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Use of electronic health records and primary health care accessibility according to data from the third cycle of the PMAQ-AB

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Abstract *The use of electronic health records (EHR) in primary healthcare (PHC) aims for better integration of services and care quality. One of most the critical points of Brazilian PHC is access. This article aims to analyze, through data from the third evaluation cycle of the Brazilian Program for Improving Access and Quality of Primary Care (PMAQ-AB), the relationship between the use of electronic health records and the parameters of access of the participant teams. Cross-sectional analytical study with secondary data. Data from 38,865 primary care teams, 30,346 health units and 140,444 interviewed users were evaluated. The use of EHR was associated with greater care for non-programmed demands (OR 1.664; 95%CI 1.485-1.866), risk and vulnerability assessment (OR 1.329; 95%CI 1.122-1.574) and use of protocols for clinical conducts (OR 1.656; 95%CI 1.530-1.793), in addition to a greater possibility of scheduling consultation by telephone (OR 3.179; 95%CI 3.030-3.335). Services using EHR are more likely to be the patients first contact (OR 1.226; 95%CI 1.171-1.283) and to be sought when facing urgent health problem (OR 1.198; 95%CI 1.161-1.236). The results point to a concrete possibility of improving access through computerization.*

Key words *Primary Health Care, Health Services Accessibility, Electronic Health Records*

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Introduction

The Primary Health Care (PHC) network in Brazil is organized by multidisciplinary teams, which take on health responsibilities for specific territories and populations. Covering over half of the national population, Brazilian PHC plays a crucial role in reducing infant mortality, preventing hospitalizations for ambulatory care-sensitive conditions, and facilitating equitable access to historically underserved and vulnerable populations[1].

The electronic health record (EHR) has become an integral component of PHC outpatient practices across various health systems[2]. EHRs can assist in identifying high-risk patients for follow-up, as well as generate standardized tools for clinical management and decision support[3]. There is evidence that the use of EHRs can contribute to a positive shift in professional attitudes and practices towards better quality of care and health indicators, in addition to reducing medication errors, enhancing communication among clinicians, and improving test monitoring[2,4].

The influence of EHR on one of the primary and most challenging aspects of PHC – access – is not yet clearly understood[5]. According to Starfield[6], access is the primary structural element that, when associated with utilization, ensures first-contact care. It can be assessed by the ease with which patients can contact their doctor, nurse, or other team members, or by the reasonableness of the time between this contact and a resolution-focused consultation. The concept is less associated with how the healthcare service defines or provides access and more with how accessible its users perceive it to be– directly impacting their utilization[6].

Granting access in this sense means placing the population's needs as a reference for organizing services and actions offered by primary care, guiding strategies such as extending service hours and diversifying appointment scheduling methods[7]. The success of these strategies is influenced by patient reception procedures and scheduling technologies.

In a systematic review, access performed the worst among all items and subitems evaluated concerning essential attributes of PHC, leading the attribute "First Contact" to be the second essential attribute with the poorest assessment[8]. Access is the dimension with the lowest user satisfaction in the Family Health Strategy, and it is the attribute with the most negative evaluation from the perspective of healthcare professionals[9]. There is a full consensus that expanding access to PHC, along with improving the quality and effectiveness of services, is a measure that strengthens healthcare systems, making them more efficient and sustainable[1].

Implementing EHRs incurs significant costs and affects a large patient population. Demonstrating a clear clinical benefit is crucial for such interventions[5]. Currently, there is a lack of comprehensive national and international studies on the relationship between health unit computerization and first contact in primary care. This study utilizes data from the third cycle of external evaluation of the Primary Care Access and Quality Improvement Program (PMAQ-AB) to objectively analyze how the use of electronic medical records relates to the access and patient reception parameters of participating units.

Methods

This study is an analytical cross-sectional quantitative research utilizing secondary data obtained from the 3rd evaluation cycle of the PMAQ-AB[10]. The evaluation involved 38,865 primary care teams, 30,346 health units, and 140,444 users. Given the use of publicly available secondary data, project submission for evaluation by a Research Ethics Committee was unnecessary.

Following the initial study of the External Assessment Instrument for Primary Care Teams, Oral Health, and NASF - PMAQ 3rd Cycle[10], variables related to the characterization of teams/units, computerization of processes, access, and patient reception of health demands were selected. The microdata from modules I (Unit), II (Team), and III (User) were grouped according to the variable "INE Final", related to the National Team Identifier of the evaluation participants.

To examine responses from modules II and III, the sample was stratified into two groups based on the presence or absence of electronic health records. Inferential statistics were conducted using IBM SPSS Statistics 22 software. Fisher's Exact test was employed for univariate analysis of nominal variables, while the Mann-Whitney U test was utilized for continuous variables after normality testing (Kolmogorov-Smirnov).

Multivariate analysis was conducted using bivariate logistic regression, employing the "Enter" method, adjusted for city size (capital or non-capital), testing dichotomous variables with a difference greater than one percentage point between groups and showing statistical ($p>0.05$

in univariate analysis) and techno-organizational significance. The results were grouped into tables and summarized in a narrative format according to their theme, context, and relevance.

Results

The average number of functional computers for health teams in the units was 7.57, with significant variability (standard deviation ±8.72). 24,907 teams (67.6%) fall below this average, with 4,572 teams (12.4%) having only one computer in the unit, and 3,321 teams (9%) having no functional computers. Regarding internet access, 22.8% of teams report not having access in the unit, and among those with access, 14.4% report that the connection is irregular or non-functional.

Geographic factors are associated with team computerization, as shown in Table 1. The Southeast is the region with the highest number of functional computers and internet access, followed by the southern region; the Northeast is the region with the lowest averages in both categories.

However, the most significant difference in terms of unit computerization is not related to regional divisions but rather to city size. Of the responding teams, 86.2% (32,676) are in rural cities, where the average number of functional computers is approximately 13 computers less than the average in capitals. While only 6.2% (n=323) of teams in capitals are in units without internet access, in rural areas, this proportion is 25.5% (n=8,067).

Of all the teams, only 38.7% (n=14,455) reported recording information in electronic health records; of these, 68.4% (n=9,881) still simultaneously maintain information recorded on paper forms. Multivariate analysis of modules II and III shows that teams located in capitals are 2 to 2.5 times more likely to be computerized than teams in rural areas; 57% of responding teams in capitals (n=2,824) report using electronic health records, while in rural areas, this proportion is 35.9% (n=11,631).

The type of electronic health record used by computerized teams also differs between samples: rural, 61.6% (n=7,165) of teams use the *Prontuário Eletrônico do Cidadão* (PEC), a public software provided for free by the Ministry of Health, while in capitals, 73.1% (n=2,824) operate with other software, whether paid or developed in-house.

The analyses of Module II (respondents being health professionals) and Module III (focused on users' perceptions and experiences) revealed positive differences in favor of electronic health records concerning the access and patient reception processes. The team-related data is presented in Tables 2 and 3, while user-related data can be found in Tables 4 and 5.

Regarding first-contact care, 88.4% of interviewed users (n=124,086) reported that the assessed PHC unit was the first service they sought when in need of healthcare. Although this proportion is higher in rural (89.6%; n=108,539) than in capital units (80.6%; n=15,547), first-contact care remained positively associated with the use of electronic health records in both univar-

Table 1. Mean number of computers in usable condition, with internet access, and form of information recording, by region and size of the city of the responding teams (n=37,894).

Geographic Characteristic	Computers in usable condition		Computers with internet access		Recording information %(n)		
	Mean	SD	Mean	SD	PEC	Other EHR	No EHR
Southeast	11,53	11,4	12,29	11,63	18.2 (2,269)	24.1 (3,002)	57.8 (7,211)
South	11.12	7.24	11.05	7.19	30.3 (1,686)	50.6 (2,813)	19.1 (1,059)
Midwest	7.41	6.66	7.25	6.1	40.6 (1,077)	20.4 (542)	39.0 (1,035)
North	5.06	4.73	6.08	5.39	21.5 (672)	1.1 (34)	77.4 (2,421)
North East	3.22	3.99	4.02	4.25	15.8 (2,222)	1.0 (138)	83.2 (11,713)
Capitals	19.14	13.07	19.29	13.23	14.6 (761)	39.5 (2,063)	45.9 (2,394)
Rural cities	5.67	5.9	6.66	6.1	21.9 (7,165)	13.7 (4,466)	64.4 (21,045)
Total	7.57	8.72	8.83	9.14	20.9 (7,926)	17.2 (6,529)	61.9 (23,439)

SD: Standard Deviation; PEC: Prontuário Eletrônico do Cidadão; EHR: Electronic Health Record.

Source: Authors.

Table 2. Responses regarding access and patient reception of "Module II - Team" by use of electronic health records and statistical significance (univariate analysis).

Team questions		Electronic Health Record		p-value
		Yes	No	
When the user needs to schedule an appointment, what are the possibilities?	In person, at unit [1]	99.8 (14,428)	99.8 (22,838)	0.263
	By phone [1]	53.3 (7,706)	28.0 (6,419)	<0.001
	By social networks [1]	23.1 (3,342)	18.4 (4,216)	<0.001
	By specific website or application [1]	4.3 (621)	3.4 (774)	<0.001
Has the team carried out an assessment or study of spontaneous demand in the last 12 months? [1]		74.4 (10,757)	68.5 (15,682)	<0.001
Does the team attend to spontaneous demand in this unit? [1]		99.6 (14,390)	98.8 (22,622)	<0.001
Number of shifts (morning/afternoon/night) in which patient reception takes place [2]		2.049±0.374	1.954±0.365	<0.001
Number of days of the week in which patient reception takes place [2]		4.986±0.526	4.808±0.760	<0.001
Does the team provide patient reception during weekends? [1]		5.8 (831)	1.7 (379)	<0.001
Does the team provide patient reception on Saturdays? [1]		5.8 (830)	1.6 (373)	<0.001
Does the team provide patient reception on Sundays? [1]		0.8 (116)	0.6 (139)	0.033
What is(are) the main process(es) for spontaneous demand reception?	By queue/ticket number [1]	25.7 (3,702)	25.3 (5,731)	0.399
	By order of arrival [1]	71.1 (10,234)	76.4 (17,281)	<0.001
	By risk and vulnerability assessment [1]	96.0 (13,816)	94.4 (21,356)	<0.001
When responding to spontaneous demand, the team carries out:	Emergency care [1]	96.9 (13,937)	93.8 (21,216)	<0.001
	Prescription renewal [1]	93.3 (13,433)	95.0 (21,484)	<0.001
	Risk and vulnerability assessment [1]	98.5 (14.172)	97.4 (22,036)	<0.001
Does the team use protocols/criteria to guide the case management in patient reception? [1]		92.8 (13,357)	86.4 (19,535)	<0.001
Were the professionals on the patient reception team trained in the use of risk and vulnerability assessment protocols/criteria? [1]		90.3 (12,065)	86.6 (16,927)	<0.001
The team provides facilitated access to:	Retrieve and present test results [1]	98.3 (14,204)	97.5 (22,314)	<0.001
	Address post-appointment questions or show how their situation has progressed [1]	98.5 (14,233)	98.3 (22,513)	0.333

[1]% (n) - Fischer's Exact Test; [2]Mean±SD - Mann-Whitney U test for independent samples.

Source: Authors.

iate (OR 1.177; 95%CI 1.137-1.218; p<0.0001) and multivariate analysis (adjusted OR 1.226; 95%CI 1.171-1.283; p<0.001).

The primary service sought by users in the units is scheduled appointments, as reported by 87.1% of respondents (n=122,046), with no significant difference between the groups with and without EHR (p=0.123). However, the demand for emergency care was higher in units with EHRs, with 45.4% of respondents in units with EHRs compared to 39.8% in units without EHRs (p<0.001).

The percentage of users considering changing health units/teams is lower in computerized units. The primary reason reported for considering a change is the inability to receive care, with no statistically significant difference between computerized and non-computerized units (p=0.419).

While addressing spontaneous demand can involve various aspects, it can broadly be categorized into receiving the demand and ensuring its proper resolution. Regarding patient reception, 82.1% of teams (n=31,891) reported providing reception during the unit's two service shifts. When users needed to visit the health unit without a prior appointment to address an issue, 86.5% (n=101,022) received a qualified hearing. EHRs appear to have a marginal influence on qualified listening, both in its occurrence (adjusted OR 1.047; 95%CI 1.004-1.092; p=0.033) and in the user's perception of its quality (average 0.05 points closer to a "very good" evaluation; p<0.001).

Table 3. Multivariate analysis (logistic regression) of Odds Ratios associated with the presence of Electronic Health Records for nominal variables from "Module II - Team" with significant differences greater than a 1 percentage point between groups.

Variable for analysis	Sig.	Adjusted Odds Ratio	95%CI	
			Bottom	Higher
When the user needs to schedule an appointment, scheduling by phone is a possibility	<0.001	3.179	3.030	3.335
When the user needs to schedule an appointment, scheduling via social media is a possibility	<0.001	0.780	0.736	0.827
The primary care team carried out an assessment or study of spontaneous demand in the last 12 months	<0.001	1.106	1.051	1.163
One of the main processes for spontaneous demand reception is through risk and vulnerability assessment	0.356	1.053	0.944	1.174
When responding to spontaneous demand, the team provides emergency care	<0.001	1.664	1.485	1.866
When responding to spontaneous demand, the team carries out a risk and vulnerability assessment	0.001	1.329	1.122	1.574
The team uses protocols/criteria to guide the case management in patient reception	<0.001	1.656	1.530	1.793
The team is located in a capital	<0.001	2.614	2.453	2.787

Source: Authors.

The results indicate that 99.1% of teams (n=37,012) report addressing spontaneous demand in the unit, while 95% (n=35,153) report responding to emergencies. Additionally, 70.8% (n=26,439) conducted a study of spontaneous demand in the last 12 months. All three variables exhibited a positive association with the use of EHRs, demonstrating a higher proportion of units addressing spontaneous demand (99.6%; p<0.001; univariate analysis), an increased likelihood of attending emergencies (96.9%; adjusted OR 1.664; 95%CI 1.485-1.866; p<0.001), and a greater likelihood of conducting an assessment or study of spontaneous demand (74.4%; adjusted OR 1.106; 95%CI 1.051-1.163; p<0.001).

The presence of EHRs was also associated with improved practices in addressing spontaneous demand, demonstrated by a higher proportion of teams reporting training for the use of risk and vulnerability assessment protocols/criteria (90.3%; n=12,065; p<0.001; univariate analysis), a higher likelihood of conducting risk and vulnerability assessments (adjusted OR 1.329; 95%CI 1.122-1.574; p=0.001) and greater use of protocols/criteria to guide conduct in cases (adjusted OR 1.656; 95%CI 1.530-1.793; p<0.001). While the proportion of units organizing the patient reception flow based on risk and vulnerability assessment was higher in computerized units, this difference was not significant in the multivariate analysis (p=0.356).

Such service organization reflected in the users' interactions with it. In addition to the first-contact care bond already described previously, users of computerized units had a higher likelihood of reporting seeking said unit the next time they were affected by an urgent problem (65.7%; adjusted OR 1.198; 95%CI 1.161-1.236; p<0.001). Among these users, 89.5% (n=22,756) reported receiving care – a slightly higher proportion than in non-computerized units (88.6%; p=0.001). The average time for addressing urgent demands varied greatly (25.76±36.57 minutes), with the presence of electronic health records being associated with longer intervals between reception and care (p<0.001) – a fact better addressed in the discussion.

Regarding appointment scheduling, only 63% of responding patients (n=81,361) reported that appointments could be scheduled every day and at any time during the unit's operating hours. Unit computerization appears to positively influence this access (66.4%; adjusted OR 1.188; 95%CI 1.153-1.224; p<0.001). In univariate analysis, this increased access seems to extend the time between scheduling and the actual appointment, both in the medical and nursing schedules (p<0.001). In computerized units, it is less com-

Table 4. Responses regarding access and patient reception from "Module III - User" by use of electronic health records and statistical significance.

User questions		Electronic Health Record		p-value
		Yes	No	
Most of the time, the first service you tend to look for when you need health care is this primary healthcare unit [1]		89.4 (49,364)	87.8 (74,417)	<0.001
For which services do you usually seek this primary healthcare unit:	Scheduled consultations [1]	87.3 (48,220)	87.0 (73,826)	0.123
	Unscheduled consultations [1]	68.8 (37,989)	65.8 (55,791)	<0.001
	Emergency care [1]	45.4 (25,056)	39.8 (33,760)	<0.001
Most of the time, how are medical appointments scheduled at this Primary Healthcare Unit?	By phone [1]	4.6 (2,548)	1.6 (1,348)	<0.001
	Online [1]	0.2 (119)	0.2 (138)	0.025
	Goes to the unit and schedules the appointment [1]	83.9 (46,180)	80.1 (67,783)	<0.001
	The community health agent schedules the appointment [1]	8.7 (4,779)	14.6 (12,363)	<0.001
	This primary healthcare unit does not offer appointment scheduling [1]	1.8 (1,010)	2.9 (2,474)	<0.001
	Other unmentioned scheduling methods [1]	0.7 (379)	0.6 (491)	0.012
Is appointment scheduling available every day and at any time the Primary Healthcare Unit is open? [1]		66.4 (33,963)	60.9 (47,239)	<0.001
How do you evaluate this appointment scheduling method? [2,3]		2.20±0.91	2.20±0.88	0.001
When you manage to schedule an appointment, is it usually for the same day? [1]		39.7 (21,267)	43.0 (35,104)	<0.001
Most of the time, your appointments at this unit are:	On an individual, previously scheduled time slot [1]	26.6 (14,282)	13.6 (11,166)	<0.001
	On previously scheduled period/shift time slot, in a first-come, first-served basis [1]	61.0 (32,746)	74.9 (61,342)	<0.001
	On a first-come, first-served basis, without scheduling [1]	11.5 (6,195)	10.6 (8,644)	<0.001
	Other forms not mentioned in instrument [1]	0.9 (490)	0.9 (703)	0.312
On average, how many days do you wait between scheduling an appointment and seeing the doctor at this unit? [2]		11.89±22.05	9.18±18.00	<0.001
On average, how many days do you wait between scheduling the appointment and seeing the nurse in this unit? [2]		5.01±13.81	4.23±10.07	<0.001
Most of the time you come to the health unit without having an appointment to resolve any problem, are you able to be heard? [1]		87.1 (41,272)	86.1 (59,528)	<0.001
For your convenience, would you prefer appointments to be:	On an individual, previously scheduled time slot [1]	25.0 (13,644)	20.3 (17,030)	<0.001
	On previously scheduled period/shift time slot, in a first-come, first-served basis [1]	9.1 (4,941)	11.3 (9,481)	<0.001
	On a first-come, first-served basis, without scheduling [1]	7.5 (4,075)	8.1 (6,767)	<0.001
	I am satisfied, there is no need for changes in scheduling [1]	56.3 (30,683)	58.2 (48,838)	<0.001
	Other forms not mentioned in instrument [1]	2.2 (1,179)	2.2 (1,813)	0.985
The last time you had an urgent problem, did you seek out this Primary Healthcare Unit? [1]		65.7 (25,473)	61.2 (34,140)	<0.001
Why didn't you seek this Primary Healthcare Unit?	Because you need to arrive early since the service is on a first-come, first-served basis [1]	5.1 (584)	3.7 (714)	<0.001
	Because it does not handle urgent cases [1]	52.2 (6,010)	59.7 (11,453)	<0.001
	Because there was no professional available at the unit [1]	6.3 (727)	7.1 (1,370)	0.005
	Because the unit was closed at the time [1]	36.5 (4,203)	29.4 (5,649)	<0.001
Did you manage to get assistance at this Primary Healthcare Unit? [1]		89.5 (22,756)	88.6 (30,198)	0.001

it continues

Table 4. Responses regarding access and patient reception from "Module III - User" by use of electronic health records and statistical significance.

User questions		Electronic Health Record		p-value
		Yes	No	
Why were you unable to get assistance at this Primary Healthcare Unit?	Because you need to arrive early since the service is on a first-come, first-served basis [1]	15.2 (360)	11.6 (403)	<0.001
	Because it does not handle urgent cases [1]	38.4 (909)	42.1 (1,465)	0.005
	Because there was no professional available at the unit [1]	29.1 (688)	27.7 (962)	0.237
	Because the unit was closed at the time [1]	17.3 (409)	18.7 (649)	0.189
How long did you wait to be seen? [2]		28.83±39.62	23.37±33.80	<0.001
When you didn't have an appointment scheduled and needed to ask questions to professionals, were you able to? [1]		81.7 (34,201)	81.2 (50.234)	0.031
When you didn't have a scheduled appointment and needed to retrieve or show test results to professionals, were you able to? [1]		66.2 (27,929)	68.3 (42,946)	<0.001
What do you think about the way you are welcomed/received when seeking the service? [2.3]		1.82±0.72	1.87±0.71	<0.001
If you could, would you change teams or health units? [1]		10.3 (5,589)	11.3 (9,481)	<0.001
Why would you change teams/units?	Unit is far [1]	13.6 (760)	17.8 (1,684)	<0.001
	Service hours do not meet needs [1]	15.9 (887)	18.1 (1,720)	<0.001
	Cannot get service [1]	29.7 (1,662)	30.4 (2,880)	0.419
	Poor service [1]	32.1 (1,796)	29.5 (2,798)	0.001
	Professionals at another unit are better [1]	28.7 (1,604)	25.8 (2,450)	<0.001
	Other reasons not listed [1]	31.7 (1,773)	34.6 (3,279)	<0.001

[1]%(n) - Fischer's Exact Test; [2]Mean±SD - Mann-Whitney U test for independent samples; [3]Scale from 1 to 5, where "1 = Very good" and "5 = Very bad".

Source: Authors.

Table 5. Multivariate analysis (logistic regression) of Odds Ratio associated with the presence of Electronic Health Records for nominal variables from "Module III - User" with significant differences greater than 1 percentage point between groups.

Variable for analysis	Sig.	Adjusted Odds Ratio	95%CI	
			Bottom	Higher
Most of the time, the first service that the user tends to look for when they need health care is this Primary Healthcare Unit	<0.001	1.226	1.171	1.283
Appointments can be done every day and at any time during the unit operating hours	<0.001	1.188	1.153	1.224
Most of the time, consultations at this unit are by individual time slot appointment.	<0.001	1.438	1.364	1.515
Most of the time, appointments at this unit are on previously scheduled period/shift time slot, in a first-come, first-served basis.	<0.001	0.728	0.696	0.761
Most of the time when users come to the unit without having an appointment to resolve any problem, they are able to be heard	0.033	1.047	1.004	1.092
The last time the user had an urgent problem, they sought out this Primary Healthcare Unit	<0.001	1.198	1.161	1.236
The unit is located in a capital	<0.001	2.113	2.030	2.200

Source: Authors.

mon for a scheduled appointment to take place on the same day as the scheduling (p<0.001).

Scheduling appointments in person at the health unit appears to be the predominant method in Brazil: 99.8% of teams report offering this scheduling option, with no significant difference between units with or without electronic health records (p=0.263). Similarly, 81.4% (n=113,963) of users interviewed during the external evaluation reported this as the primary scheduling method, with a higher proportion in computerized units (83.9%; n=46,180; p<0.001).

Alternative scheduling methods have shown greater variation according to unit computerization. In the univariate analysis of team responses, the use of electronic health records was associated with more scheduling via phone, social networks, websites, and apps; in the multivariate analysis, the relationship was positive for scheduling by phone (OR 3.179; 95%CI 3.030-3.335; p<0.001) and negative for social networks (OR 0.780; 95%CI 0.736-0.827; p<0.001).

In interviews with users, although computerized units show a slightly higher proportion of scheduling by phone (4.6%; n=2,548; p<0.001) and in person (83.9%; n=46,180; p<0.001), users of units without electronic health records report more scheduling mediated by community health agents (14.6%; n=12,363; p<0.001). Although both groups have the same average satisfaction with the scheduling process (average 2.20; median 2 = "good"), the distribution of responses was different between the groups (p=0.001), with slightly more variability in the group with electronic health records.

The appointment schedule organization process also appears to be optimized by computerization; units with electronic health records have a higher likelihood of providing hourly scheduled appointments (26.6%; adjusted OR 1.438; 95%CI 1.364-1.515; p<0.001), as opposed to the more common first-come, first-served appointments. Hourly scheduled appointments seem to be the most desired change in the way scheduled demands are addressed (22.2% of respondents; n=30,780).

Another important aspect of access is the operating hours: 17.3% of users who would like to change health units (n=2,625) would do so because the operating hours of their actual unit do not meet their needs. In addition to the previously mentioned situation – where not all units offer scheduling throughout their whole operating hours – some units only conduct patient reception during one shift of operation (7%; n=2,735), and only 6.1% of units (n=2,386) provide reception in a third shift, covering morning, afternoon, and evening.

The proportion of users who do not feel accommodated by the operating hours is lower in computerized units (15.9%; p<0.001), a fact possibly explained by the average number of shifts and weekdays during which patient reception occurs being higher in services with electronic health records (p<0.001). Although incipient (5.8%; n=831), the percentage of computerized teams that conduct patient reception during weekends is considerably higher than that of non-computerized teams (1.7%; n=379; p<0.001).

Discussion

The EHR was found to be related to the expansion of emergency care, which is a crucial aspect from the user's perspective[11]. Services that do not establish an agenda for addressing emergencies and spontaneous demands have lower credibility with users, reducing the likelihood of user satisfaction with the service by up to 42% and directly impacting their first-contact and continuity of care[8,11-13].

Corroborating theoretical models and evidence already identified in the scientific literature[6,9,12-17], the obtained data demonstrates the logical relationship between first-contact care and the ability of PHC services to offer unscheduled appointments and emergency care – and allow the association of computerization with the increase in these capabilities.

The relationship of EHRs with the extension of days and hours of service also demonstrates the synergy between access expanding tools and practices. The extension of operating hours linked to the computerization of units and the utilization of access management practices, such as advanced access, stands out in successful experiences and recommendations as potent ways to revitalize the role of PHC in the healthcare system[18,19].

The high waiting time is problematic as it represents the inability of healthcare services to offer timely access. When the user can schedule an appointment, but it does not happen on the same day, their chance of being satisfied with the service drops by 16%; and the time between scheduling and the appointment has been inversely related to the quality of primary care[12,13]. It is worth noting that variables related to waiting time did not undergo multivariate analysis, being

susceptible to confounders such as the municipality's size.

As in other studies on the subject, the results demonstrate that the culture of in-person scheduling still dominates access to scheduled care in Brazil. This model is often characterized by the formation of queues at health services, creating barriers for users who need to arrive very early or even stay overnight to obtain care[20].

Simple changes to the appointment scheduling system can alter the way users are received, often being sufficient to avoid queues and human suffering[21]. Despite the large positive association between computerization and the possibility of scheduling appointments by telephone, the same relationship is not repeated when evaluating scheduling via social networks (Facebook, WhatsApp, etc.) – indicating the complexity of the topic. The use of information technology to overcome barriers to scheduling appointments is not a new proposal[21], but the computerization of Brazilian PHC makes it particularly opportune. The *Conecte SUS* ministerial application allows the user to check available times on a professional's schedule, send a scheduling request to the unit, and receive reminders about schedule confirmation, cancellations, and appointment days. However, as the functionality needs to be enabled by the reference PHC team, by June 2020, the system only recorded 539 appointments made through the application throughout Brazil[20].

Changes to more agile scheduling models that are sensitive to users' needs can be positively related to the quality of care provided in PHC services[12]; however, without the engagement of health teams, such interventions are unable to address access problems and inequities. Savas *et al.*[4] reported how the use of EHR can, within a context of systemic intervention, help change professional practices towards better quality of care in PHC; In addition to the increasing improvement in the health indicators, the teams' attitudes, behaviors, and perceptions regarding the use of EHR also proved to be positive at the end of the intervention.

The EHR only has the capacity to improve parameters of a health service if its use is significant – that is, when it is utilized to enhance quality, safety, efficiency, and reduce health disparities[22]. The results show that it is plausible that significant use of EHR is not the norm in Brazil, as, in addition to the lack of computers and internet connection, the computerization of Brazilian primary care presents weaknesses related to infrastructure, deficiencies in training, and resistance of professionals[23,24]. More than half of the teams that use electronic health records perform dual registration, simultaneously maintaining electronic and paper records. It is possible that, in these units, the electronic record serves only bureaucratic purposes, since Brazil has made it mandatory to record information related to primary care actions through EHRs[25].

The larger the scale of a new technological project in health, the higher the chances of failure[26]. PMAQ data shows that the computerization of national primary care, despite its expansion, still suffers from the heterogeneity of a non-consolidated policy. An example is the failure to establish the PEC e-SUS APS (ministerial software) as a single national health record – even with a wide range of features, constant improvement processes, a focus on primary care, and the system's free availability.

Despite the characteristics of computerization in Brazil, the positive results obtained allow us to conclude that once the significant use of electronic health records (EHR) is institutionalized in primary care, the improvement in practice can be tangible. The implementation of EHR enhances and enables the reconfiguration of patient reception in primary care, allowing the monitoring of access for local and national programs like *PREVINE Brasil*[27]. However, for the policy to be successful, it needs to encompass – in addition to the allocation of resources – the recruitment and retention of professionals with key skills, knowledge, and credibility to implement and disseminate it, as technology alone brings only meager benefits[2,26].

It is important to emphasize that the users interviewed for the responses in Module III were derived from intentional sampling. All quantitative data collection had a maximum number (for example, the maximum response for "number of computers in usable condition in the unit" is "50"), which could affect (albeit minimally) the measures of central tendency, dispersion, and other statistics in the database. The study design precludes generalizations about the magnitude of the intervention's effect. Ideally, pragmatic randomized controlled trials could generate more robust evidence regarding the size of the effect of computerization on the evaluated parameters.

Final considerations

According to the data from the 3rd cycle of external evaluation of the PMAQ-AB, the comput-

erization of Brazilian primary health care is still bureaucratic, precarious, and unequal among regions, leading to an incipient and non-significant use of EHR. Despite this, the use of EHR was associated with more hours and days of service, more appointment scheduling methods, more tools for addressing spontaneous demand, more team training and planning, and more emergency care, ultimately contributing to the expansion of access.

The use of EHR should not be considered in isolation but rather linked to institutional policies for meaningful use, health surveillance, improvements in access, quality, communication, and interprofessional collaboration in PHC. It is advisable that an agenda for expanding access through the computerization of patient reception, scheduling, and care processes finds a prominent place in the National Primary Health Care Policy (PNAB) and other PHC monitoring and financing programs, such as *PREVINE Brasil*.

The results indicate a concrete possibility of improving access parameters and patient reception processes through the computerization of health records and their meaningful use. Work in PHC is inherently complex; tools that directly or indirectly facilitate practices and provide solutions to problems have an impact on the proper realization of the essential attributes of primary health care. Therefore, they should be appropriately recognized and studied.

Collaborations

G Valdes: study design, theoretical foundation, data collection and processing, descriptive and inferential statistics, discussion, and article writing. AS Souza: study's conception, methodological design, discussion refinement, and final review.

References

1. Organização Pan-Americana da Saúde (OPAS). *Relatório 30 Anos de SUS, que SUS para 2030?* Brasília: OPAS; 2018.
2. Holroyd-Leduc JM, Lorenzetti D, Straus SE, Sykes L, Quan H. The impact of the electronic medical record on structure, process, and outcomes within primary care: A systematic review of the evidence. *J Am Med Informatics Assoc* 2011; 18(6):732-737.
3. James KA, Fernald DH, Huff J, Ross S, Staton EW, West D, Ricciardi R. GAPS in implementing health assessments in primary care: A literature review. *J Ambul Care Manage* 2014; 37(1):2-10.
4. Savas A, Smith E, Hay B. EHR quality indicator tracking: A process improvement pilot project to meet MACRA requirements. *Nurse Pract* 2019; 44(4):30-39.
5. Bowden T, Coiera E. The role and benefits of accessing primary care patient records during unscheduled care: a systematic review. *BMC Med Inform Decis Mak* 2017; 17(1):138.
6. Starfield B. *Atenção Primária: equilíbrio entre necessidades de saúde, serviços e tecnologia*. Brasília: UNESCO; 2002.
7. Brasil. Ministério da Saúde (MS). Departamento de Atenção Básica. Secretaria de Atenção à Saúde. *PMAQ - Programa de Melhoria do Acesso e da Qualidade: Instrumento de Avaliação Externa para as Equipes de Atenção Básica, Saúde Bucal e NASF (Saúde da Família ou Parametrizada) – Terceiro Ciclo*. Brasília: MS; 2017.
8. Prates ML, Machado JC, Silva LS, Avelar PS, Prates LL, Mendonça ET, Costa GD, Cotta RMM. Desempenho da Atenção Primária à Saúde segundo o instrumento PCATool: uma revisão sistemática. *Cien Saude Colet* 2017; 22(6):1881-1893.
9. Cirino FMSB, Schneider Filho DA, Nichiata LYI, Fracolli LA. O Acesso Avançado como estratégia de organização da agenda e de ampliação do acesso em uma Unidade Básica de Saúde de Estratégia Saúde da Família, município de Diadema, São Paulo. *Rev Bras Med Fam Comun* 2020;15(42):2111.
10. Brasil. Ministério da Saúde (MS). Secretaria de Atenção Primária à Saúde. *Programa de Melhoria do Acesso e da Qualidade na Atenção Básica: Microdados do Terceiro Ciclo Avaliativo* [Internet]. 2021 [acessado 2021 set 9]. Disponível em: https://aps.saude.gov.br/ape/pmaq/ciclo3/.
11. Franco TB, Merhy EE. PSF: contradições de um programa destinado à mudança do modelo tecnoassistencial. In: Merhy EE, Franco TB, editores. *O Trabalho em Saúde: Olhando e experienciando o SUS no cotidiano*. São Paulo: Hucitec; 2003. p. 1-35.
12. Vidal BT, Rocha SA, Harzheim E, Hauser L, Tesser CD. Modelos de agendamento e qualidade da atenção primária: estudo transversal multinível. *Rev Saude Publica* 2019; 53(1):38-53.
13. Protasio APL, Gomes LB, Machado LS, Valença AMG. Fatores associados à satisfação de usuários com a atenção primária à saúde no Brasil. *Cad Saude Publica* 2017; 33(2):1-15.
14. Merhy EE, Feuerwerker LCM. Novo olhar sobre tecnologias de saúde: uma necessidade contemporânea. In: Celestino A, editor. *Avaliação compartilhada do cuidado em saúde: surpreendendo o instituído nas redes*. Rio de Janeiro: Hexis; 2016. p. 59-72.
15. Brasil. Ministério da Saúde (MS). Departamento de Atenção Básica, Secretaria de Atenção à Saúde. *Cadernos de Atenção Básica n. 28 - Acolhimento à demanda espontânea: Queixas mais comuns na Atenção Básica - Volume II*. Brasília: MS; 2012.
16. Gomide MFS, Pinto IC, Zacharias FCM, Ferro D. Análise do acesso e acolhimento entre os resultados do PMAQ-AB e a satisfação dos usuários do pronto atendimento: Semelhanças e diferenças. *Medicina (Ribeirão Preto)* 2017; 50(1):29-38.
17. Protasio APL, Gomes LB, Machado LDS, Valença AMG. User satisfaction with primary health care by region in Brazil: 1st cycle of external evaluation from PMAQ-AB. *Cien Saude Colet* 2017; 22(6):1829-1844.
18. Almeida ER, Pereira FWA. Ampliação e flexibilização de horários na APS: análise das experiências do Prêmio APS Forte. *APS Rev* 2020; 2(3):240-244.
19. Tasca R, Massuda A, Carvalho WM, Buchweitz C, Harzheim E. Recomendações para o fortalecimento da atenção primária à saúde no Brasil. *Rev Panam Salud Publica* 2020; 44:1.
20. Postal L, Celuppi IC, Lima GDS, Felisberto M, Lacerda TC, Wazlawick RS, Dalmarco EM. PEC e-SUS APS online appointment scheduling system: A tool to facilitate access to primary care in Brazil. *Cien Saude Colet* 2021; 26(6):2023-2034.
21. Rocha SA, Bocchi SCM, Godoy MF. Acesso aos cuidados primários de saúde: revisão integrativa. *Physis* 2016; 26(1):87-111.
22. Hamade N, Terry A, Malvankar-Mehta M. Interventions to improve the use of EMRs in primary health care: a systematic review and meta-analysis. *BMJ Health Care Informatics* 2019; 26(1):1-10.
23. Cavalcante RB, Vasconcelos DD, Gontijo TL, Guimarães EAA, Machado RM, Oliveira VC. Computerization of primary health care information systems: Advances and challenges. *Cogitare Enferm* 2018; 23(3):e54297.
24. Velloso RA. *Implantação do prontuário eletrônico na atenção primária no sistema único de saúde: resultado do PMAQ-AB 2011 e 2014* [dissertação]. Belo Horizonte: Universidade Federal de Minas Gerais; 2019.
25. Brasil. Ministério da Saúde (MS). Comissão Intergestores Tripartite. Resolução CIT nº 7, de 24 de novembro de 2016. Define o prontuário eletrônico como modelo de informação para registro das ações de saúde na atenção básica e dá outras providências. *Diário Oficial da União* 2016; 25 nov.
26. Greenhalgh T, Stramer K, Bratan T, Byrne E, Mohammad Y, Russell J. Introduction of shared electronic records: Multi-site case study using diffusion of innovation theory. *BMJ* 2008; 337(7677):1040-1044.

27. Brasil. Ministério da Saúde (MS). Portaria GM/MS nº 102, de 20 de janeiro de 2022. Altera a Portaria GM/MS nº 3.222, de 10 de dezembro de 2019, que dispõe sobre os indicadores do pagamento por desempenho, no âmbito do Programa Previne Brasil. *Diário Oficial da União* 2022; 21 jan.

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