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The Impact of ACA and Medicaid Expansion on Progress Toward UNAIDS 90-90-90 Goals

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Abstract

Purpose of Review Passage of the Affordable Care Act (ACA) in 2010 and subsequent Medicaid expansion has influenced access to HIV treatment and care in the USA. This review aims to evaluate whether the implementation of these policies has impacted progress toward UNAIDS 90-90-90 goals.

Recent Findings Preliminary evidence has emerged suggesting that the ACA and Medicaid expansion has increased the likelihood of HIV testing and diagnosis, reduced the number of people unaware of HIV infection, and increased the number of people on antiretroviral therapy (ART) who are virally suppressed.

Summary While the ACA is associated with some progress toward 90-90-90 goals, more years of data after policy implementation are needed for robust analysis. Methods including difference-in-differences, instrumental variables, and propensity scores are recommended to minimize bias from unmeasured confounders and make causal inference about non-random Medicaid expansion among states.

Keywords Affordable Care Act · Medicaid expansion · HIV · 90-90-90 · Viral suppression · Policy analysis

Introduction

There are approximately 1.2 million people living with HIV (PLWH) in the United States (US), many of whom are not effectively treated [1]. The "HIV Care Continuum" enumerates the major steps of HIV-related care (diagnosis, linkage to and retainment in medical care, starting antiretroviral therapy (ART), and achieving viral suppression) and was established as a tool to illustrate, monitor, and enhance HIV care. In 2014, approximately 85% of PLWH in the US were diagnosed, 73% of diagnosed people received care, and 80% of people who received care achieved viral suppression [1, 2]. In the same year, the Joint United Nations Program on HIV/AIDS (UNAIDS) launched "90-90-90" goals: 90% of PLWH diagnosed, 90% of those diagnosed on ART, and 90% of those on ART virally suppressed by 2020 [3]. The "National HIV/AIDS Strategy for the United States: Updated to 2020" aligns with the 90-90-90 targets and adds focus on key populations, key geographic areas, and key practices in the US [1, 4].

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The Affordable Care Act and HIV Care

The Patient Protection and Affordable Care Act (ACA) is an expansive piece of health care reform legislation. It was passed in 2010 to improve the accessibility, quality, and cost of health care in the USA. In 2012, before implementation of the ACA, 42% of PLWH in the US were insured by Medicaid, 12% by Medicare, 13% by private health insurance, and 8% had unknown coverage [5]. Furthermore, before the ACA was passed, approximately 70,000 PLWH in care did not have insurance [6•]. Many uninsured, as well as underinsured, PLWH received coverage through the Ryan White HIV/AIDS Program (RWHAP). The RWHAP is a federal funding

mechanism which awards grants to states, cities, and local organizations for HIV care-related programming. The RWHAP also provides funds for the AIDS Drug Assistance Program (ADAP) administered by states [7].

Many components of the ACA were expected to be highly influential in terms of HIV care, most notably, Medicaid expansion. Specifically, starting in 2014 under the ACA, states had the opportunity to expand Medicaid coverage to 138% of the federal poverty level ($28,180 for a family of three in 2017). The ACA also eliminated categorical eligibility; that is, low-income PLWH were no longer required to qualify for disability status to receive Medicaid coverage. Other relevant ACA provisions relevant to HIV care include increased support for private health insurance coverage, elimination of pre-existing condition coverage exclusions, alleviating the Medicare Part D "donut hole" for patient out-of-pocket drug costs, and greater emphasis on preventative and primary care, patient-centered medical homes, and mail-order pharmacies.

To date, 32 states and the District of Columbia have expanded their Medicaid programs (Table 1 and Supplementary Figures) [12], and there is growing evidence that Medicaid expansion has improved healthcare coverage for PLWH as expected [13•, 14]. The share of Medicaid-insured PLWH rose from 31% in 1996–1997 [15] to 34% in 2006 [16], covering approximately half of PLWH in 2016 [17]. In one sample of states with expanded Medicaid programs, Medicaid coverage rose from 39% in 2012 to 51% in 2014, private insurance coverage decreased from 34 to 29%, and the share of uninsured PLWH decreased from 13 to 7% [18••]. Alternatively, in non-expansion states, while there were (non-significant) increases in private insurance coverage, there were no significant increases in Medicaid coverage [18••]. This is especially problematic when considering the fact that many of the states that have chosen not to expand their Medicaid programs have remarkably high HIV prevalence (e.g., Texas and Georgia, see Supplementary Figures) [19]. Interestingly, even with the increase in Medicaid and private insurance under the ACA, the RWHAP remains a critical source of coverage. From 2012 to 2014, there was a significant increase in reliance on RWHAP among PLWH with other forms of insurance [19].

Review Objective

Despite promising trends in health care coverage for PLWH, the impact of the ACA and Medicaid expansion on the HIV Care Continuum has not been described to date. This is an important next step as increasing access and utilization of healthcare does not necessarily improve health outcomes [20]. As such, this article focuses on the ways the ACA and Medicaid expansion may be influencing measurable 90-90-90 goals in the USA. Others have reviewed the effect of the ACA and Medicaid expansion on HIV prevention [21•] and disparities in access [22•], and these topics will not be described here.

Notably, the availability of relevant outcome data post-ACA is limited, and the 90-90-90 targets differ slightly from the US HIV Care Continuum milestones. Therefore, for the purpose of this review, we will consider engagement in care (i.e., linkage to care and retention in care) as part of the "on ART" target. We believe these to be reasonable surrogate measures as linkage and retention in care are quite proximal to ART use on the causal pathway. We will also discuss indirect evidence when direct evidence is not available. We define direct evidence as results from a study designed to describe an association or test for causal inference between the ACA, or Medicaid expansion specifically, and one of the 90-90-90 targets. Indirect evidence can be derived from a study that describes the effect on related outcomes.

Specifically, we will be highlighting indirect findings from two hallmark policy experiments that occurred prior to the ACA. One is the case study of "RomneyCare." This 2006 set of reform laws aimed to provide all Massachusetts residents with affordable quality health insurance [23]. It is still in effect today and was used as a model when designing the ACA. As an early-adopter of Medicaid expansion, Massachusetts provides the longest retrospective data source to evaluate the impact of Medicaid expansion on 90-90-90 targets. The legislation expanded publicly funded HIV tests, care linkage, treatment access, and retention services as Massachusetts became the first state to provide nearly universal health insurance coverage [24]. A second case study discussed is the 2008 Oregon Medicaid Experiment. Lottery drawings from an Oregon waiting list for Medicaid facilitated a natural, randomized, and controlled experiment to estimate the effect of Medicaid coverage [20].

Summary of 90-90-90 Targets After the ACA

Table 1 presents a summary of state-specific progress toward the 90-90-90 targets, using available Centers for Disease Control and Prevention (CDC) surveillance data [8–11]. The extant literature supports a positive association between the percent of people on ART and percent of people virally suppressed [25–27]. Similarly, Supplementary Figures use 2014 CDC data to visualize state proximity to viral suppression goals [11]. States are stratified by Medicaid expansion (as of 2015, blue) or other (red). Visual inspection shows that Medicaid expansion occurred in a heterogeneous mix of states with varying degrees of HIV prevalence and viral suppression. In the following sections, we examine the available scientific literature more closely to explore existing evidence of the impact of the ACA and Medicaid expansion on each of the 90-90-90 targets (summarized in Table 2).

Table 1 Incremental change in HIV diagnosis rates, ART use, and viral suppression as markers of progress toward 90-90-90 goals among states with and without Medicaid expansion

	2014 Medicaid expansion				2015–2018 Medicaid expansion				Non-expansion			
		Progress (% change)[a]				Progress (% change)[a]				Progress (% change)[a]		
N	State	Dx[b]	ART[c]	VS[d]	State	Dx[b]	ART[c]	VS	State	Dx[b]	ART[c]	VS[d]
1	Arizona	8.7	NA	NA	Alaska	51.5	13.3	22.5	Alabama	− 19.1	0.7	11.1
2	Arkansas	15.4	NA	NA	Indiana	− 24	− 12.5	6.9	Florida	3.4	NA	NA
3	California	− 0.8	9.8	17	Kentucky	− 6.5	NA	NA	Georgia	3.5	NA	NA
4	Colorado	8.6	NA	NA	Louisiana	2.9	3.1	18.5	Idaho	4	NA	NA
5	Connecticut	− 7.8	NA	NA	Maine	8.6	31.6	79.9	Kansas	− 9.3	NA	NA
6	Delaware	11.8	NA	NA	Montana	− 5.6	NA	NA	Mississippi	− 16.5	NA	NA
7	DC	− 11.8	− 16	2.4	Pennsylvania	− 2.2	NA	NA	Missouri	10.4	2.2	7.6
8	Hawaii	− 32.9	7.6	18.8					Nebraska	− 7	− 22.2	− 10.1
9	Illinois	− 8.4	7.5	16.1					North Carolina	3.7	NA	NA
10	Iowa	10	− 2.5	16.7					Oklahoma	− 7.4	NA	NA
11	Maryland	−8	1.8	15.3					South Carolina	11.7	0.8	9.4
12	Massachusetts	14.3	NA	NA					South Dakota	58.6	1.8	0.7
13	Michigan	2.7	− 2.6	14.3					Tennessee	− 3.5	5.8	2.8
14	Minnesota	− 3.7	NA	NA					Texas	− 1.8	4.9	16.3
15	Nevada	7.2	NA	NA					Utah	4.8	− 14.7	6.1
16	New Hampshire	72.2	2	9					Virginia	− 7	9.8	NA
17	New Jersey	− 1.5	NA	NA					Wisconsin	0	− 3.5	11.2
18	New Mexico	− 9.1	NA	NA					Wyoming	17.2	NA	NA
19	New York	− 7.6	− 1	6.9								
20	North Dakota	134.6	6.5	7.6								
21	Ohio	3.7	NA	NA								
22	Oregon	0	− 0.7	1.7								
23	Rhode Island	8.2	NA	NA								
24	Vermont	− 40.9	NA	NA								
25	Washington	− 4.8	− 1.3	8.6								
26	West Virginia	− 15	13.3	17.8								
Mean (% change)		5.6	1.9	11.7		3.5	8.9	32.0		2.5	− 1.4	6.1

NOTES: The table shows the state classification regarding Medicaid eligibility for adults. The data source was CDC AtlasPlus [8] and CDC Surveillance Reports [9–11]. [a] The rate of change is calculated as the incremental difference in value comparing 2 years and then divided by the value of the earlier year. [b] Dx: comparing HIV diagnosis rates in 2016 to 2015; [c] ART: comparing the proportion of diagnosed people living with HIV (PLWH) who are using ART in 2014 to proportion in 2012; [d] VS: comparing the proportion of PLWH with viral suppression in 2014 to 2012

Coverage under the Medicaid expansion became effective January 1, 2014, in all states that have adopted the Medicaid expansion except for the following: Michigan (4/1/2014), New Hampshire (8/15/2014), Pennsylvania (1/1/2015), Indiana (2/1/2015), Alaska (9/1/2015), Montana (1/1/2016), Louisiana (7/1/2016), Maine (to be determined), and Virginia (to be determined) [12]

NA: where public data was not available

Impact on Progress Toward 90% Diagnosed Infections

Accurate surveillance of diagnosed HIV cases can be difficult. It remains a challenge to disentangle whether a change in the rate of new diagnoses is attributable to a change in HIV incidence or an improvement in diagnosis. In 2013, it was predicted that the ACA would result in an additional 466,153 people being tested for HIV and 2598 new diagnoses of HIV by 2017 [6•]. Similarly, among PLWH who were expected to gain insurance through the ACA, the proportion of individuals who were unaware of their status was expected to decline by 22% [6•].

Our review of recent literature found two studies demonstrating the impact of Medicaid expansion on HIV testing. Using 2010–2015 Behavioral Risk Factor Surveillance System (BRFSS) data, Simon and colleagues demonstrated a 5% increase in the probability of ever receiving an HIV test

Table 2 Summary of 90-90-90 impact evidence

90% target	Evidence of impact	Strength of available evidence
Diagnosed	• *Predicted:* that ACA would reduce the fraction of HIV unaware by 22% among PLWH in 2017 who gained insurance in 2013 [28] • *Direct:* Massachusetts shows evidence that Medicaid expansion reduced the fraction unaware among all people living with HIV [29••]. • *Direct:* ACA increased the probability of receiving an HIV test by 5% [30••]. • *Indirect:* Insurance effect of 64.7-percentage-point-increase in likelihood of checkup in the past year [31]	Moderate
On ART	• *Direct:* Medicaid coverage from expansion was associated with a 17.2% increase in HIV proportion of days covered refill ratio ($p < 0.001$) [32••]. • *Indirect:* Insurance effect of 40.9-percentage-point-increase in likelihood of having a personal doctor for adults with chronic conditions [31] • *Indirect:* Insurance effect of 55.9-percentage-point-increase in regular care for adults with chronic conditions	Needs further research
Viral Suppression	• *Direct:* Viral suppression rates increased 2.8% annually from 2010 to 2015 [33] • *Direct:* The odds of not having an undetectable viral load were 4.0 times higher in an uninsured group compared with the insurance group ($p < 0.001$) [32••]. • *Direct:* Early Medicaid expansion in Massachusetts led to rate of viral suppression (65%) among individuals with HIV alive in 2014 higher than the national average and a suppression rate of 89% among those retained in health care [29••]. • *Indirect:* Insurance effect of 50.8-percentage-point reduction in skipping medication because of cost for adults with chronic conditions [31] • *Indirect:* Failed HIV clinic appointments were more common among the uninsured group (32.3% vs 51.5%, $p = 0.006$) [32••].	Strong

during the first 2 years of the ACA Medicaid expansion [30••]. Though this was the only direct evidence that HIV testing increased, the study design (difference-in-differences) was strong. More HIV testing is insufficient alone to confirm that the fraction of unware PLWH among all PLWH is declining.

Higher CD4 T cell count at diagnosis can be an indicator that people are being diagnosed sooner after infection. While HIV incidence in Massachusetts declined with effective prevention after the implementation of Romney Care, the average CD4 counts at the time of diagnosis increased. This indicates that the population of unaware PLWH was being depleted (as they become aware of HIV infection) at a faster rate than prior to Medicaid expansion. The Massachusetts Department of Public Health agreed that fewer new HIV diagnoses over time were because of fewer HIV transmissions and not attributable to delays in diagnosing or reporting HIV infections [29••]. These findings are also consistent with indirect evidence from the 2008 Oregon Medicaid Experiment, which found that Medicaid coverage significantly increased the probability of diagnosis of chronic disease [20].

Impact on Progress Toward 90% on ART

Little direct evidence exists to show an association between Medicaid expansion and change in ART use (and/or engagement in care). In a small sample of HIV patients in Nebraska, Medicaid coverage resulting from expansion was significantly associated with a 17.2% increase in the proportion of days covered with HIV medication, defined by the refill ratio, compared with eligible patients that remained uninsured [32••]. Regarding to the retention in medical care, failed HIV clinic appointments were more common among the eligible uninsured group compared with patients that gained coverage with Medicaid expansion (32.3% vs 51.5%, $p = 0.006$) [32••]. Eaton and Mugavero suggest that engagement in care, rather than eligibility alone, is associated with uptake of insurance coverage [34]. Not specific to HIV patients, a national study found that the 2014 Medicaid expansions increased the probability of having a personal doctor by 6% for all low-income adults [30••]. The impact on this marker of healthcare utilization may parallel the unobserved trend in PLWH on ART.

Impact on Progress Toward 90% Viral Suppression

Strong evidence suggests that the ACA and Medicaid expansion have bolstered progress toward 90% viral suppression among PLWH on ART. Viral suppression rates among all PLWH increased 2.8% annually from 2010 to 2015, based on an analysis of BRFSS survey data [33]. Studies in California and Nebraska similarly concluded that the ACA

led to more virally suppressed PLWH. Enrollees in Kaiser Permanente Northern California were more likely to be virally suppressed after the ACA than a similar group enrolled prior to the ACA [35]. In Nebraska, people newly covered from Medicaid expansion in 2013–2014 were four times more likely to be virally suppressed compared with other people living with HIV who were eligible but uninsured ($p < 0.001$) [32••]. As an early-adopter of Medicaid expansion, Massachusetts observed a rate of 65% viral suppression among all PLWH and 89% among those retained in health care in 2014, both being substantially higher than the national average [29••].

More broadly, continuous access to care is a critical step in the pathway to continuous viral suppression. The RWHAP showed continuous access to care was associated with an improvement from 69.5% viral suppression in 2010 to 84.9% in 2016 [7]. Interventions targeting segments of the cascade, especially those that increase the proportion of virally suppressed, show promise to improve health and slow transmission. In Virginia, people with comprehensive assistance from RWHAP are more likely to have viral suppression (AOR, 3.3, 95% CI, 2.9–3.8) compared with people who receive one or two of the three services offered: core medical, support, and insurance and/or direct medication assistance [36]. It is unclear whether this is evidence of ACA effect as much as the benefits of the RWHAP.

Heterogeneity of Risk and Heterogeneity of Effect

Despite some evidence of improvements associated with the ACA, it is important to acknowledge that certain subgroups in the US are disproportionately affected by HIV, uniquely disadvantaged within the health care system, and further burdened by other social determinants of health (e.g., race, gender, geography, and socioeconomic status). In the USA, people living in places with a high HIV burden are less likely to have health insurance, more likely to live in poverty, less likely to have a high-school education, and more likely to live in an area with severe income inequality [37]. Of the 18 states that have not expanded Medicaid, most of those states are in the south (Supplementary Figures) where continuous retention in HIV care remains the worst in the country [38, 39]. In 2016, 40% of the new HIV diagnoses occurred in four non-expanded southern states (Florida, Texas, Georgia, and North Carolina) [40].

Consequently, of the 2.4 million PLWH who have not benefitted from Medicaid expansion, almost 90% live in the south. Similarly, a disproportionate number of racial/ethnic minorities do not qualify for Medicaid in non-expansion states, and the majority of these individuals are also located in the south. Additionally, while racial/ethnic differences in insurance coverage have decreased overall post-ACA, among men who have sex with men, differential uptake of health insurance could actually enhance HIV disparities between Blacks and Whites [41]. Finally, comorbidities also likely play a moderating role. Mental health and substance use conditions among PLWH are more common in California's Medicaid population compared with Medicare [42], and adults with a chronic condition were more likely to have benefitted from Medicaid Expansion compared with adults without a chronic condition [43].

Limitations

We encountered several limitations in conducting this review. Much of the data are too young to draw conclusions about the impact of ACA on ART use and viral suppression. Namely, there are simply not very many studies evaluating the impact of the ACA and Medicaid expansion on the 90-90-90 goals. Using CDC trends is useful, but data collection is non-uniform over time and there is a multiple year time-lag before data is available. Researchers may need to wait several years until enough data becomes available in the post-ACA period to adequately assess the effect. We estimate that sufficient data might be available in 2020. This review was also limited by the scope of the 90-90-90 targets. Quality and availability of HIV care [44] and HIV care providers [45], as well as costs associated with HIV care and drugs, are also important outcomes to consider when evaluating the impact of the ACA and Medicaid expansion.

Next Steps

Clearly, evidence is limited, and more data needs to be generated from real-world experiments planned with a valid design for causal inference. CDC monitoring of national HIV prevention and care objectives is based on surveillance data that lends itself more toward cross-sectional descriptions than longitudinal trends [9], but it is necessary to move beyond cross-sectional glimpses of the care cascade and look at the trends over time within and between US states. Researchers are challenged by the lack of a natural counterfactual, necessitating one to mathematically simulate a counterfactual for states that account for differences within and between states.

A Framework for Future Impact Evaluations

Difference-in-differences (DID) models are common in policy analysis and economics. The approach relies on the assumption of parallel trends between "treatment" (e.g., Medicaid expansion) and "control" (e.g., Medicaid non-expansion) states. Good examples of its application are seen in two

studies described here [30••, 46]. We recommend that future studies consider applying a DID framework similar to Simon and colleagues [30••] for each target within the 90-90-90 goals. In this framework, the "pre-period" is 2010 or earlier to 2014, and the "post-period" is 2014 to most recent data. For each 90-90-90 outcome, variable Y (e.g., percent of HIV diagnosed, percent of those diagnosed on ART, or percent of those on ART virally suppressed) estimates the following regression:

$$Y_{ist} = \alpha + \beta(\text{Treatment}_s \times \text{Post}_t) + \gamma \text{X}_{ist} + \eta \text{UempRate}_{st} + \delta \text{State}_s + \vartheta \text{Time}_t + \varepsilon,$$

where Y_{ist} represents the likelihood of the 90-90-90 target reached by person i living with HIV in state s at time t. As Simon and colleagues describe, "Treatment is a binary variable equal to 1 if the individual lives in a treatment state and equal to 0 if the respondent lives in a control state. Post is a binary variable equal to 1 if the time period is after the policy implementation and equals 0 if the time period is prior to the policy implementation. X is the vector of control variables [such as]: household income, education, sex, race, unemployment status, age, marital status, household size, and cell-phone sample indicator. UnempRate is a continuous variable measuring the state unemployment rate in a given quarter/year. State is a vector of state fixed effects, and Time is a vector of [time period]-fixed effects. Standard errors are clustered by state" [30••]. Models can be estimated separately for subgroups of interest for impact on horizontal and vertical equity. Other studies on general health have estimated ACA impact on health outcomes using a DID regression analysis approach [43, 46], and more should be focused on HIV.

Other strong study designs that would facilitate valid causal inference with non-randomized data include instrumental variables and propensity scores. An instrumental variable is a naturally occurring factor that is strongly associated with the primary independent variable (e.g., Medicaid expansion) and only associated with the outcome of interest (e.g., viral suppression) through its effect on the independent variable [28, 47, 48]. The instrument acts like a natural randomizer to help mitigate selection bias and identify the causal effect when there is unobserved confounding. Propensity scores are another approach to make inference about the causal effect of a binary intervention after controlling for observed confounders [49]. For this application, a propensity score would be the probability that a state with a vector of characteristics X chose to expand Medicaid. This balancing score can be estimated easily using a logistic regression where the outcome is Medicaid expansion and the covariates are the vector of characteristics X that are hypothesized to be associated with the likelihood of Medicaid expansion. Propensity scores could be used to balance the distribution of observed confounders between states that have and have not expanded Medicaid through further matching or weighting methods [50]. Both propensity scores and instrumental variables are approaches to mitigate bias from unmeasured confounders in natural experiments of non-random policy implementation.

Conclusions

This review identified a growing body of evidence that the ACA is associated with an improvement in viral suppression. There is moderate, less-certain evidence to date suggesting the ACA affected HIV diagnoses. Analysts need several more years of CDC Surveillance data in the period following Medicaid expansion to make inference about the causal impact of the policy. Substantially, more research is needed to show the relationship between Medicaid expansion and the percent of diagnosed people on ART. For all targets, we recommend frameworks for conducting causal inference analysis (e.g., DID, instrumental variables, or propensity scores) to isolate the attributable impact of ACA and Medicaid expansion on the rate of progress toward UNAIDS 90-90-90 goals.

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Compliance with Ethical Standards

Conflict of Interest The authors declare that they have no competing interests.

Human and Animal Rights and Informed Consent This article does not contain any studies with human or animal subjects performed by any of the authors.

Abbreviations *ACA,* Affordable Care Act; *ADAP,* AIDS Drug Assistance Program; *ART,* antiretroviral therapy; *BRFSS,* Behavioral Risk Factor Surveillance System; *CDC,* Centers for Disease Control and Prevention; *DID,* difference-in-differences analysis; *FPL,* Federal Poverty Level; *HIV,* human immunodeficiency virus; *MSM,* men who have sex with men; *PLWH,* people living with HIV; *RWHAP,* Ryan White HIV/AIDS Program; *UNAIDS,* Joint United Nations Program on HIV/AIDS; *US,* United States

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