



Health consequences of the US Deferred Action for Childhood Arrivals (DACA) immigration programme: a quasi-experimental study

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Summary

Background The effects of changes in immigration policy on health outcomes among undocumented immigrants are not well known. We aimed to examine the physical and mental health effects of the Deferred Action for Childhood Arrivals (DACA) programme, a 2012 US immigration policy that provided renewable work permits and freedom from deportation for a large number of undocumented immigrants.

Methods We did a retrospective, quasi-experimental study using nationally representative, repeated cross-sectional data from the US National Health Interview Survey (NHIS) for the period January, 2008, to December, 2015. We included non-citizen, Hispanic adults aged 19–50 years in our analyses. We used a difference-in-differences strategy to compare changes in health outcomes among individuals who met key DACA eligibility criteria (based on age at immigration and at the time of policy implementation) before and after programme implementation versus changes in outcomes for individuals who did not meet these criteria. We additionally restricted the sample to individuals who had lived in the USA for at least 5 years and had completed high school or its equivalent, in order to hold fixed two other DACA eligibility criteria. Our primary outcomes were self-reported overall health (measured on a 5 point Likert scale) and psychological distress (Kessler 6 [K6] scale), the latter was administered to a random subset of NHIS respondents.

Findings Our final sample contained 14 973 respondents for the self-reported health outcome and 5035 respondents for the K6 outcome. Of these individuals, 3972 in the self-reported health analysis and 1138 in the K6 analysis met the DACA eligibility criteria. Compared with people ineligible for DACA, the introduction of DACA was associated with no significant change among DACA-eligible individuals in terms of self-reported overall health ($b=0.056$, 95% CI -0.024 to 0.14 , $p=0.17$) or the likelihood of reporting poor or fair health (adjusted odds ratio [aOR] 0.98 , 95% CI 0.66 – 1.44 , $p=0.91$). However, DACA-eligible individuals experienced a reduction in K6 score compared with DACA-ineligible individuals (adjusted incident risk ratio 0.78 , 95% CI 0.56 – 0.95 , $p=0.020$) and were less likely to meet screening criteria for moderate or worse psychological distress (aOR 0.62 , 95% CI 0.41 – 0.93 , $p=0.022$).

Interpretation Economic opportunities and protection from deportation for undocumented immigrants, as offered by DACA, could confer large mental health benefits to such individuals. Health consequences should be considered by researchers and policy makers in evaluations of the broader welfare effects of immigration policy.

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Introduction

Undocumented migration has become an important public policy issue worldwide. From a public health perspective, it is well recognised that the estimated 11 million undocumented immigrants in the USA¹ and 8 million in Europe² are at risk of poor health outcomes.^{3–6} In particular, the results of studies from both the USA and European settings suggest that immigration policies that raise the risk of deportation or place limits on legal rights and access to social services might raise the risk of poor mental health outcomes, such as depression and anxiety, and curtail access to health care more generally.^{7–15}

In recent years, the USA has witnessed substantial changes in policies towards undocumented immigrants. In June, 2012, the US Government initiated the Deferred

Action for Childhood Arrivals (DACA) programme, which provided temporary work permits and freedom from deportation to individuals who met specific eligibility criteria (panel).¹⁶ Although the programme has not been a pathway to citizenship, the work permits are renewable, ostensibly staving off the risk of deportation. Since its inception, the programme has enrolled more than 720 000 of an estimated 1.9 million eligible individuals.¹⁷

In addition to any microeconomic and macroeconomic benefits, DACA could improve the health of beneficiaries in several ways. First, research has shown increases in employment and income after DACA implementation,^{18,19} both of which are well known social determinants of health.²⁰ Second, expanded economic opportunities might raise future aspirations and thereby increase

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Research in context

Evidence before this study

We searched PubMed, Google Scholar, and EconLit with the terms (“undocumented immigrants” OR “illegal immigrant” OR “undocumented migrant”) AND (“health” OR “mental health” OR “depression”) AND (“immigration policy” OR “deportation” OR “DACA”) OR (“Deferred Action for Childhood Arrivals”). We did not apply any restrictions by language or date, and the latest search was done on Feb 7, 2017. We found two summative reviews and several commentary and research articles examining the association between immigration policy and health outcomes in the USA, Europe, and Australia. Most studies were descriptive in nature and used both qualitative and quantitative methods to show links between immigration policy and mental health outcomes, health-care access, or both. No studies used quasi-experimental methods to assess causality between changes in immigration policy and health. Although we found two studies investigating the economic effects of the US Deferred Action for Childhood Arrival (DACA) programme, we did not find any study examining its effects on health.

Added value of this study

We used a large, nationally representative survey of non-citizen, Hispanic adults living in the USA to investigate

the effects of the DACA programme on self-reported overall health and psychological distress. We found that DACA eligibility was associated with large, clinically meaningful reductions in symptoms of psychological distress. We found no effects on self-reported overall health, although this finding was anticipated given the overall youth of the DACA-eligible population. Our findings contribute to the public health literature by showing for the first time robust, quasi-experimental evidence of the effect of immigration policy towards undocumented immigrants on their mental health.

Implications of all the available evidence

Our findings add to a growing evidence base showing strong links between immigration policy choices and health outcomes. These results might be informative for clinicians providing health care to undocumented immigrants, public health officials, and policy makers. Our findings are relevant to ongoing debates around immigration policy in the USA and Europe and suggest that mental health outcomes should be taken into account when considering policy alternatives.

perceived returns on health investments, both of which can in turn affect health outcomes.²¹ Third, eliminating the risk of deportation and providing access to employment opportunities could raise hope and reduce psychosocial stress, which might directly improve mental health and indirectly affect physical health by leading to improved health behaviours.^{22,23}

Despite these strong theoretical links, the health consequences of the DACA programme have not yet been explored. More generally, studies linking policies targeting undocumented migrants to health outcomes are generally descriptive, with the underlying causality less clear.^{7–15} This broader question has gained significance in recent months, as fundamental changes in US immigration policy are being debated.^{24,25}

In this study we aimed to examine the consequences of the US DACA programme on self-reported overall and mental health among undocumented immigrants of Hispanic origin (who represent the majority of DACA-eligible individuals). We used a quasi-experimental research strategy based on the timing of programme implementation, as well as eligibility rules, to estimate causal relationships.

Methods

Data

We used data from the US National Health Interview Survey (NHIS), an annual, nationally representative, repeated cross-sectional sample survey that tracks health outcomes, behaviours, and access to care in the

US civilian, non-institutionalised population.²⁶ We used surveys for the period January, 2008, to December, 2015. We restricted our sample to adults (aged 19–50 years) who reported Hispanic ethnicity because nearly 90% of DACA beneficiaries were born in central America or South America.²⁷ Following evidence from the economics literature,¹⁸ we prespecified that we would exclude individuals with less than a high school education and recently arrived immigrants to minimise confounding from well established differential trends in socioeconomic outcomes.^{28,29} These sample restrictions hold fixed two key DACA eligibility criteria (panel): completion of high school or its equivalent and residence in the USA for at least 5 years.

Exposures and outcomes

Our exposure measure was DACA eligibility based on two key criteria: age at immigration and age at the time of the policy change. We estimated age at immigration by subtracting years living in the USA from the participant's current stated age; individuals aged 16 years or younger at the time of immigration were defined as meeting this DACA eligibility criterion. Because the public-use files from the NHIS provide a binned value for years living in the USA (<1 year, 1–4 years, 5–9 years, 10–14 years, and ≥15 years), our estimates of age at immigration were not exact and are therefore subject to classic measurement error. We used the exact date of birth to assess whether the individual met the other DACA eligibility criterion of

being age 31 years or younger at the time of the policy announcement.

Our primary outcomes were self-reported overall health (measured on a 5 point Likert scale, where a score of 1 represents poor health, 2 represents fair health, 3 represents good health, 4 represents very good health, and 5 represents excellent health) and symptoms of non-specific psychologic distress as represented by the summed score from the Kessler 6 (K6) scale (symptoms of feeling nervous, hopeless, depressed, restless, depressed, that everything was an effort, and worthless over the past 30 days assessed by six questions that are coded by frequency, with 0 representing none of the time, 1 representing a little of the time, 2 representing some of the time, 3 representing most of the time, and 4 representing all of the time; the summed score can thus range from 0 to 24).^{30,31} The K6 was administered only to a randomly selected one-third sample of NHIS respondents. The K6 has been shown to have high reliability, validity, and internal consistency in identifying of the symptoms serious mental illness as denoted by the DSM-IV.³⁰ We also used these variables to specify binary outcomes denoting self-reported classifications of poor or fair health (vs good, very good, or excellent health) and presence of moderate or worse psychological distress (K6 score ≥ 5).³¹

Statistical analyses

We used the difference-in-differences³² method to estimate the health consequences of DACA. Specifically, we estimated versions of the following regression models:

$$H_{it} = g(\beta_0 + \beta_1 \times Eligible_{it} \times DACA_t + \beta_2 \times Eligible_{it} + \beta_3 \times DACA_t + \beta \times X_{it(t)} + \epsilon_{it})$$

where the subscript i references the individual and t the year-month of the survey. $Eligible_{it}$ is a binary indicator denoting whether the individual met DACA eligibility criteria (1 if DACA-eligible, 0 otherwise), and $DACA_t$ is a binary indicator for survey timing (1 if surveyed after DACA implementation in June, 2012, and 0 otherwise). H_{it} is the health outcome of interest and the function $g(\cdot)$ refers to a least squares, Poisson, or logistic link function. The vector $X_{it(t)}$ consists of key covariates, consisting of participant age in years at the time of the policy change, estimated age at immigration, census region of residence, gender, and year-month of interview. We adjusted for the complex survey design of the NHIS—which included use of sample weights (along with SEs robust to heteroscedasticity where appropriate)—in all analyses to recover nationally representative estimates.³³ This step is particularly important given the reported (potentially non-random) decline in participation in the NHIS and other US sample surveys,³⁴ which the weights are designed to take into account.

The difference-in-differences estimate (both in linear and non-linear models³⁵) is denoted by the coefficient

Panel: Deferred Action for Childhood Arrivals (DACA) eligibility criteria

- No lawful status and physically present in USA as of June, 2012
- Under age 31 years as of June 15, 2012
- Arrived in USA prior to 16th birthday
- Continuous residence in USA since June 15, 2007
- Currently in school; have graduated or obtained certificate of completion from high school; have obtained general education development certificate; or honourably discharged veteran of Armed Forces
- Have not been convicted of a felony, significant misdemeanour (or more than two other misdemeanours), and/or otherwise do not pose threat to public safety or security

Source: Citizenship and Immigration Services, US Department of Homeland Security (2017).

on the product term (β_1). This estimate can be interpreted as the effect of the policy on DACA-eligible individuals before versus after the policy change, compared with the effect on DACA-ineligible individuals. We estimated least-squares regression models for self-reported health, and Poisson regression models for the count outcome (K6), both with heteroscedasticity-corrected standard errors. For the binary outcomes (poor or fair self-reported overall health and moderate or worse psychological distress), we estimated logistic regression models. We hypothesised larger estimates on mental health outcomes in view of findings from previous descriptive studies on migration,^{7–9,36} quasi-experimental studies on the health benefits of social policies,^{37,38} and the relative youth of our study population (who would otherwise be expected to be in good physical health).

Importantly, the NHIS did not elicit undocumented immigrant status from survey respondents. This is a long-standing feature of publicly available, large-scale US databases that are used to examine undocumented immigration.^{18,29} Among self-reported non-citizens, 60% of individuals are estimated to be undocumented.¹⁸ Thus, our effect estimates will be smaller than the intention-to-treat effect. Additionally, data for other DACA eligibility criteria—criminal offenses and recent honourable discharge from the military—were also not available in the NHIS (because crimes and misdemeanours are not directly queried and honourable discharges were not queried after 2010). This data limitation is also likely to lead to attenuated estimates, as individuals with these histories might be inaccurately assigned to the treatment or control group.

We did four sensitivity analyses. First, because the Great Recession (2007–09) could have had differential effects on DACA-eligible versus DACA-ineligible individuals, we restricted our sample to participants

	Eligible for DACA		Not eligible for DACA	
	Pre-DACA	Post-DACA	Pre-DACA	Post-DACA
Number of respondents				
Self-reported overall health outcomes	2188	1784	6331	4670
Mental health outcomes	598	540	2217	1680
Self-reported overall health (Likert scale score 1-5)	3.99 (0.91)	4.00 (0.94)	3.83 (0.98)	3.81 (0.98)
Fair or poor health	95 (4%)	101 (6%)	523 (8%)	408 (9%)
K6 score (0-24)	3.06 (4.49)	2.66 (4.3)	2.72 (4.57)	2.70 (4.38)
Moderate or worse psychological (K6 score ≥5)	168 (28%)	133 (25%)	554 (25%)	423 (25%)
Gender, female	1116 (51%)	906 (51%)	3270 (52%)	2428 (52%)
Age (years)	23.0 (3.32)	25.39 (4.02)	36.9 (6.73)	38.27 (6.71)
Age at immigration (years)	9.6 (4.19)	10.6 (3.81)	24.2 (6.48)	24.9 (6.01)
Census region				
Northeast	240 (11%)	168 (9%)	884 (14%)	536 (11%)
North central or midwest	161 (7%)	199 (11%)	536 (8%)	430 (9%)
South	728 (38%)	587 (33%)	2216 (35%)	1750 (33%)
West	1059 (42%)	830 (47%)	2695 (43%)	1954 (48%)

Data are mean (SD) or n (%) unless specified otherwise. All data are from the NHIS, 2008–15. The sample is restricted to non-citizen, Hispanic men and women aged 18–50 years who have lived in the USA for at least 5 years and who have completed at least a high school education or above. Eligible for DACA refers to individuals who were 31 years or younger as of June, 2012, and had immigrated to the USA at age 16 years or before. Pre-DACA denotes respondents interviewed before June, 2012, and post-DACA those interviewed thereafter. The K6 instrument was administered to a random subset of NHIS respondents. Descriptive statistics were weighted by NHIS sampling weights. DACA=Deferred Action for Childhood Arrivals. K6=Kessler 6 scale. NHIS=National Health Interview Survey.

Table 1: Descriptive statistics of study population

See Online for appendix

interviewed in 2010 and thereafter. Second, we further restricted the sample to individuals younger than 40 years. This would help to account for differential time trends in the health of middle-aged immigrants, which might be distinct from younger DACA-eligible individuals, and therefore bias the difference-in-differences estimates. Finally, as a pre-specified falsification test,³⁹ we estimated our models for adults who had completed less than a high school education (and were not currently in school at the time of the survey): because these individuals were not DACA-eligible, we expected to observe no effect of the policy on their health outcomes. Fourth, we re-estimated all models without sampling weights; differences in coefficient estimates in weighted versus unweighted models might reflect errors in model specification, incorporation of the survey sampling process, or both.⁴⁰

We did all analyses with Stata version 14. This study relied solely on public-use data so no ethical approval was sought for the study procedures.

Role of the funding source

There was no funding source for this study. The corresponding author had full access to all the data in the study and had final responsibility for the decision to submit for publication.

Results

During the study period, 783 026 people were interviewed, and 14973 people met our inclusion criteria (appendix). For the outcome of self-reported overall health, our total sample consisted of 14973 survey respondents, of whom 3972 were eligible for DACA. For the K6 psychological distress outcomes, our total sample contained 5035 respondents, 1138 of whom were eligible for DACA. Before the start of DACA, DACA-eligible respondents reported slightly better overall health than did ineligible respondents, but had higher K6 scores and rates of moderate psychological distress (table 1). Mean K6 scores and the likelihood of meeting screening criteria for moderate or worse psychological distress declined among DACA-eligible respondents in the survey years after policy implementation. However, similar declines did not occur for DACA-ineligible individuals. For both groups, mean self-reported overall health did not change, although we noted small increases in the likelihood of reporting poor or fair health in both groups. As expected on the basis of eligibility criteria, eligible respondents were younger and had immigrated to the USA earlier in their lives than had ineligible respondents. The sex and residential composition of the eligible and ineligible respondent samples were similar.

Difference-in-differences estimates (table 2) did not show significant changes in self-reported overall health before and after programme implementation for eligible versus ineligible respondents (adjusted $b=0.056$, 95% CI -0.024 to 0.14 , $p=0.17$). However, our estimates showed significant reductions in K6 scores among DACA-eligible versus DACA-ineligible respondents (adjusted incident risk ratio 0.78 , 95% CI $0.56-0.95$, $p=0.020$). The binary outcomes showed similar patterns, with no significant differences estimated for the odds of reporting poor or fair health (adjusted odds ratio [aOR] 0.98 , 95% CI $0.66-1.44$, $p=0.91$), but a significant decline in the odds of reporting moderate or worse psychological distress before and after programme implementation for eligible versus ineligible respondents (aOR 0.62 , 95% CI $0.41-0.93$, $p=0.022$).

Sensitivity analyses (table 3) showed similar coefficient estimates when we restricted estimation to individuals in the same age range interviewed between 2010 and 2015 and when we further restricted the sample to individuals younger than 40 years. Consistent with programme eligibility criteria, we found no evidence that DACA improved outcomes for DACA-ineligible people (ie, individuals with less than a high school education). We found mostly similar results in analyses without sampling weights (appendix), suggesting that the specification of our model and handling of the complex survey design was appropriate.

Discussion

In this quasi-experimental study of Hispanic adults in the USA, we found that exposure to the DACA programme

	Self-reported health (Likert scale score 1–5)	Poor or fair health	K6 score (0–24)	Moderate or worse psychological distress (K6 score \geq 5)
Regression method (estimate)	Least squares (b)	Logistic (adjusted OR)	Poisson (adjusted IRR)	Logistic (adjusted OR)
Differences-in-differences estimate (95% CI)	0.056 (–0.024 to 0.14)	0.98 (0.66 to 1.44)	0.78 (0.56 to 0.95)	0.62 (0.41 to 0.93)
p value	0.17	0.91	0.020	0.022
Number	14 973	14 973	5035	5035

Differences-in-differences estimates of the effects of the DACA programme on health outcomes. Estimator and interpretation of coefficient is provided in the column header. For the ordinary least-squares (self-reported health) and Poisson (K6 score) models, we calculated 95% CIs with heteroscedasticity-corrected SEs. The estimates shown reflect coefficients on the interaction between binary indicators that denote meeting the eligibility criteria of age at immigration (16 years or younger) and age at policy implementation (31 years or younger) and being surveyed after programme implementation (June, 2012). All models include the main effects for meeting DACA eligibility thresholds, interview year-month fixed effects (which subsume the main effects of being surveyed after DACA implementation), and adjust for respondent age (at the time of policy), gender, fixed-effects for years living in the USA, and fixed effects census region of residence. All models use National Health Interview Survey sampling weights. K6=Kessler 6 scale. IRR=incident risk ratio. OR=odds ratio. DACA=Deferred Action for Childhood Arrivals.

Table 2: Difference-in-differences estimates

	Self-reported health (Likert scale score 1–5)	Poor or fair health	K6 score (0–24)	Moderate or worse psychological distress (K6 score \geq 5)
Restricted to 2010–15				
Regression method (estimate)	Least squares (b)	Logistic (adjusted OR)	Poisson (adjusted IRR)	Logistic (adjusted OR)
Differences-in-differences estimate (95% CI)	0.017 (–0.072 to 0.11)	1.00 (0.65 to 1.54)	0.69 (0.52 to 0.92)	0.56 (0.36 to 0.87)
p value	0.71	0.99	0.010	0.011
Number	11 672	11 672	4008	4008
Restricted to 2010–15 and younger than 40 years				
Regression method (estimate)	Least squares (b)	Logistic (adjusted OR)	Poisson (adjusted IRR)	Logistic (adjusted OR)
Differences-in-differences estimate (95% CI)	–0.013 (–0.11 to 0.08)	1.16 (0.73 to 1.83)	0.76 (0.56 to 1.02)	0.61 (0.38 to 0.99)
p value	0.78	0.53	0.073	0.044
Number	8715	8715	2963	2963
Restricted to less than high-school education (falsification test)				
Regression method (estimate)	Least squares (b)	Logistic (adjusted OR)	Poisson (adjusted IRR)	Logistic (adjusted OR)
Differences-in-differences estimate (95% CI)	0.043 (–0.06 to 0.14)	0.72 (0.49 to 1.06)	1.07 (0.76 to 1.49)	1.38 (0.89 to 2.15)
p value	0.40	0.11	0.67	0.15
Number	16 552	16 552	5696	5696

Models are identical to those presented in table 2, except the sample is restricted as denoted. K6=Kessler 6 scale. IRR=incident risk ratio. OR=odds ratio.

Table 3: Sensitivity analyses

led to meaningful reductions in symptoms of psychological distress among DACA-eligible individuals. The effects on mental health were large and clinically significant, with the DACA programme significantly reducing the odds of individuals reporting moderate or worse psychological distress. We did not find any improvements in self-reported overall health, which was consistent with the fact that the population was relatively young (mean age <40 years in all groups) and therefore generally in good physical health.

Our findings advance the existing public health literature by providing the first quasi-experimental evidence of a link between immigration policies that target undocumented immigrants and their health outcomes. The findings of large effects on mental health are consistent with results from observational studies

showing rising symptoms of anxiety and depression with policies that raise the risk of deportation.^{7–15} These findings could be of considerable importance in the current policy environment, with the USA broadening the legal infrastructure and human resources base needed to deport undocumented immigrants and restrict the entry of new migrants.^{24,41} Additionally—as of the time of writing—the future of the DACA programme itself seems to be in doubt.⁴²

In addition to informing the public health community about the health impacts of immigration policy, our findings add to a growing evidence base on the mental health consequences of social policies more generally.^{37,38} Our findings also show the importance of economic opportunities for health outcomes. In particular, the use of quasi-experimental methods builds on and greatly

advances findings from observational studies linking measures of area-level economic opportunity to various health outcomes.^{21,43–45}

Several limitations are inherent to the data available and the study design. First, despite the quasi-experimental research strategy, unobserved bias from time-varying factors that differentially affect immigrants who are eligible or ineligible for DACA cannot be definitively excluded. The potential for such confounders might be exacerbated by the fact that the NHIS data represent repeated cross sections rather than a panel. Moreover, well described downward trends exist in sample survey participation in the USA.³⁴ We supported the robustness of our findings by showing that estimates remained similar when we applied tighter restrictions to the estimation sample. We also did a falsification test, the results of which showed the absence of an association among individuals who met all other eligibility criteria except for high school completion.

Second, differences in mean ages among DACA-eligible and DACA-ineligible respondents, which are inevitable because age is part of the eligibility criteria, might also generate bias in our results. To address these differences, we included individual age-specific fixed effects to flexibly control for non-linear age effects. We also estimated our models with a narrower age band, which produced mostly similar estimates.

Third, the NHIS did not specifically identify undocumented immigrants, exact age at immigration, or individuals who met two other DACA eligibility criteria (absence of criminal history and honourable discharge from the military). However, each of these data limitations would bias our estimates toward the null, either by deflating estimates of the intention-to-treat effect, introducing classic measurement error, or inaccurately assigning respondents to eligible and ineligible groups. Finally, well known differences exist between US states in the implementation and acceptance of DACA,^{17,46} which might have modified programme effects on health outcomes. Unfortunately, we cannot examine this possibility in the NHIS because the public-use data do not include state identifiers.

In conclusion, we found that the DACA programme had important, positive effects on mental health outcomes. These benefits have so far been underappreciated and, in conjunction with the reported positive economic benefits,¹⁸ can help to guide ongoing policy debates⁴⁷ around the overall benefit of the DACA programme and its future in US immigration policy, as well as around the design of policies towards undocumented migrants in Europe.

Contributors

ASV, SJS, and ACT conceived the study. ASV obtained the publicly available NHIS data, did the statistical analysis, and wrote the first draft of the manuscript. SJS, ROB, IK, and ACT suggested improvements to the statistical analysis and contributed important revisions to the manuscript. All authors approved the final submission of the manuscript.

Declaration of interests

We declare no competing interests.

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