critical to both (1) identify eligible but under-screened people and, (2) impact population health by improving the surveillance of cervical cancer screening uptake.

We are conducting an ongoing study that leverages the disproportionately under-screened patient population of the ED (Sabatino et al., 2015; Brown et al., 2014) to evaluate the efficacy of a behavioral intervention aimed at increasing cervical cancer screening uptake

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among this target rich population (PI: Adler; R01CA246626; NCT04374760). The first step in the screening and enrollment process for this parent study is to identify patients that are both eligible for cervical cancer screening, and non-adherent with cervical cancer screening guidelines (i.e. in need of screening). Although the ED setting has significant potential to address preventive health needs, resources for preventive health interventions are limited, and evaluating cancer screening needs is not standard of care in the ED environment. Thus, in order to improve the prospects for scalability of an ED-based cervical cancer screening intervention, we compared in-person determination of screening needs via interview by trained human subjects research staff, to the much lower resource strategy of a self-administered tablet-based survey for determining cervical cancer screening needs among ED patients.

2. Materials & methods

2.1. Participants and procedure

A convenience sample of lower acuity ED patients at a high volume urban hospital and lower volume rural hospital were enrolled. "Lower acuity" was defined as a patient receiving an Emergency Severity Index (Gilboy et al., 2011) score of 3, 4, or 5 at triage. Research staff monitored the ED tracking board of registered patients for potentially eligible participants (women ages 21 to 65) and consented those individuals found to be eligible that were interested in the study. Enrolled participants then completed baseline data collection to determine cervical cancer screening eligibility and need. This study was approved by the University of Rochester's Research Subjects Review Board.

2.2. Data collection

Study participants were randomized to complete the baseline data collection of the study via (a) an in-person interview with research staff or, (b) a self-administered, tablet computer based survey. Survey wording was at an elementary level and was identical across both study arms. Surveys were translated into Spanish for patients who only read Spanish, and interpreters were available for Spanish and American Sign Language (ASL)-speaking patients (patients who spoke languages other than English/Spanish/ASL were excluded from the study).

Surveys included demographic characteristics and cervical cancer screening behaviors adapted from the National Health Interview Survey (National Health Interview Survey, 2019). Based on participant responses, study participants were categorized as adherent/up-to-date or non-adherent/not up-to-date with U.S. Preventive Services Task Force (USPSTF) recommendations for cervical cancer screening (Curry et al., 2018). Individuals identified as non-adherent with cervical cancer screening guidelines receive a follow-up phone call at 150 days post-enrollment to determine updated screening status as part of the parent study's data collection.

2.3. Plan of analyses

A chi-square test of independence was used to compare survey modalities on identification of cervical cancer screening adherence status. A statistically non-significant difference, coupled with an absolute difference smaller than 3%, were considered necessary evidence for equivalence of method (i.e., in-person interview vs. self-administered survey). We then performed independent measures t-tests and chi-square tests of independence comparing individuals identified as non-adherent using in-person interviews to those identified using the self-administered survey on demographic characteristics. Finally, we compared conditions on confirmed adherence status among patients identified as non-adherent in the ED but who expressed uncertainty and sought confirmation from their usual providers of women's health care. Similar rates of over-referral among these uncertain patients would provide additional support for equivalence of method.

3. Results

3.1. Descriptive statistics

A total of 2,807 participants (mean age = 36.8 years; SD = 21.1) were consented into the study at the time of analysis (additional data collection is ongoing as of February 2023), with more than 95% coming from the high volume, urban ED (see Table 1). The sample was racially diverse, with more than 1/3 of participants identifying as people of color. A wide range of socioeconomic statuses were represented, as indicated by the considerable variability in educational level and insurance coverage. More than 4 out of 5 participants had a usual source of women's health care, and a large majority of patients reported a high degree of healthcare literacy.

3.2. Comparing groups on identification of screening adherence

Table 2 presents rates of adherence with cervical cancer screening guidelines across experimental conditions. Results indicate nearly identical reported rates of non-adherence across conditions (1.7% absolute difference; $X^2_1 = 0.96$, $p = 0.33$).

3.3. Comparing Non-Adherent participants across groups

There were minimal differences in demographic characteristics among participants identified as non-adherent across conditions. Results showed nearly identical average age (self-administered = 36.2 years; in-person = 36.7), primary language, race, ethnicity, educational level, and having a women's health provider (p's greater than 0.05; see Table 1). Statistically significant baseline differences were observed on insurance status and health literacy measures, with greater public insurance and lower health literacy observed in the self-administered group. These baseline differences imply either minor failures of randomization or differential responding to potentially stigmatized items depending on using a self-administered tablet-based survey or being interviewed in-person.

3.4. Comparing Over-referral rates across groups

A total of 104 participants identified as non-adherent at baseline (N = 756) sought provider confirmation of their screening status by the 150-day follow-up call (58 in the self-administered condition; 46 in the in-person interview condition). This provider confirmation is intrinsic to the intervention and would be a part of future implementation, as linkage to primary care is essential for ED-based cervical screening initiatives. Rates of over-referral among these uncertain participants (i.e., provider indicated participant adherence) were 21.0% in the self-administered condition and 21.7% in the in-person interview condition ($X^2_1 = 0.01$, $p = 0.93$). These results, when coupled with nearly identical reported rates of adherence, provide evidence for equivalence of method.

4. Discussion

Most cases of cervical cancer occur in never-screened and under-screened people (Spence et al., 2007) and significant progress is needed to reach national cervical cancer screening goals (US Department of Health and Human Services Office of Disease Prevention and Health Promotion, Healthy People 2030). A critical first step in reaching these goals is to identify individuals who are in need of screening. Although this step may be straightforward among populations steadily engaged with primary care services, it is a challenge among harder to reach groups that are at highest risk of developing cervical cancer. Identification of the need for screening must then be followed by linking

Table 1
Adherence with USPSTF Cervical Cancer Screening Recommendations Among Emergency Department Patients Age 21–65 in Rochester, NY (December 2020 – December 2022) - Participant Demographic Frequencies and Percentages.

	Overall Sample N (%)	Self-administered survey N (%)	In-person interview N (%)	p-value
Enrollment Location				0.992
Strong Memorial Hospital	2707 (96)	1298 (48)	1409 (52)	
Noyes Memorial Hospital	100 (4)	48 (48)	52 (52)	
Primary Language Spoken				0.269
English	2733 (97)	1304 (97)	1429 (98)	
Spanish	62 (2)	36 (3)	26 (2)	
American Sign Language	12 (<1)	6 (<1)	6 (<1)	
Racial Background				0.235
White	1799 (64)	839 (47)	960 (53)	
Black/African American	701 (25)	345 (26)	356 (24)	
Asian	75 (3)	40 (3)	35 (2)	
Other	199 (6)	102 (8)	97 (7)	
Refused to Answer or Omitted	33 (1)	20 (1)	13 (1)	
Hispanic or Latino/ Latina	391 (14)	189 (14)	202 (14)	0.867
Educational Level				0.318
Less than High School	171 (6)	87 (7)	84 (6)	
High School/GED	725 (26)	349 (26)	376 (26)	
Some College	933 (33)	461 (35)	472 (32)	
4 year College Degree	575 (21)	254 (19)	321 (22)	
Professional Degree (MA/PhD/MD)	393 (14)	186 (14)	207 (14)	
Missing	10 (<1)	9 (<1)	1 (<1)	
Insurance[a]				
No Insurance	47 (2)	17 (1)	30 (2)	0.103
Private Insurance	1496 (53)	639 (48)	857 (59)	<0.001
Medicaid	1080 (39)	564 (42)	516 (35)	<0.001
Medicare	257 (9)	144 (11)	113 (8)	0.007
Other	106 (4)	49 (4)	57 (4)	0.717
Refused to Answer or Does not Know	54 (2)	37 (3)	17 (1)	
Do you have a normal provider for women's health issues?				0.108
Yes	2277 (82)	1069 (80)	1208 (83)	
No	507 (18)	258 (19)	249 (17)	
Refused to Answer or Missing	23 (1)	19 (1)	4 (<1)	
How confident are you filling out medical forms by yourself?				0.036
Not at all Confident	74 (3)	39 (3)	37 (3)	
A little	99 (4)	57 (4)	42 (3)	
Somewhat	208 (7)	112 (8)	96 (7)	
Quite a bit	509 (18)	253 (19)	256 (18)	
Extremely Confident	1904 (68)	877 (66)	1027 (70)	
Refused to Answer or Missing	11 (<1)	8 (<1)	3 (<1)	
How often do you have someone like a family member, friend, hospital or clinic worker, or caregiver, help you read hospital materials?				<0.001
Never	1865 (66)	826 (62)	1039 (71)	
Rarely	411 (15)	237 (18)	174 (12)	
Sometimes	295 (11)	154 (12)	141 (10)	
Often	105 (4)	58 (4)	47 (3)	
Always	120 (4)	64 (5)	56 (4)	
Refused to Answer or Missing	11 (<1)	7 (<1)	4 (<1)	
How often do you have problems learning about your medical condition because of difficulty understanding written information?				<0.001
Never	1938 (69)	850 (64)	1088 (75)	
Rarely	460 (16)	277 (21)	183 (13)	
Sometimes	273 (10)	150 (11)	123 (8)	
Often	70 (3)	32 (2)	38 (3)	
Always	55 (2)	29 (2)	26 (2)	
Refused to Answer or Missing	11 (<1)	8 (<1)	3 (<1)	

[a] Categories are not mutually exclusive as participants can have more than one insurance.

Table 2
Frequencies and Percentages of Cervical Cancer Screening Adherence Status Across Experimental Groups of Emergency Department Patients Age 21–65 in Rochester, NY (December 2020 – December 2022).

Data Collection Method	Adherent N (%)	Non-Adherent N (%)
Self-administered, tablet-based survey	972 (72.2)	374 (27.8)
In-person interview	1079 (73.8)	382 (26.1)

individuals with screening services using methods ranging from simple referral to intensive patient navigation (the ongoing parent study compares behavioral interventions aimed at achieving this goal). This study demonstrates that a low-resource approach, using a tablet-based self-administered survey, to determine cervical cancer screening needs is equivalent to a labor intensive in-person interview approach. This low-resource approach promises greater scalability and thus greater potential for widespread implementation.

There is substantial precedent for acquisition of health data from patients using self-administered surveys/questionnaires delivered by tablet computers. For example, PROMIS® (Patient-Reported Outcomes Measurement Information System) is a U.S. Department of Health and Human Services product that uses this approach to assess patient function, symptoms, and behavior for a range of clinical and research purposes (Cella et al., 2010; Cella et al., 2007; Cook et al., 2016; Fries et al., 2005; Fries et al., 2009). Although there are potential challenges to scaling the use of tablet computers including theft, data security, and integration of tablet data into the electronic health record, these challenges can be overcome. Inexpensive security features including device location tracking, geofencing that disables the device beyond a defined area, remote data wiping, remote screen lock, and anti-mute alarm that cannot be silenced are commercially available (Prey, 2019).

While this study was conducted in ED settings, a similar approach to identifying screening needs could be used at health fairs, community clinics, and educational and workplace environments where the population may include individuals that do not have routine access to primary care.

Although this study used a survey measure based on the National Health Interview Survey (National Health Interview Survey, 2019) and

USPSTF recommendations for cervical cancer screening (Curry et al., 2018), it has the limitation of not assessing survey validity. However, upon completion of our ongoing interventional trial, we will be able to compare results of both in-person and self-administered surveys to the objective data source of the electronic health record for enrolled patients. Because randomization only occurred for research participants whose surveys indicated a need for screening, our method does not allow for identification of under-reporting of non-adherence (i.e. participant incorrectly reports adherence). Still, the rate of non-adherence in our study cohort was comparable to the national rate. Low health literacy was uncommon in our cohort, making comparisons among sub-groups for this variable not feasible. Our findings may have been different in a cohort with lower health literacy. In addition, some baseline differences were observed across randomized groups, such that subsequent work might benefit from seeking independent corroboration of insurance status and/or health literacy to determine whether randomization failure occurred on these variables or there were differential response patterns. Finally, as a convenience sample, characteristics of non-responders might differ from responders in a manner that affects comparisons.

5. Conclusions

Among ED patients, a low-resource approach of using a tablet-based self-administered survey to determine cervical cancer screening needs is equivalent to a labor intensive in-person interview approach conducted by trained research staff. This low-resource approach has the potential to facilitate the scalability of ED-based cervical cancer screening interventions.

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CRediT authorship contribution statement

David Adler: Conceptualization, Methodology, Formal analysis, Investigation, Supervision, Funding acquisition, Writing – original draft. **Adrienne Bonham:** Conceptualization, Methodology, Writing – review & editing. **Sydney Chamberlin:** Investigation, Writing – review & editing. **Kevin Fiscella:** Conceptualization, Methodology, Writing – review & editing. **Karen Mustian:** Conceptualization, Methodology, Writing – review & editing. **Chanjun Syd Park:** Formal analysis, Data curation, Writing – review & editing. **Nancy Wood:** Methodology, Investigation, Project administration, Writing – review & editing. **Beau Abar:** Conceptualization, Methodology, Formal analysis, Investigation, Software, Data curation, Writing – original draft.

Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Data availability

Data will be made available on request.

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