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ABSTRACT

Immigration Policy and Immigrants' Sleep: Evidence from DACA

Stress is associated with sleep problems. And poor sleep is linked with mental health and depression symptoms. The stress associated with immigrant status and immigration policy can directly affect mental health. While previous studies have documented a significant relationship between immigration policy and the physical and mental health of immigrants, we know little about the effects that immigration policy may have on immigrants' sleep patterns. Exploiting the approval of the Deferred Action for Childhood Arrivals (DACA) in 2012, we study how immigrants' sleep behavior responds to a change in immigration policy. Consistent with previous research documenting positive effects of DACA on mental health, we find evidence of a significant improvement in immigrants' sleep in response to this policy change. However, the estimated effects of the policy quickly disappear since 2016. While temporary authorization programs, such as DACA, may have beneficial impacts on immigrants' sleep in the short-term, the effects of temporary programs can be rapidly undermined by the uncertainty on their future. Thus, permanent legalization programs may be more effective in achieving long-term effects, eliminating any uncertainty related to the undocumented immigrant legal status.

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1 Introduction

The debate on unauthorized immigrants, deportation and legal status has hardly been as lively as in the recent years. Estimates suggest there are currently 11 million undocumented immigrants in the United States (US). Immigrant legal status has been linked to socioeconomic disparities and inequality (Menjívar, 2006).

Undocumented immigrants report high levels of stress, psychological and physical loss (Garcini et al., 2019). The threat of deportation and the lack of work authorization, access to credit, and access to welfare programs affect the daily life of undocumented immigrants across the US. It is also well-known that unauthorized immigrants are at risk of poor health, and in particular, of reporting depression symptoms, anxiety disorders and other mental health problems (Passel et al., 2016).

Despite the paucity of studies analyzing the effects of immigration policy on health, recent work suggests that the stress associated with immigrant status and immigration policy can have direct impacts on mental health (Kaushal et al., 2018; Wang and Kaushal, 2018; Venkataramani et al., 2017; Giuntella and Lonsky, 2018; Hainmueller et al., 2017). Yet, we know relatively little about the mechanisms through which policy may affect immigrant health.

In this study, we examine the role of sleep deprivation, which is known to be one of the first consequences of stress. Stress causes hyperarousal, which, in turn, can upset the balance between sleep and wakefulness and induce short sleep duration and other sleep problems (Hall et al., 2000). Given the evidence of significant racial and ethnic disparities in short sleep duration (Hale and Do, 2007; Jackson et al., 2014, 2013), and the close link between stress, mental health and sleep disorders, in this paper we examine the effects of an immigration reform on immigrants' sleep behavior. If stress is an important determinant of sleep deprivation, and sleep deprivation has detrimental effects on health, this may be one of the channels through which immigration policy may affect mental health. While previous studies have documented a significant relationship between immigrant status and mental health of immigrants, we know little about the possible impacts of an immigration policy change on immigrants' sleep patterns.

Insufficient sleep has been associated with increased detrimental effects on health outcomes, including a higher risk of weight gain and obesity, type 2 diabetes, cardiovascular diseases, and

premature mortality (Cappuccio et al., 2010). Previous evidence documents significant disparities in sleep duration across ethnic groups. Furthermore, the stress associated with supporting family members in their country of origin, racial discrimination (Bhattacharya and Schoppelrey, 2004), and concerns about legal status may represent important stress factors that could in turn contribute to explaining the disparities in sleep duration (Liang and Fassinger, 2008; Slopen and Williams, 2014).

Previous research has also documented the detrimental effects of these challenges on human capital, labor market outcomes, and health. Illegal immigrants tend to earn substantially lower hourly wage rates (for both genders) and family income compared to their legal immigrant or native-born counterparts (Rivera-Batiz, 1999; Borjas, 2017). It has also been shown that legalization programs can have positive impacts on labor market integration, leading to higher labor force participation and lower likelihood of unemployment among legalized immigrants (Kossoudji and Cobb-Clark, 2002; Devillanova et al., 2018; Amuedo-Dorantes and Antman, 2017; Kuka et al., 2020; Pope, 2016). In addition, legalization leads to a significant increase in immigrants' wages (Rivera-Batiz, 1999), thereby contributing to the growth of private sector GDP (Edwards and Ortega, 2017). On the other hand, previous studies have found that programs requiring employers to check workers' eligibility to work legally in the US have reduced average hourly earnings among likely unauthorized Mexican immigrants (Orrenius and Zavodny, 2015). To the best of our knowledge, there has been no work analyzing the effects of immigrant legalization on immigrants' sleep patterns. We believe sleep may be one of the primary channels through which stress related to immigration policy changes may affect health. We focus on the effects of the Deferred Action for Childhood Arrivals (DACA) program. DACA is an executive memorandum issued by President Obama on June 15, 2012. This large-scale immigration policy change provides temporary work authorization and deferral from deportation for undocumented, high-school-educated youth. However, DACA-status is only a temporary authorization, and although it enables undocumented youth to remain in the US legally, it does not provide them with a path to citizenship or permanent residency. The status can be renewed every two years, conditional on still meeting the eligibility criteria.

Exploiting the introduction of DACA, we study how immigrants' sleep behavior responds to a change in immigrant status. Consistent with previous research documenting positive effects of

DACA on mental health, we find evidence that this policy significantly improved the duration and quality of immigrants' sleep but only in the short-run. To estimate the effects of DACA, we employ a difference-in-differences strategy, which relies on the discontinuities in the DACA eligibility criteria. We find that DACA-eligible individuals are 9.5 percentage points less likely to sleep less than seven hours and 13.9 percentage points less likely to sleep less than eight hours. The effects are concentrated among men, who are also significantly more likely to report satisfaction with their sleep. Interestingly, we also find that DACA-eligible immigrants —after the introduction of the reform— are less likely to report episodes of sleeplessness. Specifically, DACA-eligible immigrants are 1.6 percentage points less likely to report sleeplessness. Since 2016, the uncertainty around DACA increased, and the program was eventually terminated by President Trump in 2017. Unsurprisingly, we show that the beneficial effects of DACA on sleep behavior tend to dissipate starting from 2016. This finding is consistent with the idea that the uncertainty around this temporary program may have undermined its positive impact on health and well-being, and, in turn, on sleep (Mallet and Garcia Bedolla, 2019).

Our study adds to the literature analyzing the effects of immigration policies on the mental health of immigrants. Using data from the National Health Interview Survey and the California Health Interview Survey, Venkataramani et al. (2017) and Giuntella and Lonsky (2018) demonstrate that economic opportunities and protection from deportation can have large positive effects on the mental health of undocumented immigrants. Their findings confirm associations obtained by Patler and Pirtle (2017). Moreover, Hainmueller et al. (2017), using Medicaid claims data from Oregon, show that children of DACA-eligible mothers had 50% fewer diagnoses of adjustment and anxiety disorders relative to children of non-eligible mothers. However, to the best of our knowledge, this is the first paper to study the effects of DACA on immigrants' sleep patterns. Our findings are also in line with recent evidence on the health and mental health consequences of local immigration enforcement (Wang and Kaushal, 2018).

The remainder of this paper is organized as follows. Section 2 discusses the background and the data. In Section 3, we illustrate the identification strategy. We present the results in Section 4. Section 5 concludes.

2 Background and Data

2.1 Deferred Action for Childhood Arrivals (DACA)

The Deferred Action for Childhood Arrivals (DACA) was announced by President Obama on June 15, 2012. DACA is the largest immigration reform since the passage of the Immigration Reform and Control Act (IRCA) by the US Congress in 1986. Approximately 1.7 million unauthorized immigrants (Passel and Lopez, 2012) are targeted by this policy, which provides eligible applicants with a two-year renewable status that shields them from deportation and enables them to stay and work in the US legally. However, it is worth remarking that the program does not provide a path to citizenship or permanent residency. The United States Department of Homeland Security's Citizenship and Immigration Services started accepting applications for DACA-status on August 15, 2012.

The eligibility criteria for the program are defined as follows: (1) no lawful status as of June 15, 2012; (2) under the age of 31 as of June 15, 2012; (3) entered US before reaching 16th birthday; (4) continuously residing in the States since June 15, 2007; (5) physically present in the US on June 15, 2012, and at the time of applying for DACA; (6) currently in school, with high school diploma (or GED), or honorably discharged veteran of the Coast Guard or Armed Forces of the United States; (7) not convicted of felony, significant misdemeanor, or three or more other misdemeanors. In addition, DACA applicants have to be at least 15 years old, they are required to pay a processing fee of 495 dollars, and they have to provide evidence that they were living in the US at the prescribed times, proof of education, and confirmation of their identities.[1] They also have to pass a background check, fingerprinting, and other checks that consider their identifying biological features. Applicants do not need legal representation. Officials can revoke DACA protection if individuals pose a threat to public safety or national security. For instance, about 1,500 people have had their deferral canceled due to a crime or gang-related activity or an admission of such activities. This amount represents less than 0.2% of the total number of people accepted into the program (source: Immigration and Customs Enforcement).

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[1]Documents showing that individuals arrived in the US before 16th birthday include: passport with admission stamp, Form I-94, school records from US schools attended. USCIS provides a complete list of accepted documents for each of the eligibility criteria: `https://www.uscis.gov/archive/consideration-deferred-action-childhood-arrivals-daca`

As of August 2018, approximately 823,000 individuals were ever granted DACA. Out of these, roughly 699,000 individuals were actively enrolled in the program on August 31, 2018, whereas about 40,000 had adjusted to lawful permanent resident status, and the rest either had not renewed the status or had had their renewal request denied. Overall, there have been 1,264,000 renewal cases, with only 13,400 of the renewal requests (1%) denied. Most of the current DACA recipients come from Latin America. In particular, Mexico is the major source country (558,100), followed by El Salvador (26,500) and Guatemala (18,100). Approximately 75% of DACA recipients live in 20 US metropolitan areas. Los Angeles-Long Beach-Anaheim had the largest concentration of DACA enrollees (88,400 DACA recipients) followed by New York-Newark-Jersey City (46,500) and Dallas-Fort Worth-Arlington (37,800). A third of the DACA recipients live in California (29%), while 16% of the enrollees reside in Texas. Approximately 63% of the current status-holders are 25 or younger, 53% of them are women, and 80% of them are single (USCIS and PEW Research Center). The main benefits of DACA for unauthorized immigrants are reprieve from deportation and working permit. DACA recipients receive a Social Security Number, which enables them to open a bank account, build credit history, and access Earned Income Tax Credit (EITC). Furthermore, most states (the only exceptions being Arizona and Nebraska) allow DACA recipients to obtain a driver's license. At the same time, DACA does not provide access to federal welfare programs, federal student aid, nor to any provisions of the 2010 Patient Protection and Affordable Care Act.

With the approaching of the 2016 presidential elections, uncertainty around the future of the program increased significantly. The DACA program was challenged several times in court and encountered firm opposition of many members of the Republican party. Furthermore, since the beginning of the primary election campaign of 2016, (the future) President Trump clearly remarked his intention to end the program. In August 2015, Trump said that he would rescind President Obama's Immigration Accountability Executive Actions, which proposed extending DACA and creating DAPA. Immigration became quickly one of the leading topics of the campaigns, with several candidates casting doubt on the future of DACA.

With the presidential campaign and the election of Donald Trump in 2016, the uncertainty around the future of the program increased dramatically. The DACA program was initially rescinded by President Trump's administration in September 2017, although this repeal has since been blocked

by three preliminary injunctions issued by federal district court judges in California, New York, and D.C.. On May 1, 2018, Texas and six other states filed a lawsuit in the US District Court for the Southern District of Texas challenging the 2012 program itself. The plaintiffs asked for a preliminary injunction that would stop USCIS from accepting DACA renewal requests while the lawsuit was pending. However, this request was denied by the judge on August 8, 2018. Thus, the US Department of Homeland Security currently accepts only requests for renewal of the existing status but no new applications (source: National Immigration Law Center).

2.2   Previous Literature

Our study closely relates to the growing number of studies analyzing the impact of immigration policy on health, and, more specifically, to the studies investigating the effects of DACA on labor market outcomes, human capital, and health. DACA has been shown to positively influence labor market opportunities of undocumented immigrants (Pope, 2016), reducing the likelihood of life in poverty (Amuedo-Dorantes and Antman, 2016) and increasing GDP (Ortega et al., 2018). There is instead mixed evidence on the effects of DACA on human capital. While some scholars have shown that DACA may have incentivized work over educational investment (Amuedo-Dorantes and Antman, 2017; Hsin and Ortega, 2017), Kuka et al. (2020), using administrative data from California, find evidence that DACA increased high school graduation rates and college attendance. There is also growing evidence on the effects of DACA on health. Using data from the the National Health Interview Survey, Venkataramani et al. (2017), Patler and Pirtle (2017), and Giuntella and Lonsky (2018) show that economic opportunities and protection from deportation can have large positive effects on the mental health of undocumented immigrants. Hainmueller et al. (2017) use Medicaid claims data from Oregon to document how children of DACA-eligible mothers had 50% fewer diagnoses of adjustment and anxiety disorders compared to children with non-eligible mothers. Finally, Wang and Kaushal (2018) report significant effects of local immigration enforcement policy on immigrants' health.

Second, we relate to a growing number of studies analyzing the determinants and consequences of sleep deprivation using quasi-natural experiments and time-use data. In particular, there is increasing evidence on the causal effects of sleep deprivation on chronic diseases, health,

cognitive skills, decision making, human capital, and productivity (Luyster et al., 2012; Giuntella and Mazzonna, 2016; Giuntella et al., 2017; Jin et al., 2015; McKenna et al., 2007; Hafner et al., 2017; Heissel and Norris, 2018; Gibson and Shrader, 2014).

Finally, we speak to the literature analyzing disparities in sleep (Guglielmo et al., 2018; Jackson et al., 2013, 2014; Williams et al., 2015). Prior studies have shown that there are marked differences in sleep duration by race and ethnicity (Lauderdale et al., 2006; Hale and Do, 2007,?; Jackson et al., 2014, 2013). A handful of studies analyze acculturation and sleep using small cross-sectional studies and comparing first-generation immigrants with later generations immigrant descendants. For example, Hale and Rivero-Fuentes (2011), using data from the National Health Interview Survey, suggest that US-born Mexican Americans are more likely to be short sleepers than Mexican immigrants. Similarly, Hale et al. (2014) employ data from the Study of Women's Health Across the Nation, and find that US-born Hispanics, Chinese and Japanese immigrant descendants are more likely to report sleep complaints compared to their first-generation ethnic counterparts. However, while previous studies have investigated how immigration policy may affect immigrants' health, we know little about the effects of immigration reforms on sleep.

2.3 Data

Our data are drawn from the American Time Use Survey. The American Time Use Survey (ATUS) is a nationally representative, repeated cross-sectional survey of the time use of Americans conducted by the US Bureau of Labor Statistics from 2003 to the present (Bureau of Labor Statistics, 2018). The monthly Current Population Survey (CPS) provides the sampling frame for this survey; households that complete the eighth and final CPS interview become eligible for selection into the ATUS sample. Specifically, respondents, aged 15 years and above, are asked to complete a detailed diary of their previous day, with 50 percent of the sample reporting about weekdays, and 50 percent reporting about Saturday and Sunday. This diary provides information on all performed activities recorded during the entire 24 hours. In addition, respondents are also requested to answer questions about socio-demographic characteristics.

In our analysis, we focus on the period between 2009 and 2017.[2] Following Pope (2016) and in

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[2]Although ATUS data are available since 2003, we use data from 2009 to avoid the confounding effect of the Great Recession. Moreover, given the eligibility criteria of being under 31 in 2012, we avoid having a pre-policy group

according with the eligibility criteria (see also Section 2.1), we restrict attention to individuals between 18 and 35 years old and with at least a high-school degree at the time of the survey. Furthermore, we drop individuals reporting more than 16 or less than 2 hours of sleep, and consider only night sleeping by excluding the naps (i.e., sleep that starts and finishes between 7 am and 7 pm).[3] After these restrictions, our final estimation sample comprises 22,072 observations. Following previous literature on the economic and health effects of DACA (Pope, 2016; Venkataramani et al., 2017), we test the sensitivity of our results restricting the sample to non-citizen or non-citizen adults who reported Hispanic ethnicity (i.e., roughly 90% of the DACA beneficiaries). Clearly, as we narrow the sample selection criteria and include only Hispanic foreign-born, we increase the comparability between the treatment and the control group, but the sample size decreases substantially.

Table 1 displays the descriptive statistics for the three samples described above. Specifically, we report the mean and standard deviation for the main sample (all individuals aged 18-35 with at least a high-school degree), the foreign-born respondents, and the foreign-born Hispanics. Individuals report sleeping on average about 9 hours per day and immigrants tend to sleep more than natives (compare the main sample with foreign-born and Hispanic samples). It is worth noting that self-reported sleep tends to overestimate objective measures of sleep duration (Lauderdale et al., 2008). Moreover, Basner et al. (2007) note that the values for sleep time may overestimate actual sleep because the ATUS Activity Lexicon includes transition states (e.g, falling asleep). We also use nonlinear measures of sleep, such as sleeping less than seven or eight hours, which have often been used in the medical literature analyzing sleep deprivation (Cappuccio et al., 2010), as well as other subjective measures related to sleep quality such as reporting to be very well rested, and episodes of sleeplessness.

Regarding the other individual characteristics, it is worth noting that the proportion of people with a college degree is lower in the Hispanic sub-sample and, more generally, foreign-born individuals are more likely to be married. Finally, in the main sample approximately 2% of the respondents are eligible to the DACA program (roughly 60 individuals per year). The proportion is larger when we focus on Hispanics. Overall, this table illustrates the trade-off we face between

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systematically younger than the post-policy group.

[3]Results are not sensitive to these restrictions.

comparability and power as we move towards the group mostly affected by the immigration policy.

3 Identification Strategy

To identify the effect of DACA, we adopt the difference-in-differences (DiD) approach proposed by Pope (2016) and Amuedo-Dorantes and Antman (2016). Specifically, we exploit the discontinuities in the eligibility criteria of the DACA program and compare DACA-eligible (treatment group) with DACA-ineligible individuals (control group), before and after the implementation of the program. As mentioned in Section 2.1, DACA-eligible individuals are defined as those who: (1) were under the age of 31 as of June 15, 2012; (2) have lived in the US since June 15, 2007; (3) entered US before reaching 16th birthday; (4) have at least a high school degree (or equivalent); (5) are not US citizens; (6) are unauthorized immigrants. Since the survey asked the respondents about their age, year of migration, education and citizenship status, we can identify individuals who meet the first five qualification criteria, but as typical in publicly available US databases, we cannot determine the immigrant's legal status. Previous estimates using survey data suggest that among self-reported non-citizens, approximately 60% of individuals are expected to be undocumented (Baker and Rytina, 2014; Pope, 2016).

Specifically, we estimate different versions of the following equation for individual i residing in state s at the year of interview t:

$$Y_{ist} = \alpha + \beta_1 \text{Post}_{ist} + \beta_2 \text{Eligible}_{ist} + \beta_3 \text{Post}_{ist} * \text{Eligible}_{ist} + \gamma X_{ist} + \mu_t + \eta_s + \epsilon_{ist} \qquad (1)$$

where Y_{ist} represents a set of sleep outcomes, defined as follows: 1) sleep hours; 2) an indicator variable for whether the individual sleeps less than seven hours; 3) a binary variable for whether the individual sleeps less than eight hours; 4) a measure of sleep satisfaction proxied by a dummy equal to one if the individual reported to have rested very well the previous day; and 5) episodes of sleeplessness. $Post_{ist}$ is a binary variable taking value one for all years after

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DACA was implemented in the US (i.e., 2013 or later),[4] while $Eligible_{ist}$ is a dummy equal to one if individual i is DACA-eligible when the survey is administered. $Eligible_{ist}$ is interacted with $Post_{ist}$ to capture the effect of the policy. Model (1) also contains survey year fixed effects (μ_t) to account for possible trends in sleep behavior. We also include a full set of state fixed effects (η_s), which are meant to capture unobservable, time-invariant differences across states that may affect our outcomes. X_{ist} is a vector of control variables including, for instance, gender, age and age squared, indicators for marital status, education, and dummies for the race groups (i.e., White people, Hispanics, and Black people). Finally, ϵ_{ist} represents an idiosyncratic error term.

Specifically, the coefficient β_1 captures the overall change in sleep behavior after the reform, while β_2 measures the average difference in sleep behavior between the treated and the control group. The key parameter is β_3, which indicates the change in the sleep behavior of the treated individuals after the reform, relative to the control group. Therefore, β_3 measures the effect of the policy on DACA-eligible individuals. As already mentioned, since nearly 40% of the non-citizens in the data are estimated to be authorized immigrants, our estimated effect of the policy (β_3) will be smaller than the intent-to-treat effect of DACA. Furthermore, it is worth remarking that not all DACA-eligible individuals applied and received DACA status. The Migration Policy Institute estimates that there were 1,326,000 DACA-eligible individuals in 2017. However, as of January 2018, the number of individuals who obtained DACA status was 682,750.[5] Based on these estimates, the program participation rate is 52%, suggesting that the treatment on the treated effects could potentially be as much as 2 times larger than the intent-to-treat effects.

Differently from previous literature on the effect of DACA, we also evaluate whether the increasing uncertainty about the future of the program (starting already early in 2016) affected the sleep behavior of the eligible individuals. For this reason, we present our results for the impact of the program separated for two periods (2013–2015 vs. 2016–2017). In other words, the *Post* variable in equation (1) will be split in the two sub-periods. Since the sleep satisfaction question is asked only up to 2013, we cannot identify for this outcome the effect of the policy in the second period. We estimate our model using ordinary least squares (OLS), and reported standard errors are robust to heteroskedasticity and clustered at household level. All our analyses use the ATUS re-

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[4]It is worth noting that most of the applications were approved in 2013. However, in alternative specifications (see Tables A.3 and A.4 in the Appendix), we use the year of announcement (2012).

[5]See https://www.migrationpolicy.org/programs/data-hub/deferred-action-childhood-arrivals-daca-profiles.

spondent weights (variable named *WT*06), i.e., the probability weights that are meant to recover nationally representative estimates.

4   Results

Before presenting the results, we provide a visual analysis of the effect of the policy by comparing the outcome means of DACA eligible individuals and DACA non-eligible ones before and after the policy implementation, starting from 2009. Specifically, Figures 1 and 2 report this comparison by showing the difference between the two groups in the share of individuals reporting less than eight and less than seven hours of sleep, respectively. The start of the policy is highlighted by the shaded area between 2012 and 2013. The figures also illustrate that there are no significant differences in the pre-trends between eligible and non-eligible individuals (between 2009 and 2011). Indeed, when testing the joint hypothesis that the pre-trend coefficients for the years preceding the DACA adoption are non-significantly different from zero, we fail to reject the null hypothesis for all the sleep duration outcomes (see Table A.5 in the Appendix). On the contrary, starting from 2012, and more clearly from 2013, DACA-eligible immigrants became significantly less likely to report insufficient sleep. However, Figure 1 and 2 show that the beneficial effects of DACA attenuate over time, and in particular since 2016. We believe that there are two main explanations for this convergence. First, DACA is subject to renewal every two years, thereby leading to some uncertainty among individuals who are up for renewal. However, the effect of concerns about renewal should materialize already in 2015 as most of the applications were approved in 2013. Second, with the approaching of the 2016 presidential primaries and elections and the change in the political climate, the uncertainty about the future of the program increased substantially. During the 2016 campaign, Donald Trump (as many other Republican candidates) publicly declared his intention to rescind the program. Unsurprisingly, Figures 1 and 2 document an increase in the standard error of our estimates, which becomes particularly marked in the election year (2016).

Table 2 presents the results of a simple OLS estimation of the model (1), using the pooled data from the entire 2009–2017 period for the individuals aged 18 to 35 years and distinguishing between the short- (2013–2015) and the long-run effects (2016–2017) of the policy. Starting from

the short-run effects, we find that DACA-eligible individuals sleep on average 28 minutes longer than non-eligible individuals. We do find a significant reduction in the likelihood of reporting less than seven and less than eight hours of sleep. In particular, eligible immigrants are 9.5 percentage points less likely to sleep less than seven hours and 13.9 percentage points less likely to sleep less than eight hours.

The effects are larger and more precisely estimated when focusing on men (see Panel B), while they are much smaller in magnitude and no longer significant among women (see Panel C). This result is consistent with other evidence suggesting little or no impacts of DACA on women (Kuka et al., 2020). Among men, we also find a significant increase in sleep satisfaction, which is markedly larger among DACA-eligible immigrants (see column 4 of Panel B).

While we do not have a perfect measure of sleep quality, we can identify the time individuals report sleeplessness. Interestingly, DACA-eligible immigrants are less likely to report sleeplessness episodes after the introduction of DACA. Specifically, Table 2 documents that DACA-eligible individuals are 1.6 percentage points less likely to report episodes of sleeplessness (see column 5 of Panel A). Effects are significantly larger among men than among women (see column 5 of Panels B and C, respectively).

As shown in Figures 1 and 2, in the long-run the effects of DACA become not statistically different from zero, and, if anything, they change sign (the coefficients on the interaction term DACA-Eligible* 2016–2017 in Table 2).

We run several sensitivity analyses to check the robustness of our results. First, we replicate our analyses using different samples, implying different control groups. In particular, we narrow our sample including only non-citizens, and, as in Venkataramani et al. (2017), we also consider non-citizen adults with Hispanic ethnicity (see, respectively, Panels A and B of Table 3). However, our sample selection criteria are more restrictive than those applied by Venkataramani et al. (2017), who focus on non-citizen adults with Hispanic ethnicity aged 18 to 50, while we maintain the DACA requirement 18–35. Reassuringly, point estimates are almost identical, although standard errors largely increases because sample size shrinks considerably especially in the Hispanic subgroup.

Moreover, our results are robust to the use of a larger sample of both citizens and non-citizens aged 18–50 years (see Table A.1 in the Appendix). Second, we repeat our analyses taking into

account the discrete nature of most of our outcome variables using probit models (see Table A.2 in the Appendix). Finally, Table A.3 (A.4) in the Appendix replicates the main estimates using the year (month) of the policy announcement to define our treatment variable. While the estimates become somehow noisier, the coefficients are not statistically different from those reported in our main specification. Overall, the sensitivity analyses confirm our baseline results.

5 Conclusion

There has been a heated political debate on the effectiveness of DACA program. Previous work provided evidence of positive effects of DACA on labor force participation and other labor market outcomes. There is evidence of positive effects on health insurance, access to health care, and mental health outcomes, as well as mixed evidence regarding the effects on academic outcomes. However, we know little about the mechanisms underlying such effects. This paper explores the role of sleep, which is known to be an important health factor, and directly affected by stress. Exploiting the discontinuities in the DACA eligibility criteria, we provide evidence that DACA-eligible immigrants after 2012 significantly improved their sleep duration. Effects are larger among men. These results are consistent with some recent studies suggesting that DACA had beneficial effects on immigrants' mental health and well-being (Kaushal et al., 2018; Wang and Kaushal, 2018; Venkataramani et al., 2017; Giuntella and Lonsky, 2018).

While we do not have precise measures of sleep quality, we do find evidence that DACA-eligible immigrants —after the introduction of DACA— were significantly less likely to report episodes of sleeplessness. At the same time, the beneficial effects of the policy seem to dissipate after a few years, becoming non-significantly different from zero since 2016. Therefore, we cannot exclude that DACA provided only short-term benefits, and that the increased uncertainty around the future of the program attenuated the positive effects of DACA observed also in previous studies. This study has some limitations. First, we use self-reported data from a time-use survey. As pointed out by Lauderdale et al. (2008), the lack of more objective information on sleep may result in substantial measurement error. Second, our results are based on a relatively small sample size. While other data (e.g., the National Health Interview Survey) would provide a larger sample, they do not contain precise information on the year of immigration to the US, which is crucial to identify DACA-eligible individuals. Third, we are not able to precisely identify authorized and unauthorized immigrants, and thus, the exact DACA-eligible population. Fourth, we estimate an intention-to-treatment effect of DACA. Our estimates suggest that the treatment on the treated effects could potentially be as much as 2 times larger than the intent-to-treat effects.

Despite the above limitations, our study offers a relevant contribution to the extant literature. This is the first analysis of the impact of immigration policy on immigrants' sleep patterns.

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Furthermore, while previous studies suggested that concerns regarding immigrant status may affect immigrants' stress and sleep, we are the first to employ a difference-in-differences approach to quantify the impacts of an immigration policy change on immigrants' sleep.

Overall, our results reveal that the stress associated with immigration status, and in particular, the threat of deportation and the lack of work authorization, may significantly affect immigrants' sleep habits. We also show that legalization or temporary authorization programs, such as the DACA program, may have non-negligible impact on immigrants' sleep. At the same time, the effects of temporary programs can be quickly undermined by the uncertainty on their future. Thus, while there may be positive effects in the short-term, the uncertainty around the program may increase the vulnerability of the targeted individuals over time.

Given the growing evidence on the detrimental effects of sleep deprivation on health, cognitive skills, and productivity (Gibson and Shrader, 2018; Giuntella and Mazzonna, 2019; Giuntella et al., 2017), policy makers should not discount the impact of immigration policies on health disparities and the economic integration of immigrants. Sleep deprivation may contribute to explaining the unhealthy assimilation of immigrants with time spent in the U.S. (Antecol and Bedard, 2006). Yet, permanent legalization programs may be more effective in achieving long-term effects by eliminating any uncertainty related to the undocumented immigrant legal status. While this goes beyond the scope of our paper, future research could shed light on the role of sleep in explaining immigrants' health trajectories.

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Figures

Figure 1: Daca Eligibility and Insufficient Sleep (sleeping less than 8 hours)
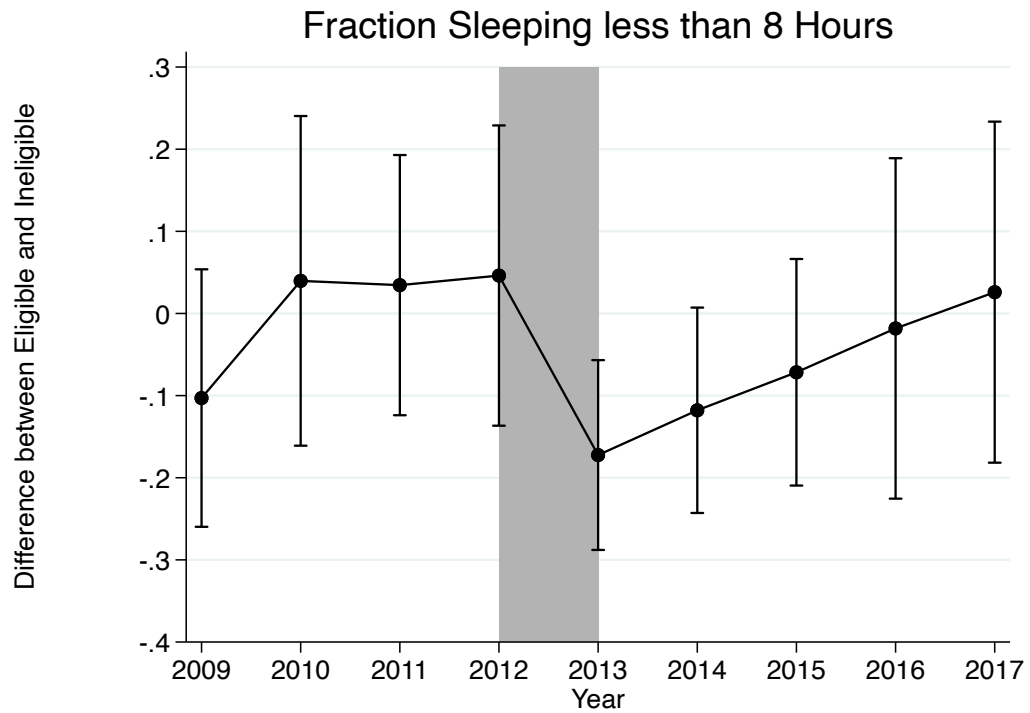
Notes - Data are drawn from ATUS (survey years: 2009-2017). The sample is restricted to individuals aged 18-35 with at least a high-school degree.

Figure 2: Daca Eligibility and Insufficient Sleep (sleeping less than 7 hours)
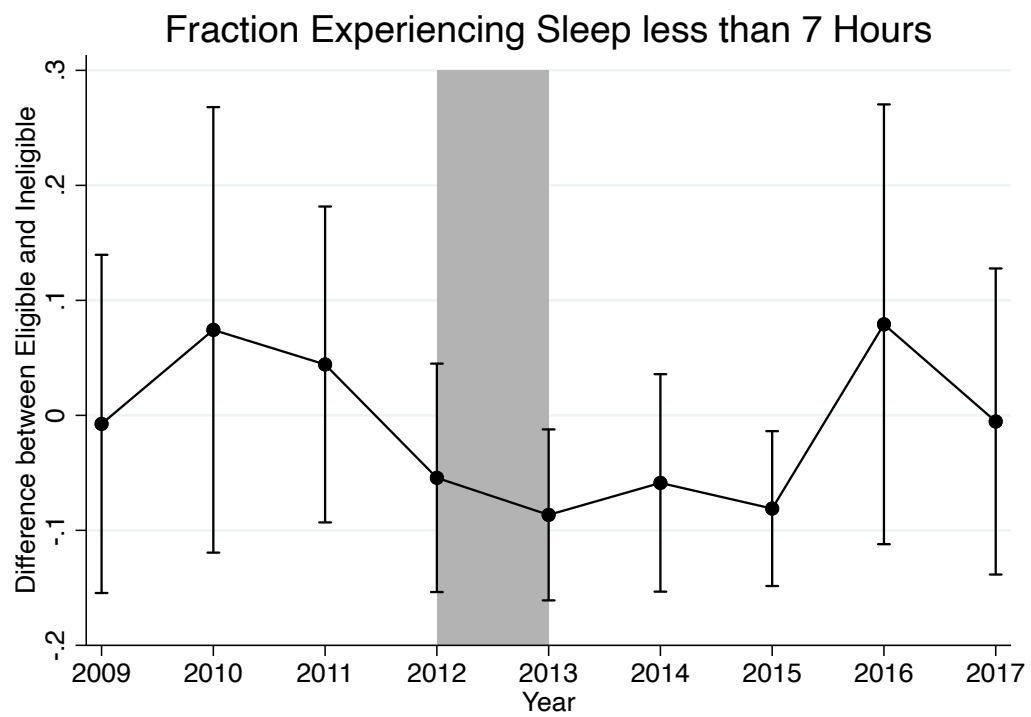
Fraction Experiencing Sleep less than 7 Hours

Notes - Data are drawn from ATUS (survey years: 2009-2017). The sample is restricted to individuals aged 18-35 with at least a high-school degree.

Tables

Table 1: Descriptive Statistics

	Full Sample		Foreign-born Sample		Hispanic Sample	
	Mean	Std. Dev.	Mean	Std. Dev.	Mean	Std. Dev.
Hours of sleep	9.15	2.32	9.4	2.37	9.51	2.41
Sleep less than 7	0.15	0.36	0.13	0.34	0.13	0.34
Sleep less than 8	0.29	0.46	0.26	0.44	0.25	0.43
Sleep satisfaction	0.35	0.48	0.41	0.49	0.47	0.5
Espisodes of sleeplessness	63.88	57.38	63.84	43.15	59.29	36.45
Female	0.57	0.49	0.57	0.5	0.55	0.5
Age	28.46	4.71	29.23	4.47	28.51	4.59
Married	0.44	0.50	0.57	0.49	0.55	0.5
High school degree	0.26	0.44	0.3	0.46	0.5	0.5
Some college	0.36	0.48	0.28	0.45	0.3	0.46
College degree	0.37	0.48	0.42	0.49	0.2	0.4
Black	0.14	0.35	0.13	0.33	0.04	0.19
Hispanic	0.17	0.37	0.43	0.5	1	
White	0.78	0.41	0.58	0.49	0.92	0.27
DACA-eligible immigrants	0.02	0.13	0.12	0.32	0.2	0.4
Immigrants	0.14	0.35	1		1	
Observations	22,072		3,171		1,364	

Notes - Data are drawn from the ATUS for individuals aged 18-35 with at least a high school degree (survey years: 2009-2017). All the samples contain individuals for whom information on all observables and the respective outcome variable are not missing. The sample size for sleep satisfaction reduces to 7,335 observations for the full sample, 997 observations for the foreign-born sample, and 423 observations for the Hispanic sample.

Table 2: Effects of DACA on Sleep - Individuals aged 18-35

Dep. var.:	(1) Sleep hours	(2) Sleep hours<7	(3) Sleep hours<8	(4) Sleep satisfation	(5) Sleeplessness
Panel A: Full Sample					
DACA-Eligible * 2013-2015	0.472	-0.095**	-0.139**	0.101	-0.016*
	(0.337)	(0.042)	(0.061)	(0.134)	(0.009)
DACA-Eligible * 2016-2017	0.148	0.001	-0.044	NA	-0.013
	(0.438)	(0.067)	(0.084)	NA	(0.023)
Mean of dep. var.	9.146	0.150	0.293	0.346	0.0436
Std. dev. of dep. var.	2.320	0.358	0.455	0.476	0.204
Observations	22,072	22,072	22,072	7,335	22,072
Panel B: Males					
DACA-Eligible * 2013-2015	0.805	-0.166**	-0.214**	0.422***	-0.038**
	(0.499)	(0.069)	(0.091)	(0.126)	(0.017)
DACA-Eligible * 2016-2017	-0.160	-0.013	0.021	NA	-0.013
	(0.633)	(0.103)	(0.124)	NA	(0.035)
Mean of dep. var.	8.991	0.175	0.323	0.386	0.0411
Std. dev. of dep. var.	2.371	0.380	0.468	0.487	0.199
Observations	9,435	9,435	9,435	3,178	9,435
Panel C: Females					
DACA-Eligible * 2013-2015	0.146	-0.018	-0.042	-0.239	-0.007
	(0.477)	(0.052)	(0.083)	(0.152)	(0.009)
DACA-Eligible * 2016-2017	0.866	-0.028	-0.171*	NA	-0.015
	(0.536)	(0.085)	(0.099)	NA	(0.026)
Mean of dep. var.	9.262	0.132	0.270	0.316	0.0454
Std. dev. of dep. var.	2.275	0.339	0.444	0.465	0.208
Observations	12,637	12,637	12,637	4,157	12,637

Notes - Heteroskedasticity-robust standard errors in parentheses. All models are estimated using data from 2009-2017 ATUS. Panel A includes both genders, while Panel B includes only men, and Panel C includes only women. Control variables: gender (only Panel A), age and its quadratic term, indicators for the ethnic group, marital status and education, as well as state and survey years fixed effects. NA=not applicable. * Significant at 10%; ** significant at 5%; *** significant at 1%.

Table 3: Effects of DACA on Sleep - Foreign-born and Hispanic Sample - Individuals aged 18-35

Dep. Var.:	(1) Sleep hours	(2) Sleep hours<7	(3) Sleep hours<8	(4) Sleep satisfation	(5) Sleeplessness
Panel A: Foreign-born Sample					
DACA-Eligible * 2013-2015	0.438	-0.092**	-0.117*	0.119	-0.012
	(0.348)	(0.047)	(0.064)	(0.133)	(0.010)
DACA-Eligible * 2016-2017	0.098	0.001	-0.010	NA	0.009
	(0.480)	(0.072)	(0.092)	NA	(0.023)
Mean of dep. var.	9.396	0.135	0.259	0.414	0.0243
Std. dev. of dep. var.	2.367	0.342	0.438	0.493	0.154
Observations	3,171	3,171	3,171	997	3,171
Panel B: Hispanic Sample					
DACA-Eligible * 2013-2015	0.338	-0.082	-0.127	0.026	-0.010
	(0.435)	(0.064)	(0.085)	(0.166)	(0.013)
DACA-Eligible * 2016-2017	-0.175	0.052	0.043	NA	0.021
	(0.575)	(0.088)	(0.113)	NA	(0.025)
Mean of dep. var.	9.511	0.133	0.253	0.473	0.0176
Std. dev. of dep. var.	2.414	0.339	0.435	0.500	0.132
Observations	1,364	1,364	1,364	423	1,364

Notes - Heteroskedasticity-robust standard errors in parentheses. All models are estimated using data from 2009-2017 ATUS. Panel A includes only foreign-born individuals, while Panel B includes only Hispanics. Control variables: gender, age and its quadratic term, indicators for the ethnic group (only Panel A), marital status, education, as well as state and survey years fixed effects. NA=not applicable. * Significant at 10%; ** significant at 5%; *** significant at 1%.

Appendix: Supplemental Tables

Table A.1: Effects of DACA on Sleep - Individuals aged 18-50

Dep. var.:	(1) Sleep hours	(2) Sleep hours<7	(3) Sleep hours<8	(4) Sleep satisfation	(5) Sleeplessness
Panel A: Full Sample					
DACA-Eligible * 2013-2015	0.457	-0.091**	-0.137**	0.115	-0.014*
	(0.334)	(0.042)	(0.060)	(0.134)	(0.008)
DACA-Eligible * 2016-2017	0.212	-0.007	-0.043	NA	-0.003
	(0.444)	(0.067)	(0.085)	NA	(0.022)
Mean of dep. var.	8.907	0.168	0.334	0.348	0.0431
Std. dev. of dep. var.	2.252	0.374	0.472	0.476	0.203
Observations	49,413	49,413	49,413	16,502	49,413
Panel B: Males					
DACA-Eligible * 2013-2015	0.799	-0.166**	-0.213**	0.430***	-0.028*
	(0.496)	(0.068)	(0.091)	(0.130)	(0.015)
DACA-Eligible * 2016-2017	-0.035	-0.033	0.006	NA	-0.004
	(0.642)	(0.102)	(0.124)	NA	(0.034)
Mean of dep. var.	8.752	0.191	0.364	0.376	0.0408
Std. dev. of dep. var.	2.284	0.393	0.481	0.484	0.198
Observations	22,030	22,030	22,030	7,395	22,030
Panel C: Females					
DACA-Eligible * 2013-2015	0.098	-0.006	-0.035	-0.236	-0.008
	(0.471)	(0.051)	(0.081)	(0.149)	(0.006)
DACA-Eligible * 2016-2017	0.841	-0.013	-0.144	NA	-0.006
	(0.531)	(0.083)	(0.097)	NA	(0.023)
Mean of dep. var.	9.032	0.149	0.309	0.326	0.0450
Std. dev. of dep. var.	2.219	0.356	0.462	0.469	0.207
Observations	27,383	27,383	27,383	9,107	27,383

Notes - Heteroskedasticity-robust standard errors in parentheses. All models are estimated using data from 2009-2017 ATUS. Panel A includes only foreign-born individuals, while Panel B includes only Hispanics. Control variables: gender, age and its quadratic term, indicators for the ethnic group (only Panel A), marital status and education, as well as state and survey years fixed effects. NA=not applicable. * Significant at 10%; ** significant at 5%; *** significant at 1%.

Table A.2: Effects of DACA on Sleep - Individuals aged 18-35 - Probit Analysis

Dep. var.:	(1) Sleep hours<7	(2) Sleep hours<8	(3) Sleep satisfation
Panel A: Full Sample			
DACA-Eligible * 2013-2015	-0.116**	-0.153**	0.099
	(0.050)	(0.069)	(0.131)
DACA-Eligible * 2016-2017	0.002	-0.046	NA
	(0.062)	(0.085)	NA
Mean of dep. var.	0.151	0.293	0.346
Std. dev. of dep. var.	0.358	0.455	0.476
Observations	22,037	22,072	7,335
Panel B: Males			
DACA-Eligible * 2013-2015	-0.197**	-0.250**	0.513***
	(0.077)	(0.107)	(0.169)
DACA-Eligible * 2016-2017	-0.013	0.017	NA
	(0.085)	(0.119)	NA
Mean of dep. var.	0.175	0.323	0.387
Std. dev. of dep. var.	0.380	0.468	0.487
Observations	9,420	9,435	3,173
Panel C: Females			
DACA-Eligible * 2013-2015	-0.031	-0.044	-0.262
	(0.064)	(0.089)	(0.174)
DACA-Eligible * 2016-2017	-0.033	-0.204	NA
	(0.114)	(0.141)	NA
Mean of dep. var.	0.133	0.270	0.316
Std. dev. of dep. var.	0.339	0.444	0.465
Observations	12,617	12,637	4,157

Notes - Probit estimations; average marginal effects reported. Heteroskedasticity-robust standard errors in parentheses. All models are estimated using data from 2009-2017 ATUS. Panel A includes both genders, while Panel B includes only men, and Panel C includes only women. Control variables: gender (only Panel A), age and its quadratic term, indicators for the ethnic group, marital status and education, as well as state and survey years fixed effects. NA=not applicable. * Significant at 10%; ** significant at 5%; *** significant at 1%.

Table A.3: Effects of DACA on Sleep - Individuals aged 18-35 - Treatment in 2012

Dep. var.:	(1) Sleep hours	(2) Sleep hours<7	(3) Sleep hours<8	(4) Sleep satisfation	(5) Sleeplessness
Panel A: Full Sample					
DACA-Eligible * 2012-2015	0.317	-0.106**	-0.053	0.143	-0.014
	(0.352)	(0.051)	(0.065)	(0.118)	(0.011)
DACA-Eligible * 2016-2017	0.130	-0.023	-0.012	NA	-0.014
	(0.466)	(0.074)	(0.087)	NA	(0.024)
Mean of dep. var.	9.146	0.150	0.293	0.346	0.0436
Std. dev. of dep. var.	2.320	0.358	0.455	0.476	0.204
Observations	22,072	22,072	22,072	7,335	22,072
Panel B: Males					
DACA-Eligible * 2012-2015	0.560	-0.128	-0.098	0.414***	-0.035*
	(0.550)	(0.081)	(0.100)	(0.147)	(0.021)
DACA-Eligible * 2016-2017	-0.216	-0.010	0.069	NA	-0.016
	(0.681)	(0.110)	(0.128)	NA	(0.037)
Mean of dep. var.	8.991	0.175	0.323	0.386	0.0411
Std. dev. of dep. var.	2.371	0.380	0.468	0.487	0.199
Observations	9,435	9,435	9,435	3,178	9,435
Panel C: Females					
DACA-Eligible * 2012-2015	0.064	-0.077	-0.008	-0.094	0.001
	(0.437)	(0.061)	(0.084)	(0.172)	(0.009)
DACA-Eligible * 2016-2017	0.846	-0.070	-0.158	NA	-0.011
	(0.567)	(0.094)	(0.103)	NA	(0.027)
Mean of dep. var.	9.262	0.132	0.270	0.316	0.0454
Std. dev. of dep. var.	2.275	0.339	0.444	0.465	0.208
Observations	12,637	12,637	12,637	4,157	12,637

Notes - Heteroskedasticity-robust standard errors in parentheses. All models are estimated using data from 2009-2017 ATUS. Panel A includes both genders, while Panel B includes only men, and Panel C includes only women. Control variables: gender (only Panel A), age and its quadratic term, indicators for the ethnic group, marital status and education, as well as state and survey years fixed effects. NA=not applicable. * Significant at 10%; ** significant at 5%; *** significant at 1%.

Table A.4: Effects of DACA on Sleep - Individuals aged 18-35 - Treatment in July 2012

	(1)	(2)	(3)	(4)	(5)
Dep. Var.:	Sleep hours	Sleep hours<7	Sleep hours<8	Sleep satisfation	Sleeplessness
Panel A: Full Sample					
DACA-Eligible * 2012-2015	0.148	-0.083*	-0.030	0.152	-0.013
	(0.338)	(0.044)	(0.063)	(0.122)	(0.009)
DACA-Eligible * 2016-2017	0.008	0.001	0.005	NA	-0.011
	(0.442)	(0.069)	(0.083)	NA	(0.023)
Mean of dep. var.	9.146	0.150	0.293	0.346	0.0436
Std. dev. of dep. var.	2.320	0.358	0.455	0.476	0.204
Observations	22,072	22,072	22,072	7,335	22,072
Panel B: Males					
DACA-Eligible * 2012-2015	0.408	-0.157**	-0.113	0.409***	-0.034*
	(0.518)	(0.074)	(0.095)	(0.135)	(0.019)
DACA-Eligible * 2016-2017	-0.343	-0.017	0.068	NA	-0.013
	(0.648)	(0.105)	(0.122)	NA	(0.036)
Mean of dep. var.	8.991	0.175	0.323	0.386	0.0411
Std. dev. of dep. var.	2.371	0.380	0.468	0.487	0.199
Observations	9,435	9,435	9,435	3,178	9,435
Panel C: Females					
DACA-Eligible * 2012-2015	-0.097	-0.001	0.071	-0.089	-0.005
	(0.458)	(0.053)	(0.085)	(0.167)	(0.008)
DACA-Eligible * 2016-2017	0.760	-0.021	-0.122	NA	-0.013
	(0.539)	(0.086)	(0.098)	NA	(0.026)
Mean of dep. var.	9.262	0.132	0.270	0.316	0.0454
Std. dev. of dep. var.	2.275	0.339	0.444	0.465	0.208
Observations	12,637	12,637	12,637	4,157	12,637

Notes - Heteroskedasticity-robust standard errors in parentheses. All models are estimated using data from 2009-2017 ATUS. Panel A includes both genders, while Panel B includes only men, and Panel C includes only women. Control variables: gender (only Panel A), age and its quadratic term, indicators for the ethnic group, marital status and education, as well as state and survey years fixed effects. NA=not applicable. * Significant at 10%; ** significant at 5%; *** significant at 1%.

Table A.5: Testing Parallel Pre-Trends Assumption

| | (1) | (2) | (3) |
Dep. var.	Sleep hours	Sleep hours<7	Sleep hours<8
DACA-Eligible * 2009	0.192	0.051	-0.028
	(0.580)	(0.094)	(0.099)
DACA-Eligible * 2010	0.201	0.086	0.046
	(0.565)	(0.107)	(0.110)
DACA-Eligible * 2011	-0.199	0.045	0.032
	(0.367)	(0.070)	(0.081)
Joint F statitistics (2011=2010=2009=0)	0.8275	1.31	0.7677
Observations	22,072	22,072	22,072

Notes - Heteroskedasticity-robust standard errors in parentheses. All models are estimated using data from 2009-2017 ATUS. All estimate include an indicator for DACA-eligiblity status, year dummies, and the interaction of DACA-eligibility status with year dummies. * Significant at 10%; ** significant at 5%; *** significant at 1%.