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Evaluating the effects of a targeted home visiting program on maternal and child health outcomes

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Abstract

We evaluate the effects of home visiting targeted towards disadvantaged first-time mothers on maternal and child health outcomes. Our analysis exploits a randomized controlled trial and combines rich longitudinal survey data with unique administrative health data. In a context in which the target group has comprehensive health care access, we find that home visiting has no effects on most types of health utilization, health behaviors, and physical health measures. However, the intervention has a remarkably robust and sizable positive effect on maternal mental health, reducing depressions reported in the survey data and prescriptions of psycholeptics recorded in the administrative data.

JEL-Classification: I14

Keywords: Child Health; Disadvantaged Families; Mental Health; Early Childhood Intervention

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1. Introduction

It is well established that children from disadvantaged families suffer more ill-health than children from advantaged backgrounds (e.g. Case et al. 2002; Currie and Stabile 2003; Currie and Lin 2007; Condliffe and Link 2008) and that there is a pronounced link between family income and child health (Currie and Lin 2007; Hoynes et al. 2015; Milligan and Stabile 2011). The child health gradient in socio-economic status (SES) persists into adulthood (Apouey and Geoffard 2013; Case et al. 2002) and contributes to well-documented income-related health inequalities later in life (e.g., Deaton 2002; van Doorslaer and Koolman, 2004). The gradient may indicate under-investment into child health by low-SES parents due to insufficient knowledge about children's health needs (Currie 2000). As child health is related to educational achievement and labor market outcomes, the under-investment is likely to harm economic success later in life (e.g. Currie 2009; Currie et al. 2010; Figlio et al. 2014). Moreover, due to positive externalities of child health (Currie 2000), the cost to society may exceed the private cost. For these reasons, policies that attempt to intervene early in life in order to close the SES gradient in child health have received much attention among policy makers.

A policy that intervenes particularly early to address health inequalities is home visiting targeted towards disadvantaged families. In such programs, specially trained nurses, midwives or other health workers deliver home visits from pregnancy throughout the first years of the child's lives. By providing information, instructions and support to the parents, and in particular the mothers, home visiting programs try to promote and encourage appropriate acute and preventive health care, improve home safety to reduce preventable injuries, and reduce adverse maternal health behaviors, such as smoking. Several countries have recently expanded home visiting programs for disadvantaged families. In the U.S., the Obama administration requested $500 million for fiscal year 2016 and $15 billion over the next 10 years to continue to expand these programs (U.S. Department of Health and Human Services 2015). In the U.K., home visiting programs have been expanded since 2005 delivering services to 16,000 disadvantaged new parents each year at considerable cost (U.K. Department of Health 2013) and in Germany the federal and local governments spent 102 million Euro each year since 2012 to expand home visiting programs (BMFSFJ 2015). Given the substantial cost of these programs, it is of vital interest to know how effective they are in reaching their goals.

Our study helps to answer this question by exploiting a randomized controlled trial (RCT) to examine the health effects of an intensive targeted home visiting program (*Pro Kind*) in Germany, thus contributing to the existing literature in several ways. While previous evaluations of home visiting programs have usually relied on survey-based maternal self-reports about health and health utilization (Doyle et al., 2016; and the studies surveyed in Avellar and Supplee,

2013; Peacock et al., 2013), we have the rare opportunity to combine survey data with administrative data, spanning the period from pregnancy up to two years after birth. The survey data include, among others, detailed maternal reports on health behavior, such as breastfeeding and smoking, and on child health, while the administrative data is drawn from insurance records of the German public health insurance system and includes information on all prescription medications, on hospital contacts including diagnoses codes, as well as on midwife contacts and dentist visits. The data allow drilling down to the level of individual health conditions based on diagnoses and prescription codes, providing a more objective and complete measurement of health conditions than is possible based on survey data alone. This wealth of information provides us with the opportunity of analyzing more detailed sub-domains of health than any of the previous studies in this area. In addition to child health outcomes, which most studies focus on, we also investigate maternal physical and mental health.

Since we investigate many outcomes, we adjust our results for multiple hypothesis testing (MHT) throughout the analysis and we further check the robustness of our results to different statistical approaches, including inverse probability weighting (IPW) and permutation tests. Overall, we find no clear effects of the intervention on child physical or mental health or on maternal health behavior during the first two years of life. However, we find that the intervention had a robust and sizable positive effect on maternal mental health as evidenced by both, a reduction in prescriptions of psycholeptics recorded in the administrative data, and reductions in depressions reported in the survey data. We further find effects on the utilization of oral health care, explicitly targeted by the intervention, with positive program effects on maternal dental checkups during pregnancy and dental checkups for children. Both findings are highly relevant, given that maternal depression and stress is related to many adverse child outcomes (Junge et al. 2016; Aizer et al. 2016; Carlson 2015), and oral infections during pregnancy have been linked to preterm delivery (Sanz and Kornmann 2013; Vergnes and Sixou 2007). Yet, these outcomes have not been included in previous evaluations of the health effects of home visiting.[1] While these findings imply that the program has beneficial effects in some limited areas, the overall results suggest that the program fails to affect several important domains that are explicitly targeted, such as maternal smoking behavior, breastfeeding, and prevention of accidents.

Our finding of little effects on most types of utilization and on physical health is in line with two recent studies reporting either no effect (Robling et al. 2016, for the UK) or very limited positive effects (Doyle et al. 2015, for Ireland) of similar programs. Our stronger effects on

[1] An exception is the study by Doyle et al. (2017), who find positive effects on some maternal wellbeing indicators of a home visiting program aimed at improving child cognitive development by improving parenting skills and parental knowledge on child development. While they analyze detailed survey measures of well-being, they do not exploit administrative data, and their intervention has a focus on child cognitive development rather than health.

mental health are in line with effects on mental well-being that have been found in other interventions that did not primarily focus on this outcome. These include the Moving to Opportunity program (MTO), in which disadvantaged families were offered vouchers to move to low-poverty neighborhoods (Ludwig et al. 2013), and the Oregon Health Insurance Experiment, which expanded access to health insurance (Finkelstein et al. 2012). These findings highlight the importance of routinely investigating direct mental health and well-being effects when analyzing health interventions. Our findings suggest that the mental health needs of deprived mothers in our context are not fully covered by the regular health care provision, but can be addressed to some extent through home visiting. We provide some evidence to support the idea that the beneficial mental health effect is driven by the personal relationship between mother and home visitor that substitutes for a lack of social support of the target group that experiences stressful life events.

Finally, our pattern of results sheds some light on the question which types of health outcomes can be influenced by home visiting programs. We show that in our context the SES gradient in most areas of health care utilization is small, and we argue that this is the reason why we do not find any effect on utilization, except for dental and oral health care, where the gradient is steeper. With regards to maternal smoking and breastfeeding, the program failed to affect these outcomes despite a steep SES gradient. As an explanation, we provide evidence suggesting that knowledge in the disadvantaged target population on the detrimental effects of smoking and on the benefits of breastfeeding is already sufficient. At the same time these outcomes are difficult to affect by the intervention because changing them is costly to the individual, given that smoking is an addiction, and breastfeeding can be difficult and time consuming. Overall, our pattern of results suggests that targeted home visiting is most effective for health behaviors in which the SES gradient is steep, to which the program transmits additional information, and which are not too costly to change.

The fact that the program failed to reach many of its goals despite its intensity (forty-five 90-minute meetings over two and a half years, with average costs of € 8,705, or approximately $ 9,575, per intervention—Maier-Pfeiffer et al., 2013) raises the question of how it could be improved. It seems likely that more limited interventions with specific goals (such as giving up smoking) could be more effective than a broad home-visiting program with multiple domains of intervention. At the same time, given that the participants are in frequent contact with the health care system, some elements of the program, such as the information on preventive dental health which seems to have been effective, could potentially be incorporated more strongly into routine pre- and postnatal checkups. It is likely, however, that the positive effect on maternal well-being and mental health was facilitated by the personal relationship between participant and home visitor fostered by the intensity of the program, and this might therefore be more difficult to

achieve with alternative less intensive interventions.

The remainder of the paper is organized as follows: Section 2 presents setting of the intervention. Section 3 discusses the data and randomization procedure. Section 4 presents the estimation strategy. Section 5 shows the estimation results before these are discussed in Section 6.

2. The *Pro Kind* Program

In the U.S., home visiting, and in particular the Nurse Family Partnership (NFP) program, has been found to be beneficial for maternal and child health. For example, the NFP program reduced days hospitalized for injuries/ingestions and improved maternal health behavior, e.g. less cigarette smoking (for an overview see Olds 2006). In order to investigate how transferable the results from the U.S. are, the German federal government founded the *Pro Kind* pilot project, which represents the first randomized controlled trial to investigate the effectiveness and efficacy of a home visiting program in Germany. The *Pro Kind* program is an adaptation of the NFP program, which provides instructions for home visit frequency, employee selection, teaching material, and guidebooks (see Jungmann et al. 2009; Sierau et al. 2015; Olds 2006) for more information about the *Pro Kind* project and NFP).

The *Pro Kind* intervention started between the 12th and 28th week of pregnancy, extending up to the child's second birthday. Midwives conduct the home visits either continuously or in a tandem model with social pedagogues and a pediatric nurse (Brand and Jungmann, 2012). The frequency of the home visits varies according to the NFP model prescription between weekly, biweekly, and monthly visits, with the highest frequency directly before and after birth. Overall, 52 home visits with an average duration of 90 minutes are scheduled between pregnancy and the child's second birthday. Teaching materials and visit-by-visit guidelines (both adapted from NFP in which they were proven successful) structure the theme and aim of each home visit. Nevertheless, home visitors have the flexibility to adapt the contents to maternal needs and the familial situation. All home visitors regularly receive feedback, encouragement, reflection, and support from nurse supervisors. Process evaluation data shows that the *Pro Kind* intervention was well implemented. On average families received 32.7 home visits (SD = 19, range: 0-94) and 45.3 home visits when they stayed in the program until the child's second birthday.

One of the major goals of *Pro Kind* is the improvement of maternal and child health. In order to achieve these goals the project aims at

(I) increasing utilization of immunizations and preventive care (prenatal checkups, dental checkups and oral health care, post-natal checkup for the child),

(II) improving maternal health behavior, e.g. healthy diet, breastfeeding, reduction of

maternal smoking, child passive smoking, alcohol and substance use,

(III) increasing maternal self-efficacy to improve her mental health and well-being,

(IV) ensuring mothers interact safely with the child and provide a safe environment.

The last topic was the most dominant in the *Pro Kind* guidelines with 18 home visits scheduled to cover safety aspects. In 11 home visits the focus was on maternal health behavior with five home visits focusing on smoking reduction and five visits focusing on a healthy diet. Materials of four visits include utilization of immunization and other preventive services. Four home visits are devoted to oral health care. This topic was particularly highlighted as participants received a box with oral health care products, such as tooth brushes, and home visitors received an extra training session on oral health from a dentist (see Meyer et al. (2014) for a description of the oral health module). Health and health-related topics dominated the implementation of the *Pro Kind* program. In self-ratings of the devoted time for each home visit, the home visitors stated that they invested 50 percent of their time with the family during pregnancy to the domains Maternal Health, Environmental Health and Social and Health Services. This share slightly decreased to 38 percent in the first year of life and to 34 percent in the second year of life (Brand et al. 2013).

In order to recruit families who are most likely to benefit from the *Pro Kind* intervention, the program was restricted to financially and socially disadvantaged first-time mothers. Financial disadvantage is mainly defined as receipt of social welfare benefits while social risk factors included, for example, low education, teenage pregnancy, and health problems. Project partners, like gynecologists, job centers, pregnancy information centers, and youth welfare offices, referred about 75 percent of the participants to *Pro Kind*. About 25 percent self-registered into the program, which was advertised, for example, in gynecologist's offices and pregnancy information centers.

The *Pro Kind* project was implemented between 2006 and 2012 in 13 implementation sites of three German federal states covering rural and urban regions as well as regions in Eastern and Western Germany. This mixture of sites ensures that the program was implemented under varying regional conditions in terms of the availability of child care, health care provision, and labor market conditions.

Besides health, the intervention also aims to improve maternal parenting, child development and the development of the maternal life course. Previous literature about the outcomes of the *Pro Kind* program examined the effects of the intervention on child cognitive development, maternal skills, and maternal life course (Sandner and Jungmann 2016; Sandner 2015; Sierau et al. 2015). These articles found positive effects on child cognitive development concentrated on girls, higher maternal skills in some domains, more subsequent births and lower maternal

employment for mothers in the treatment group. A systematic examination of the effects of the intervention on child and maternal health is absent so far.

3. Data and Randomization

The *Pro Kind* program was implemented as a randomized controlled trial. 755 expectant mothers were enrolled into the trial and randomly assigned to the treatment group (N=394) and to the control group (N=361). While expectant mothers in the treatment group received the described home visits, mothers in the control group had access to the regular German health care services. Details about the randomization procedure and the successful randomization into two balanced groups can be found in Sierau et al. (2015) or Sandner and Jungmann (2016).

We use administrative health insurance and survey data to measure the health and the health service utilization of mother and child and the health behavior of the mother. In Germany, health insurance is compulsory and covers all costs for preventive utilization (including dental examinations), prescriptions, hospitalizations, GP visits, and other outpatient services such as routine midwife visits before and after birth.[2] For the *Pro Kind* sample, which consists in large parts of welfare recipients, health insurance contributions are covered by the welfare office. Individuals can choose their health insurance company but competition between the health insurance companies is low because of almost identical charges and similar services. Additional private health care expenditure is very rare, in particular for this target group. Therefore, health service utilization recorded in the public health insurance data is a sensible proxy for health and preventive utilization in Germany.

Our main administrative dataset consists of health insurance records from AOK, the largest public health insurance company that covers around 30 to 40 percent of the German population depending on the federal state.[3] We have access to this data for all three German federal states in which the *Pro Kind* trial was implemented (Lower Saxony, Bremen and Saxony). The AOK data include hospital utilization (date, days in hospital, DRG, ICD, costs), all medical prescriptions (date, ATC-code, costs) and utilization of midwifes before and after birth. We use further administrative data from the Association of Statutory Health Insurance Dentists (Kassenzahnärztliche Vereinigung, KZV) for Lower Saxony and Bremen.[4] This data includes

[2] In Germany, the public health insurance pays for routine midwife visits but pregnant women are responsible to contact a midwife and arrange appointments. Midwife visits can start during pregnancy and continue until eight weeks after birth. Visits can continue until one year after birth if medically indicated. The appointments mainly include health checks of the child and the mother and some counselling.

[3] Low income households are overrepresented in the AOK because 15 percent of the population, who are above a certain income threshold, or who are civil servants, can choose to be insured with a private health insurer and some public health insurance companies are more focused on specialized employees with often higher incomes.

[4] The regional KZVs are public bodies with compulsory membership for all dentists who provide services financed through the public health insurance. Dentists receive remuneration for publicly financed services not from the public health insurances directly, but indirectly through the KZVs.

dates and cost codes of dentist visits. Cost codes enable to derive the diagnosis and to classify the services into diagnosis and counseling, prophylactic and therapeutic utilization. All visits within the borders of the federal state are covered. Finally, we use data from four face-to-face interviews (during pregnancy, as well as 6, 12 and 24 months after birth). These include questions on maternal health behavior, health care utilization for mother and child, and questions on maternal and child physical health and maternal mental health.

Table 1 gives an overview of the numbers of observations in the baseline sample and the different administrative and follow-up survey samples used in our analysis. The baseline sample covers all expectant mothers who originally registered for the study and participated in the initial interview. As Table 1 shows, the AOK insurance data comprises somewhat above 30 percent of the observations in the baseline sample. This data availability results from the combination of two factors. Although about 55 percent of the original participants are insured in the AOK, for one third of them a successful match to their health insurance record was impossible because their self-reported health insurance number was missing or incorrectly reported. For individuals included in the sample, data is available over our full period of analysis (up to 24 months of age of the child). As we show below, presence in the AOK sample is not related to treatment status.[5] Overall, the AOK sample still has a convenient size of 244 mothers and 220 children, which is larger than in other early childhood intervention trials.[6]

Data from the dental health administrative sample is available for about 70-80 percent of the baseline sample in the regions of Lower Saxony and Bremen (see bottom rows of Table 1). The main reason for missing observations in the dental health sample is similar to that for the public health insurance data. However, the regional associations of public health insurance dentists cover all individuals in a certain region, which explains the higher data availability for dental services.

In the survey data there is some attrition over time, with about 70 percent of mothers in the baseline sample answering to the survey at pregnancy, and the response rate gradually declining to just below 50 percent at the last survey at 24 months of age of the child. The most important reasons for non-compliance were loss of contact with the family, or relocation. Such attrition is very common in panel surveys with low SES samples and only poses a threat to identifying a

[5] For every mother participating in the program there should be a connected child, but it is possible that in the administrative data some mother-child pairs are incomplete. This was mainly the case when the mother only participated in the pregnancy survey in which the health insurance number of the child was not yet available, or when the mother's or the child's health insurance number was missing or misreported in the survey.

[6] For example, the Perry Preschool Project had 123 participants (Heckman et al. 2010) and in Doyle et al. (2015), who analyze a home visiting program in Ireland, 173 of the initial 233 participants remained in the study at the 6-month interview.

causal effect if the attrition is correlated to the treatment, something we investigate below.[7]

To identify causal effects of the intervention on maternal and child health, characteristics of mothers and children for whom administrative and survey data is available should be balanced between treatment and control group. Successful randomization into the study groups of the *Pro Kind* trial ensures that this is the case in the baseline sample (Sierau et al. 2015; Sandner and Jungmann, 2016). However, as shown above, the samples used in our analysis are available for a subset of individuals only. In Appendix Table A.1 we show that participants included in the administrative data deviate somewhat from the baseline sample in terms of their observed characteristics. This might indicate that some of the most disadvantaged participants may be underrepresented in the administrative data, probably because they might have been more likely to misreport their health insurance numbers.

Such differences in characteristics across samples would only violate the internal validity of our study if the attrition was related to treatment status. For the administrative AOK data, attrition based on treatment status is very unlikely and could only occur if individuals change their health insurance or move away from their federal state as a result of being assigned to the treatment group. For the administrative dental health data, only moving across state borders based on treatment status could lead to differential attrition. Both, switching between health insurances and moving across state borders is rare in the target group of the program. We therefore do not expect differential attrition by treatment status to be a problem in the administrative data. This is confirmed in Table 2, in which we show that for both, the AOK and the dental sample, and for mothers and children, the characteristics are overwhelmingly balanced across treatment and control group. Only three of the 120 hypothesis tests in the table (30 outcomes in 4 samples) indicate a weak statistically significant difference.

Differential attrition across treatment and control groups could be more likely in the survey data than the administrative data, in case the program affects the participants' motivation to respond to follow-up surveys. However, it has been shown elsewhere (Sandner and Jungmann 2016) that, similarly to what we show for the administrative data, individuals included in the follow-up survey data have fewer risk factors, but their characteristics are balanced across treatment and control groups.

A further important fact shown in Table 2 is that *Pro Kind* indeed reached a highly disadvantaged target group. Besides many socioeconomic risk factors (e.g., 44 percent are teenage mothers), the women show health related risk factors and adverse health behavior (e.g., 34 percent state to smoke daily during pregnancy).

[7] The levels of attrition we observe in the survey data are comparable to attrition of disadvantaged populations in other panel surveys. For example, in the KIGGS study or in the Panel Study 'Labour Market and Social Security' (PASS) retention is around 50% for low SES or welfare receiving households (Lange et al. 2014; Berg et al. 2010).

4. Estimation Strategy

The balanced characteristics between treated and controls shown above indicate that the randomization holds in our different estimation samples. Simple mean comparisons between the treatment and control group therefore yield valid causal effects. This constitutes our baseline approach, which for a given outcome Y and treatment indicator D can be written as

$$\beta = E[Y|D = 1] - E[Y|D = 0] \quad (1)$$

If treatment effects are heterogeneous, it is important to clarify which treatment parameter a given estimation method identifies. If equation (1) is applied to a sample that is representative of the population of disadvantaged women to which the *Pro Kind* program was targeted, β will identify the average treatment effect (ATE) for that population. While nobody in the control group had access to the treatment, participants who were assigned to the treatment group could in principle reject it. However, compliance was almost complete (97.7 percent of the participants in the treatment group received at least one home visit), meaning that (1) yields the causal effect of treatment, not an intention-to-treat effect.

As shown in Appendix Table A.1, however, the average observed characteristics in our estimation samples differ slightly from those in the wider baseline sample. This implies that β in (1), while still causal, is not fully representative for the target population. For this reason we also implement an alternative strategy based on inverse probability weighting (IPW). This approach modifies (1) by weighting treatment and control means by the inverse of the (treatment and control-group specific) probability of being included in the estimation sample. For this we run logit regressions of an indicator for whether an individual is included in the estimation sample, separately for treatment and control groups, on the observed baseline characteristics shown in Table 2. We then construct the weights as the inverse of the predicted probability from these regressions. Under the assumption that the attrition pattern is determined solely by observed characteristics, this weighting ensures that the results are representative for the characteristics of the baseline sample. These results should thus have external validity in predicting the effect of the program that we can expect if the program would be implemented at a larger scale on a population with similar baseline characteristics.

For inference, we rely on several different types of hypothesis tests. As a benchmark, we present results from a standard t-test of the equality of means across treatment and control group. As an alternative, we present results of a permutation test. The classical t-test obtains a p-value by comparing the test statistic to its theoretical sampling distribution derived from distributional assumptions. These assumptions are unlikely to hold in small samples and with non-normally distributed data. In this case a permutation test is preferable (Hayes 1996, Heckman et al. 2010). It obtains a p-value by comparing the test statistic to a distribution

generated from the observed data. This distribution of the test statistic is generated by randomly permuting the treatment indicator across individuals and repeatedly estimating the test statistic, which provides a data-driven distribution of the test statistic under the null hypothesis.

Finally, to take into account that we analyze many outcomes, we present p-values that adjust our results for multiple hypothesis testing (MHT), a problem increasingly recognized in the literature on early childhood interventions (e.g., Anderson 2008, Heckman et al. 2010, Doyle et al. 2015). To control the family-wise type I error rate within a family of outcomes at the desired level α, we conduct MHT based on the Romano-Wolf method (Romano and Wolf 2005a,b), as implemented and extended by List, Shaikh and Xu (2015).[8] This method provides adjusted p-values that we display alongside our results. For the purpose of MHT, we group variables together into a family if they measure conceptually the same or a similar outcome, for example different measures of health care costs or different prescription-based and diagnosis-based measures proxying for the same underlying medical condition.

5. Results

5.1 Health care utilization

In Table 3 we report program effects on the overall utilization of health care by mothers and children based on the administrative data. Throughout the paper, we assign outcomes that measure a similar underlying concept into groups that are identified in the tables by bold titles. When conducting multiple hypothesis tests, we control the family-wise error rate within each of the groups. In Table 3 the main groups consist of hospital utilization at different stages and overall cost, separately for mother and child, as well as midwife utilization for the mothers. Overall cost is a particularly attractive summary measure, because it is sensitive not only to the quantity of health care utilization (such as number of admissions), but also to the severity of the underlying conditions. Moreover, hospitalizations are an important outcome because the available U.S. evidence on home visiting points towards a reduction in hospitalizations due to injuries and accidents. However, in contrast to the U.S. evidence, none of these important outcomes in Table 3 is statistically significantly affected by the program.

5.2 Diagnoses and prescriptions

Following the goals and guidelines of the *Pro Kind* program, we used hospital diagnoses codes (ICD codes) and medication prescriptions (ATC codes) to generate seven groups of child health outcomes that the program could have affected. The groups are identified by bold titles in Table 4 (see Appendix Table A.9 for a more detailed description of the individual variables). Only

[8] We implement both, the individual permutation tests and the multiple hypothesis tests based on the Stata command ***mhtexp*** developed by these authors, using 10,000 repetitions.

two of the groups contain small statistically significant differences based on *individual* hypothesis tests. Among respiratory tract conditions, there is a decrease in prescriptions of drugs for obstructive airway diseases (significant at the 5%-level), and on the subgroup of antiasthmatic drugs (significant at the 10%-level). Among injuries and poisonings, point estimates indicate an increase in hospitalizations due to head injuries, as well as in hospitalization for other injuries, burns, corrosion and poisoning (the latter outcome being significant at the 10%-level in an individual permutation test) and there is a decrease in prescriptions of emollients and protectives (individually statistically significant at the 10%-level). However, after MHT, we do not find effects in any of the seven groups. Therefore, our overall conclusion from the results in Table 4 is that child health outcomes, as proxied by diagnosis codes from hospitalizations and from medication prescriptions, are not statistically significantly affected by the program.

In Table 5 we report the results for a similar range of outcomes defined for mothers. For one group of variables, maternal mental health, we find significantly (1%-level in an individual t-test, 10%-level when adjusting for multiple hypothesis testing) reduced prescriptions of calmatives. Below we show that this finding is backed up by survey evidence of a reduction of the program of maternal stress and depression. For the other outcome groups we do not find any significant effect after adjusting for MHT. Overall, the combined findings of Tables 4 and 5 suggest very little effect of the program on mother and child health outcomes, with the notable exception of a positive effect on maternal mental health.

5.3 Dental Health

To check whether the program affected dental health outcomes and utilization, we now switch to the dental health administrative dataset. In Table 6 we present results for mothers (top panel) and children (bottom panel). For mothers, the results show a significant increase in dentist visits during pregnancy, which appear to be entirely driven by prophylactic visits. We find an increase of 12 percentage points in the probability to attend at least one prophylactic visit, compared to a control group mean of 17 percent. This increase is individually highly significant and remains statistically significant at the 5%-level when applying a multiple hypothesis test. In the second group of maternal outcomes, measured in the period from after pregnancy up to age 2 of the child, there is an individually significant effect on the probability of at least one therapeutic dentist visit, but this effect is not significant in multiple hypothesis testing.

With respect to dentist visits of the child, there is an interesting pattern of increased prophylactic visits and decreased therapeutic visits, which is individually statistically significant, but not according to multiple hypothesis tests. Our overall reading of the results in Table 6 is

that the *Pro Kind* program increased maternal prophylactic dentist visits during pregnancy, and that it may also have had an effect on maternal and child dentist visits from birth up to age 2 of the child.

5.4 Survey Data

All previous results were based on administrative data. We now turn to survey data to check whether the previous results are in line with maternal self-reports on health behavior and other health outcomes. We again arrange variables into groups of outcomes according to the program goals the time at which they were surveyed. The top panel of Table 7 reports results on important maternal health behaviors that were targeted by the program: smoking, breastfeeding and nutrition of the child. At pregnancy, a strikingly high percentage of women in the control group smoke daily (29 percent), and even more state that they smoke in general (37 percent). The program, however, seems to have had no effect on this behavior. Six, twelve, and twenty-four months after birth, maternal smoking in the control group increases from 37 percent during pregnancy to 60 percent, with again no effect of the program on this behavior (with the exception of an individually significant *increase* in daily smoking at 12 months, which becomes insignificant after adjusting for multiple hypothesis testing). Breastfeeding behavior is surveyed at 6 months after birth. Here, 49 percent of mothers in the control group report not having breastfed for longer than one month. After adjusting for MHT, there is no statistically significant treatment effect on this outcome or on any of the other maternal health behaviors reported in the table.

The bottom panel of Table 7 reports results on preventive health utilization according to maternal survey responses. Outcomes include prenatal screening, vaccinations, and postnatal checkups. While there are no significant effects of the program on these group of outcomes, the control group means suggest that the target population as a whole shows relatively good preventive health behavior, with 83 percent of mothers attending all recommended prenatal checkups, 98 percent attending all 4 postnatal checkups up to age 1 of the child, a number that gradually falls to 68 percent for all 7 postnatal checkups recommended up to age 2 of the child.[9] Furthermore, almost all mothers have had their children vaccinated.

Table 8 reports the results for additional measures from the survey data, in particular maternal mental health (top panel), as well as birth outcomes and information on accidents of the child at 12 and 24 months after birth (bottom panel). Maternal mental health is captured by the outcomes depression, anxiety and stress, constructed from the Depression, Anxiety, and

[9] The reduction at the 7th postnatal checkup may be explained with a timing effect. The recommended age for the 7th postnatal checkup is between the 22 and 24 months after birth. A small delay in the checkup would therefore mean that it wouldn't be recorded in the interview 24 months after birth.

Stress scales (DASS, Lovibond and Lovibond 1995).[10] Interestingly, almost all the maternal mental health indicators show negative point estimates, suggesting that the *Pro Kind* program improved maternal mental health. The reduction is individually statistically significant at the 5%-level for stress at 6 months after birth, and for depression at 24 months after birth, and this latter effect remains significant at the 10%-level after adjusting for multiple hypothesis testing. The program reduced the probability of maternal depression by 9 percentage points, compared to a control group mean of 27 percent. This corroborates the finding from the administrative data in Table 5, where we found a strong reduction in prescriptions of psycholeptics.

The results on child health, reported in the bottom half of Table 8, confirm our earlier findings from the administrative data of no statistically significant effects of the program on birth outcomes. For both surveys, at 12 months and at 24 months after birth, the results also confirm that the program did not affect the probability of accidents of the child. Thus, the individually statistically significant positive effect in the administrative data on other injuries, burns, corrosion, or intoxication reported in Table 4 is not confirmed by any statistically significant effect in the survey data.

5.5. Additional results

In this section we briefly discuss additional results obtained from the inverse probability weighting (IPW) described in Section 4, and from a separate analysis by gender. The IPW results can be found in Appendix Tables A.2 to A.7 and correspond to the same outcomes as in Tables 3 to 8. Overall, the weighted estimates are very similar to the baseline results. In particular, the results of an improvement in maternal mental health (both in administrative and survey data) and of an increase in dental utilization hold and are of very similar magnitude as before, with otherwise no clear effect on mother or child health and no indication of any effects on breastfeeding or smoking.[11]

Appendix Table A.8 reports separate results by gender for the child health outcomes included in Tables 3 and 4. One noteworthy result is that the individually significant reduction in medication for obstructive airway diseases shown in Table 4 seems to be entirely driven by girls, for whom the effect is now much larger and significant at the 5%-level after adjusting for multiple hypothesis testing across outcomes and gender subgroups. We are not aware of any research on gender differences in the physiological effect of cigarette smoke on children. If the

[10] The DASS consists of 42 negative emotional symptoms. Participants rate the extent to which they have experienced each symptom over the past week, on a 4-point severity and frequency scale. Subscale scores are determined by summing up the values for the relevant 14 items. Internal consistencies (coefficient alpha) for each scale for the DASS normative sample were: Depression 0.91; Anxiety 0.84; Stress 0.90.

[11] Some effects that were not individually significant in the baseline results become individually significant at the 10%-level in the IPW results, but these are partly contradictory and show no clear pattern, as they imply an increase in birth complications and early delivery (Tables A.4 and A.7) at the same time as an increase in birth weight (Table A.7).

gender difference in the treatment effect on obstructive airway diseases is indeed related to maternal smoking, the only plausible mechanism would be that mothers of girls reduce smoking in presence of their child in response to the program while mothers of boys do not. When we break up the results of maternal smoking behavior in Table 7 by gender of the child, however, we do not find any evidence of a differential program effect on smoking by gender of the child. It is thus difficult to argue that the effect on obstructive airway diseases for girls is due to a reduction in maternal smoking. The only other effect in Table A.8 that gains statistical significance at the 5%-level with MHT is a reduction in prescriptions of antifungals for dermatological use for girls, but not for boys.

6. Discussion and Conclusion

Based on a unique combination of survey and administrative data, this paper exploits a randomized controlled trial to provide a comprehensive evaluation of the effects of a home visiting program targeted towards disadvantaged pregnant mothers in Germany on a wide range of health outcomes. Overall, we find no effects on most types of health utilization, health behaviors, and a wide range of physical health measures, with the exception of some effects on the utilization of oral health care. Most interestingly, we find that the intervention had a robust and sizable positive effect on maternal mental health as evidenced by both, a reduction in prescriptions of psycholeptics recorded in the administrative data, and reductions in depressions reported in the survey data.

A mental health effect of an intervention that did not primarily focus on this outcome is in line with similar findings from the Moving to Opportunity program (MTO), in which disadvantaged families were offered vouchers to move to low-poverty neighborhoods (Ludwig et al. 2013), and the Oregon Health Insurance Experiment, which expanded access to health insurance (Finkelstein et al. 2012).[12] In our study this effect is particularly noteworthy not only because maternal stress and mental health affect child outcomes (e.g. Junge et al. 2016; Aizer at al. 2016, Carlson 2015), but also because the target population of disadvantaged first-time mothers has a particularly elevated risk of mental health problems. There is a well-documented SES gradient in mental health (Aneshensel 2009; Muntaner et al. 2004; Wildman 2003) which is thought to be caused by stressors related to social disadvantage (Aneshensel 2009; Dohrenwend 2000; Turner et al. 1995) combined with a reduced access to psychosocial support and reduced effectiveness of such support (Aneshensel 2009). Stressful life events and lack of social support are also among the main risk factors for developing postnatal depression (Dennis 2005, Cooper and Murray 1998). Our data confirm the pattern that mothers who are exposed to more social

[12] Child benefit programs have also been shown to affect maternal mental health positively (Milligan and Stabile, 2011).

risk factors (stressors) and who are more socially isolated have worse mental health and a larger beneficial treatment effect from the program.[13] These findings suggest that the Pro Kind program may affect mental health because the home visits compensate for the lack of social support of socially disadvantaged mothers who face a stressful life environment. A constituent idea of the program is that the personal relationship and attachment between mother and home visitor built over the frequent and intensive visits fosters maternal self-efficacy. Higher self-efficacy, defined as the mother's belief of being able to achieve goals and influence outcomes, may increase the ability to cope with a stressful life environment. Our data offer some support for the idea that the attachment between mother and home visitor matters as a channel for the mental health effects, as we find that the beneficial effects on stress, depression and anxiety are greater among mothers who had the same home visitor throughout the program.[14]

Why did the program fail to affect child health and several important domains that were explicitly targeted, such as maternal smoking behavior, breastfeeding, and prevention of accidents? A possible reason could be that in a European style public health insurance system, the disadvantaged target group already receives high levels of preventive and acute health care. As we illustrate in Figure 1, only 10 percent of low SES mothers in Germany miss any of the six recommended postnatal checkups in the first year of life, not dramatically different from the 5 percent of high SES mothers who do so.[15] In addition, mothers can receive home visits during pregnancy and after birth by an obstetric nurse or midwife of her own choice, financed through the public health insurance. In our analysis we find that 70 percent of mothers in the control group make use of midwife consultations before birth, and 83 percent after birth (Table 3). These high take-up rates and the associated care and advice the mothers receive may be part of the reason why we find little effects on utilization, child health, and child accidents (which also do not differ markedly by SES—see Figure 1). In line with recent evidence from the UK and Ireland (Robling et al. 2016; Doyle et al. 2015), home visiting might thus be less effective when embedded in a European style public health insurance system that grants disadvantaged mothers comprehensive access to health care services. In the U.S., in contrast, where over one

[13] In Appendix Table A.10 we show that prescriptions of psycholeptics in the control group are concentrated among mothers with more social risk factors and higher social isolation. Because no mother in the treatment group has any psycholeptics prescribed, this implies that the program has stronger beneficial mental health effects for mothers with more social risk factors and higher social isolation.

[14] We show some evidence for this in Appendix Table A.11, where we present results from re-estimating the mental health outcomes at 6 and 24 months after birth on the sample of mothers who experienced no change in their home visitor. This magnifies the effects on depression, anxiety and stress by about 30 percent on average compared to the baseline results in Table 8, suggesting that the beneficial mental health effects are larger for mothers who have a more stable and consistent relationship with their home visitor. Home visitors changed in about 10% of cases, for example if home visitors moved or went into maternity leave.

[15] Figure 1 is based on data from the German Health Interview and Examination Survey for Children and Adolescents (KIGGS) (Kurth 2007). Rates in the *Pro Kind* control group are very similar to the low SES-KIGGS sample as shown in the result section. Postnatal checkups are paid by health insurance but take-up is voluntary. Checkups 1 to 3 are recommended in the first month after birth, 4 to 6 in the next 11 months. The focus of the checkups is on age specific topics, such as mental and physical development, immunization or preventing sudden infant death syndrome.

fifth (21.3 percent) of reproductive-aged females are uninsured, and 42 percent of women with less than high school diploma do not seek prenatal care in the first trimester of pregnancy (U.S. Department of Health and Human Services 2013), home visiting programs appear to have clearer beneficial effects on child health outcomes than in the European context (Avellar and Supplee 2013; Peacock et al. 2013).

Nevertheless, despite good health care access of our target group, Figure 1 also shows a clear SES gradient in adverse maternal health behavior. A high share of low-SES mothers in Germany smokes during pregnancy (35 percent), while only few high-SES mothers do so (4 percent). Low-SES mothers are also more likely to breastfeed for only a short period (less than one month) than high-SES mothers (42 percent versus 15 percent). This raises the question why the program did not lead to improvements in these areas. The main channels through which the Pro Kind program intended to affect maternal behavior are the transmission of information and the fostering of maternal self-efficacy promoted by the attachment between mother and home visitor. Evidence reported in Table 7, showing a reduced level of maternal smoking during pregnancy, a relatively low share of child passive smoking, and relatively high rates of breast feeding *initiation* (79% in the control group), suggests that the harm of smoking during pregnancy and the benefits of breastfeeding are widely known in the target population. Therefore, the program may not have transmitted new information in these areas. Moreover, changing behaviors such as smoking or breastfeeding is costly to the individual, as smoking is an addiction, and breastfeeding is time-consuming and requires perseverance in case of difficulties. Even if the program fostered self-efficacy through the attachment between mother and home visitor, as the mental health effects suggest, this may not be powerful enough to change these behaviors, in particular as the explicit policy of the program was not to put pressure on participants in order to maintain a close relationship between mother and home visitor to avoid withdrawal from the program.[16] The case is different for the utilization of dental health treatments, on which we find an effect. Here, the program may have transmitted new information on the risk of maternal oral infections to the unborn child (Sanz and Kornmann 2013; Vergnes and Sixou 2007), and taking up dental services in a publicly funded health care system which is largely free of charge at the point of use does not seem overly costly.

Overall, we conclude that home visiting targeted towards disadvantaged families has limited effectiveness in closing the SES gradient in child health, in particular if embedded within a comprehensive public health insurance system with generally good health care access of the target group. It is also unlikely to have strong effects on maternal health behaviors that are

[16] The program was guided by the idea that participants are masters of their own life, with the home visitors merely offering support. For example, home visitors would only support participants in giving up smoking if participants explicitly stated this goal and asked for help. It was feared that any form of pressure would make the program less effective by harming the attachment between home visitor and participant.

difficult to change, such as smoking and breastfeeding. The most important effect it appears to have in this context is a beneficial effect on maternal mental health. This suggests that mental health effects of similar types of policy interventions should be routinely investigated. Auxiliary evidence that we provide suggests that the mental health effect is driven by the personal relationship between mother and home visitor that substitutes for a lack of social support of the target group experiencing stressful life events.

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Table 1: Sample size of baseline and estimation samples

	Observations Control Group	Observations Treatment Group
Baseline (Lower Saxony, Bremen, Saxony)	361	394
Insurance Data (AOK)		
Mother	115	129
Child	95	125
Survey Data		
Pregnancy	247	276
6 Months	240	265
12 Months	205	227
24 Months	168	178
Baseline (Lower Saxony, Bremen)	240	265
Dental Care (KZV)		
Mother	168	197
Child	147	181

Notes: The table reports the numbers of observations by treatment and control group status that are available in the different samples used in the subsequent analysis.

Data Source: Four waves of the Prokind participant survey; administrative data from the AOK public health insurance and from KZV public dentists' association.

Table 2: Balancing tests for baseline characteristics

	AOK				**Dental**			
	Child		Mother		Child		Mother	
	Mean CG	*Diff TG-CG*	*Mean CG*	*Diff TG-CG*	*Mean CG*	*Diff TG-CG*	*Mean CG*	*Diff TG-CG*
Demographic Characteristics								
Teen	0.44	0.00	0.45	0.00	0.41	-0.03	0.43	-0.03
Age in Years	21.62	-0.52	21.78	-0,94*	21.64	0.64	21.61	0.42
Week in Pregnancy	20.43	-0.45	20.49	-0.51	19.82	0.01	19.52	0.26
German Nationality	0.09	-0.03	0.08	-0.02	0.12	-0.01	0.13	-0.02
Underage	0.16	0.07	0.17	0.07	0.15	0.02	0.16	0.02
Mon. HH-Inc. in EUR	986	-36	959	-22	1020	13	985	58
Debt over 3000 EUR	0.17	-0.01	0.17	-0.02	0.14	0.06	0.14	0.06
Education Risk	0.79	-0.02	0.81	-0.03	0.76	-0.04	0.77	-0.03
Income Risk	0.77	0.04	0.77	0.03	0.74	0.04	0.77	0.01
Employment Risk	0.85	-0.04	0.88	-0.06	0.86	-0.06	0.88	-0,07*
No Partner	0.25	0.00	0.25	0.01	0.27	0.02	0.28	0.01
Living with Parents	0.28	0.02	0.29	0.02	0.33	-0.08	0.30	-0.05
Persons in HH	2.55	0.07	2.58	0.04	2.54	-0.02	2.51	0.00
Psychological and Physical Characteristics								
Unwanted Pregnancy	0.08	0,08*	0.10	0.07	0.16	0.02	0.16	0.03
Daily Smoking	0.34	0.01	0.34	0.05	0.36	-0.03	0.38	-0.05
Isolation	0.09	-0.03	0.09	-0.03	0.08	-0.03	0.08	-0.04
Foster Care Exper.	0.14	0.06	0.17	0.05	0.16	0.05	0.17	0.03
Neglect Experience	0.37	-0.03	0.41	-0.07	0.35	-0.02	0.37	-0.03
Loss Experience	0.52	-0.01	0.55	-0.04	0.55	-0.06	0.55	-0.05
Violence Ever	0.08	-0.03	0.09	-0.04	0.07	-0.01	0.08	-0.02
Depression	0.13	-0.01	0.15	-0.05	0.07	0.01	0.10	0.00
Anxiety	0.20	-0.06	0.20	-0.04	0.14	0.02	0.16	0.01
Stress	0.27	0.03	0.27	0.03	0.24	0.02	0.28	-0.01
Aggression	0.17	-0.06	0.17	-0.01	0.14	-0.03	0.17	-0.03
Body-Mass-Index	25.43	0.30	25.31	0.25	25.74	-0.14	25.33	0.27
Medic. Indic. Risk Preg.	0.08	0.03	0.09	0.04	0.13	-0.01	0.13	0.00
Sum Risk Factors	5.65	-0.17	5.86	-0.25	5.43	-0.12	5.68	-0.27
Lower Saxony	0.32	0.02	0.29	0.03	0.50	0.05	0.54	0.02
Bremen	0.31	-0.08	0.31	-0.07	0.50	-0.05	0.46	-0.02
Saxony	0.38	0.06	0.40	0.04				
Observations	*95*	*220*	*115*	*244*	*147*	*328*	*168*	*365*

Notes: The table reports control group means (CG) and differences between treatment and control group means (TG-CG) for observed characteristics from the baseline survey separately for mothers and children who are included in the two administrative samples (AOK and Dental) used in the subsequent analysis. Statistically significant at the *** 0.01 level, ** 0.05 level, * 0.10 level.

Data Source: Prokind participant survey at baseline.

Table 3: Health care utilization

	Mean CG	*Treatment effect*	*Std. error*	p-values *t-test*	*permut.*	*MHT*
			Mother			
Hospital during Pregnancy and at Birth						
Any Admission at Birth/Pregnancy	1.00	-0.016	(0.01)	0.181	0.153	0.289
Nights in Hospital	11.28	2.016	(2.83)	0.476	0.501	0.501
Nights in Hospital (cond. on Admis.)	11.28	2.226	(2.84)	0.434	0.464	0.476
Hospital 0-2 (without Birth and Pregnancy)						
Any Admission after Birth	0.35	-0.038	(0.06)	0.533	0.534	0.783
Nights in Hospital	3.85	-0.930	(1.20)	0.441	0.467	0.734
Nights in Hospital (cond. on Admis.)	11.08	-1.650	(3.17)	0.604	0.613	0.613
Midwife Utilization (Health Insurance Financed)						
Total Contacts	18.55	-0.633	(1.55)	0.683	0.677	0.824
Number of Contacts during Preg.	6.41	-0.804	(0.83)	0.333	0.332	0.665
Number of Contacts after Birth	12.03	0.222	(1.03)	0.829	0.832	0.832
Any Contact during Preg.	0.70	-0.052	(0.06)	0.389	0.384	0.665
Any Contact after Birth	0.83	0.065	(0.04)	0.142	0.141	0.415
Costs						
Cost hospitalisation	4712	489.46	(704)	0.488	0.505	0.756
Cost medication	261	-61.15	(79)	0.442	0.503	0.880
Costs Midwifes (heal. insur. financed)	525	-8.38	(49)	0.864	0.862	0.862
			Child			
Hospital at Birth						
Any Admission at Birth	0.12	0.012	(0.04)	0.786	0.781	0.781
Nights in Hospital	5.58	-3.819	(2.86)	0.183	0.375	0.623
Nights in Hospital (cond. on Admis.)	48.18	-34.43	(20.85)	0.111	0.377	0.612
Hospital 0-2 (without Birth)						
Any Admission	0.46	-0.031	(0.07)	0.647	0.646	0.886
Nights in Hospital	6.24	-0.162	(2.94)	0.956	0.961	0.961
Nights in Hospital (cond. on Admis.)	13.48	0.597	(6.26)	0.924	0.932	0.986
Costs						
Cost hospitalisation	5671	-1938	(2372)	0.415	0.499	0.743
Cost medication	432	7.32	(142)	0.959	0.962	0.962

Notes: The table reports control group means (CG) and treatment effects (simple mean difference between treatment and control group means) for measures of health care utilization. See Appendix Table A.9 for a more detailed definition of the variables. p-values below 0.1 are in bold. The first two p-values in each row are for individual hypothesis tests using a standard t-test and a permutation test. The third p-value is from a multiple hypothesis test (MHT) within a family of outcomes. Each bold heading denotes a family of outcomes for the purpose of MHT. Number of observations are 220 for children, 244 for mothers.

Data Source: Administrative data from the AOK public health insurance.

Table 4: Health outcomes from diagnoses and prescriptions (Child)

	Mean CG	*Treatment effect*	*Std. error*	p-values *t-test*	*permut.*	*MHT*
Birth outcomes						
Birthweight Below 2500g (Hosp.)	0.04	-0.010	(0.03)	0.693	0.710	0.710
Other Perinatal Conditions (Hosp.)	0.11	0.023	(0.04)	0.607	0.602	0.837
Respiratory tract conditions						
Diseases of the Respiratory System (Hosp.)	0.18	-0.011	(0.05)	0.832	0.830	0.971
Nasal Decongestants (Presp.)	0.89	-0.007	(0.04)	0.875	0.877	0.877
Drugs for Obstructive Airway Diseases (Presp.)	0.41	-0.131	(0.06)	**0.043**	**0.046**	0.213
Cough and Cold Preparations (Presp.)	0.85	0.019	(0.05)	0.680	0.691	0.970
Antiasthmatic Drugs (Presp.)	0.25	-0.085	(0.05)	0.124	0.130	0.402
Antiasthmatic Drugs More Than Once (Presp.)	0.16	-0.078	(0.04)	**0.072**	**0.083**	0.314
Diseases of digestive system						
Intestinal Infectious Diseases (Hosp.)	0.15	-0.019	(0.05)	0.680	0.680	0.898
Diseases of the Digestive System (Hosp.)	0.04	0.006	(0.03)	0.836	0.832	0.832
Drugs for Gastrointestinal Disorder (Presp.)	0.44	-0.066	(0.07)	0.325	0.331	0.700
Drugs for Constipation (Presp.)	0.17	-0.056	(0.05)	0.229	0.237	0.656
Antidiarrheals or Antiinflammatory Agents (Presp.)	0.39	0.155	(0.07)	**0.023**	**0.023**	0.110
Injuries, Poisoning						
Head Injuries (Hosp.)	0.09	0.033	(0.04)	0.444	0.438	0.438
Other Injuries, Burns, Corrosion, Poisoning (Hosp.)	0.01	0.037	(0.02)	0.118	**0.099**	0.188
Emollients and Protectives (Presp.)	0.36	-0.110	(0.06)	**0.077**	**0.080**	0.219
Dermatological conditions						
Antifungals for Dermatological Use (Presp.)	0.74	-0.113	(0.06)	**0.078**	**0.077**	0.215
Preparations for Wounds and Ulcers (Presp.)	0.18	-0.019	(0.05)	0.711	0.710	0.710
Corticosteroids, Dermatological Prep. (Presp.)	0.14	0.071	(0.05)	0.173	0.163	0.298
Prescription of multipurpose drugs						
Painkillers (Presp.)	0.96	0.018	(0.02)	0.451	0.478	0.727
Antibacterials, Antibiotics for Systemic Use (Presp.)	0.55	0.077	(0.07)	0.254	0.255	0.582
Vitamins (Presp.)	0.44	0.110	(0.07)	0.107	0.106	0.358
Antiinflammatory Products (Presp.)	0.59	0.003	(0.07)	0.970	0.969	0.969

Notes: The table reports control group means (CG) and treatment effects (simple mean difference between treatment and control group means) for health outcomes of children derived from hospital diagnoses (Hosp. = Any admission because of the indicated diagnosis) and medication prescriptions (Presp. = Any prescription in the first two years of life). See Appendix Table A.9 for a more detailed definition of the variables. p-values below 0.1 are in bold. The first two p-values in each row are for individual hypothesis tests using a standard t-test and a permutation test. The third p-value is from a multiple hypothesis test (MHT) within a family of outcomes. Each bold heading denotes a family of outcomes for the purpose of MHT. Number of observations: 220.

Data Source: Administrative data from the AOK public health insurance.

Table 5: Health outcomes from diagnoses and prescriptions (Mother)

	Mean CG	*Treatment effect*	*Std. error*	p-values *t-test*	*permut.*	*MHT*
Birth complications						
Indications Related to Preg./Birth (Hosp.)	0.95	0.037	(0.02)	0.109	0.128	0.241
Complications at Delivery (Hosp.)	0.43	0.101	(0.06)	0.116	0.112	0.298
Complications of Fetus/Newborn (Hosp.)	0.11	-0.020	(0.04)	0.608	0.611	0.611
Fertility						
Second Birth (Hosp.)	0.05	0.056	(0.04)	0.110	0.107	0.201
Contraceptives (Presp.)	0.06	0.102	(0.08)	0.227	0.244	0.244
Mental health						
Mental and Behavioural Disorders (Hosp.)	0.06	-0.014	(0.03)	0.620	0.625	0.625
Psycholeptics - Calmatives (Presp.)	0.06	-0.061	(0.02)	**0.004**	**0.026**	**0.073**
Psychoanaleptics - Antidepressants (Presp.)	0.10	-0.050	(0.03)	0.146	0.156	0.268
Respiratory tract conditions						
Diseases of the Respiratory System (Hosp.)	0.00	0.016	(0.01)	0.181	0.160	0.434
Nasal Decongestants (Presp.)	0.07	-0.062	(0.02)	**0.010**	**0.029**	0.117
Drugs for Obstructive Airway Diseases (Presp.)	0.07	0.023	(0.04)	0.507	0.509	0.509
Cough and Cold Preparations (Presp.)	0.06	0.040	(0.04)	0.258	0.249	0.435
Antiasthmatic (Presp.)	0.05	0.041	(0.03)	0.225	0.225	0.440
Antiasthmatic more than once (Presp.)	0.02	0.037	(0.02)	0.128	0.118	0.311
Prescription of multipurpose drugs						
Painkillers (Presp.)	0.17	0.044	(0.05)	0.382	0.383	0.848
Antibacterials or Antibiotics (Presp.)	0.57	0.023	(0.06)	0.717	0.719	0.719
Vitamins (Presp.)	0.04	-0.020	(0.02)	0.378	0.392	0.768
Antiinflammatory Products (Presp.)	0.28	0.047	(0.06)	0.424	0.422	0.661

Notes: The table reports control group means (CG) and treatment effects (simple mean difference between treatment and control group means) for health outcomes of mothers derived from hospital diagnoses (Hosp. = Any admission because of the indicated diagnosis) and medication prescriptions (Presp. = Any prescription in the first two years of life). See Appendix Table A.9 for a more detailed definition of the variables. p-values below 0.1 are in bold. The first two p-values in each row are for individual hypothesis tests using a standard t-test and a permutation test. The third p-value is from a multiple hypothesis test (MHT) within a family of outcomes. Each bold heading denotes a family of outcomes for the purpose of MHT. Number of observations: 244.

Data Source: Administrative data from the AOK public health insurance.

Table 6: Dental health outcomes

	Mean CG	*Treatment effect*	*Std. error*	p-values *t-test*	p-values *permut.*	p-values *MHT*
			Mother			
Pregnancy						
Any Dental Visit	0.30	0.123	(0.05)	**0.015**	**0.015**	**0.051**
Any Prophylaxis	0.17	0.118	(0.04)	**0.008**	**0.006**	**0.023**
Any Therapy	0.17	0.020	(0.04)	0.619	0.618	0.809
Number of Prophylaxes	0.25	0.263	(0.13)	**0.042**	**0.068**	0.166
Number of Therapies	0.37	0.042	(0.12)	0.731	0.731	0.731
Child Age 0-2						
Any Dental Visit	0.65	0.076	(0.05)	0.115	0.123	0.325
Any Prophylaxis	0.51	0.032	(0.05)	0.542	0.548	0.868
Any Therapy	0.49	0.106	(0.05)	**0.043**	**0.041**	0.143
Number of Prophylaxes	1.16	0.078	(0.18)	0.664	0.671	0.873
Number of Therapies	2.60	0.176	(0.50)	0.724	0.733	0.733
			Child			
Child Age 0-2						
Any Dental Visit	0.19	0.069	(0.05)	0.139	0.130	0.302
Any Prophylaxis	0.18	0.076	(0.05)	0.102	**0.096**	0.238
Any Therapy	0.03	-0.027	(0.01)	**0.026**	**0.091**	0.247
Number of Prophylaxes	0.36	0.010	(0.10)	0.924	0.929	0.929
Number of Therapies	0.18	-0.184	(0.09)	**0.041**	0.138	0.248

Notes: The table reports control group means (CG) and treatment effects (simple mean difference between treatment and control group means) for dental health outcomes of mothers and children. See Appendix Table A.9 for a more detailed definition of the variables. p-values below 0.1 are in bold. The first two p-values in each row are for individual hypothesis tests using a standard t-test and a permutation test. The third p-value is from a multiple hypothesis test (MHT) within a family of outcomes. Each bold heading denotes a family of outcomes for the purpose of MHT. Number of observations are 328 for children, 365 for mothers.

Data Source: Administrative data from the KZV public dentists' association.

Table 7: Maternal health behaviour and preventive utilization (Survey Data)

	Obs.	*Mean CG*	*Treatment effect*	*Std. error*	p-values *t-test*	*permut.*	*MHT*
			Maternal Health Behavior				
Pregnancy							
Smoking	523	0.37	0.033	(0.04)	0.436	0.433	0.746
Daily Smoking	523	0.29	0.010	(0.04)	0.809	0.804	0.962
Expecting Mo. in Room where Smok.	521	0.57	-0.010	(0.04)	0.827	0.828	0.828
6 Months after Birth							
Smoking	499	0.62	-0.041	(0.04)	0.357	0.349	0.898
Daily Smoking	499	0.53	-0.024	(0.04)	0.599	0.596	0.974
Child in Room where Smoking	496	0.11	0.009	(0.03)	0.762	0.762	0.944
No Breastfeeding	503	0.21	0.035	(0.04)	0.349	0.343	0.922
Breastfeeding less than 31 Days	502	0.49	0.009	(0.04)	0.844	0.846	0.846
Any Sugary Drinks	489	0.24	-0.018	(0.04)	0.647	0.653	0.957
Any Sweets	490	0.34	-0.028	(0.04)	0.510	0.509	0.969
12 Months after Birth							
Smoking	431	0.60	0.006	(0.05)	0.903	0.900	0.900
Daily Smoking	431	0.46	0.081	(0.05)	**0.092**	**0.093**	0.288
Child in Room where Smoking	427	0.21	-0.030	(0.04)	0.431	0.426	0.666
Any Sugary Drinks	431	0.45	-0.085	(0.05)	**0.073**	**0.077**	0.297
Any Sweets	431	0.87	-0.053	(0.04)	0.137	0.131	0.338
24 Months after Birth							
Smoking	342	0.57	0.007	(0.05)	0.892	0.889	0.889
Daily Smoking	342	0.49	0.029	(0.05)	0.596	0.588	0.886
Child in Room where Smoking	333	0.27	-0.026	(0.05)	0.592	0.592	0.832
			Preventive Utilization				
Pregnancy							
All Prenatal Screening Examinations	521	0.83	-0.037	(0.03)	0.289	0.287	0.287
6 Months after Birth							
Sum Vaccinations	443	6.50	0.062	(0.13)	0.627	0.636	0.864
Any Vaccination	441	0.97	0.012	(0.02)	0.424	0.442	0.767
All 4 Postnatal Check Ups	518	0.98	-0.005	(0.01)	0.683	0.688	0.688
12 Months after Birth							
Sum Vaccinations	393	9.44	-0.012	(0.24)	0.960	0.964	0.964
Any Vaccination	393	0.99	0.000	(0.01)	0.951	0.900	0.991
All 6 Postnatal Check Ups	397	0.89	0.020	(0.03)	0.515	0.525	0.525
24 Months after Birth							
Sum Vaccinations	296	10.79	0.262	(0.22)	0.232	0.228	0.403
Any Vaccination	296	0.99	0.007	(0.01)	0.321	0.448	0.696
All 7 Postnatal Check Ups	275	0.68	0.037	(0.06)	0.507	0.500	0.500

Notes: The table reports control group means (CG) and treatment effects (simple mean difference between treatment and control group means) for maternal health behavior and preventive utilization. See Appendix Table A.9 for a more detailed definition of the variables. p-values below 0.1 are in bold. The first two p-values in each row are for individual hypothesis tests using a standard t-test and a permutation test. The third p-value is from a multiple hypothesis test (MHT) within a family of outcomes. Each bold heading denotes a family of outcomes for the purpose of MHT.

Data Source: Four waves of the Prokind participant survey

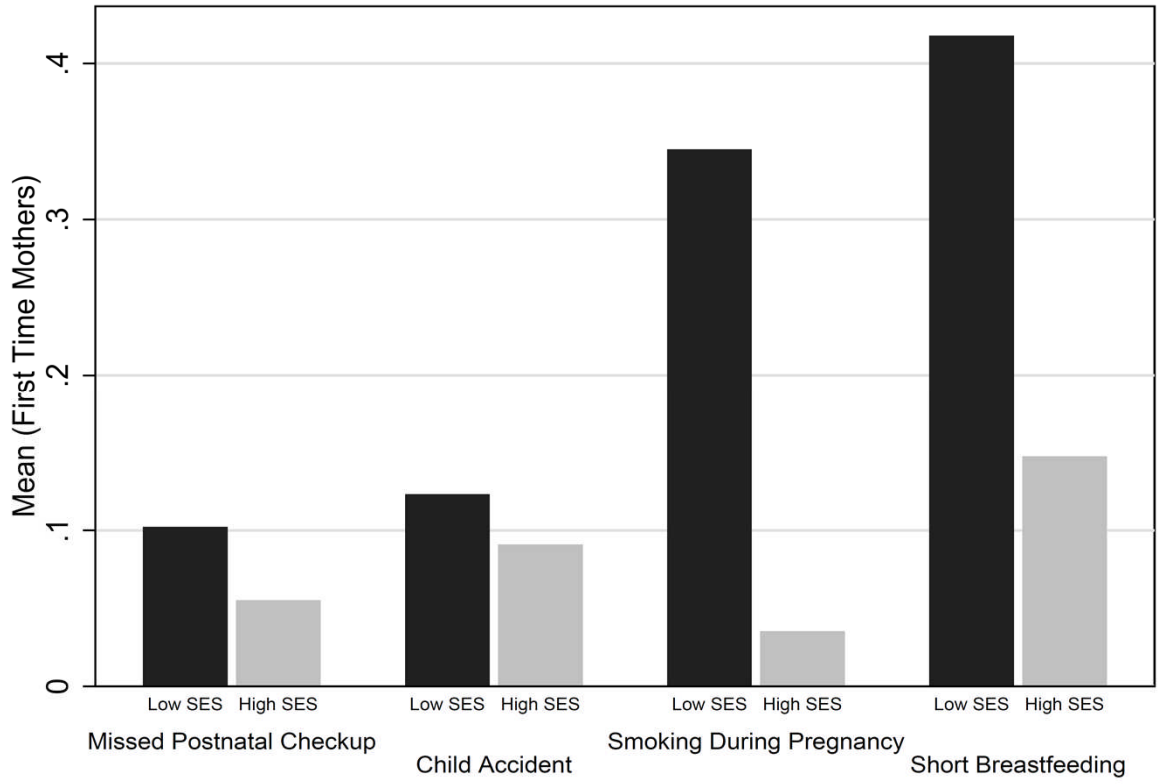
Table 8: Maternal mental health and child health (Survey Data)

	Obs.	*Mean CG*	*Treatment effect*	*Std. error*	p-values *t-test*	*permut.*	*MHT*
Pregnancy			***Maternal Mental Health***				
Depression	523	0.22	0.002	(0.04)	0.957	0.955	0.955
Anxiety	523	0.31	-0.050	(0.04)	0.201	0.201	0.449
Stress	523	0.47	-0.035	(0.04)	0.425	0.423	0.650
6 Months after Birth							
Depression	501	0.17	-0.028	(0.03)	0.395	0.397	0.602
Anxiety	501	0.16	-0.023	(0.03)	0.474	0.474	0.474
Stress	501	0.35	-0.083	(0.04)	**0.045**	**0.047**	0.117
24 Months after Birth							
Depression	344	0.27	-0.092	(0.04)	**0.041**	**0.041**	**0.100**
Anxiety	344	0.15	-0.024	(0.04)	0.524	0.525	0.525
Stress	344	0.38	-0.085	(0.05)	**0.094**	**0.088**	0.158
Pregnancy			***Child Health***				
Birthweight	603	3247.32	69.549	(44.04)	0.115	0.114	0.262
Birth Before 37 Week of Gestation	600	0.05	0.027	(0.02)	0.171	0.170	0.287
Low Birth Weight (<2500g)	603	0.06	0.003	(0.02)	0.869	0.862	0.862
12 Months after Birth							
Any Accident	429	0.19	0.007	(0.04)	0.844	0.843	0.843
Number of Accidents	429	0.22	0.027	(0.05)	0.629	0.624	0.776
Accident with Hospital Stay	429	0.05	0.026	(0.02)	0.270	0.267	0.500
24 Months after Birth							
Any Accident	310	0.34	-0.017	(0.05)	0.751	0.760	0.912
Number of Accidents	310	0.46	0.008	(0.10)	0.930	0.932	0.932
Accident with Hospital Stay	310	0.09	0.021	(0.03)	0.537	0.536	0.849

Notes: The table reports control group means (CG) and treatment effects (simple mean difference between treatment and control group means) for maternal mental health and child health indicators. See Appendix Table A.9 for a more detailed definition of the variables. p-values below 0.1 are in bold. The first two p-values in each row are for individual hypothesis tests using a standard t-test and a permutation test. The third p-value is from a multiple hypothesis test (MHT) within a family of outcomes. Each bold heading denotes a family of outcomes for the purpose of MHT.

Data Source: Four waves of the Prokind participant survey

Figure 1: Maternal health behavior by socio-economic status



Notes: The figure reports means for indicators of maternal health behavior by socio-economic status (SES). SES is measured as sum of three metric components: education and occupational qualification, educational status, and net income (Lange et al. 2007).

Data Source: German Health Interview and Examination Survey for Children and Adolescents (KIGGS), baseline survey (Kurth 2007)

Appendix: Additional Tables

Table A.1: Differences between baseline and estimation samples

	AOK			Dental		
	Baseline	*Diff Mother*	*Diff Child*	*Baseline*	*Diff Mother*	*Diff Child*
Demographic Characteristics						
Teen	0.45	0.00	-0.01	0.45	-0,04***	-0,06***
Age in Years	21.40	-0.11	-0.07	21.38	0,463***	0,62***
Week in Pregnancy	20.01	0.20	0.16	19.49	0.17	0,333*
German Nationality	0.08	-0.01	0.00	0.11	0.00	0.01
Underage	0.19	0.01	0.00	0.20	-0,026**	-0,038***
Mon. HH-Inc. in €	927	20	38	979	37**	48***
Debt over 3000 €	0.18	-0.02	-0.02	0.17	0.00	0.00
Education Risk	0.77	0.03	0.01	0.78	-0,026**	-0,044***
Income Risk	0.81	-0.03	-0.02	0.80	-0,027***	-0,038***
Employment Risk	0.84	0.01	-0.01	0.85	-0.01	-0,026**
No Partner	0.29	-0.03	-0.03	0.30	-0.01	-0.02
Living with Parents	0.27	0.03	0.02	0.27	0.01	0.02
Persons in HH	2.51	0.10	0.08	2.53	-0.02	0.00
Psychological and Physical Characteristics						
Unwanted Pregnancy	0.17	-0.03	-0,042**	0.18	0.00	0.00
Daily Smoking	0.34	0.03	0.00	0.36	-0.01	-0.02
Isolation	0.07	0.00	0.01	0.07	-0.01	-0.01
Foster Care Exper.	0.21	-0.02	-0,042*	0.22	-0.03	-0.03
Neglect Experience	0.38	-0.01	-0.03	0.39	-0,037***	-0,044***
Loss Experience	0.52	0.01	-0.01	0.53	-0.01	-0.01
Violence Ever	0.08	-0.02	-0.02	0.10	-0,024**	-0,025**
Depression	0.12	0.01	0.00	0.11	-0,016*	-0,033***
Anxiety	0.17	0.01	-0.01	0.19	-0,025**	-0,043***
Stress	0.30	-0.02	-0.01	0.31	-0,033**	-0,06***
Aggression	0.16	0.00	-0.03	0.16	-0.02	-0,039***
Body-Mass-Index	25.27	0.18	0.34	25.34	0.13	0,321*
Medic. Indic. Risk Preg.	0.11	-0.01	-0.01	0.12	0.01	0.01
Sum Risk Factors	5.80	-0.07	-0,241*	5.83	-0.30	-0,47***
Lower Saxony	0.38	-0,076***	-0,052*	0.57	-0.02	-0,036**
Bremen	0.29	-0.02	-0.03	0.43	0.02	0,036**
Saxony	0.33	0,091***	0,083***			
Observations	*755*	*244*	*220*	*505*	*365*	*328*

Notes: The table reports sample means of observed characteristics from the baseline survey, and the difference of these means to the means in the two administrative samples (AOK and Dental), separately for mothers and children. Statistically significant at the *** 0.01 level, ** 0.05 level, * 0.10 level.

Data Source: Prokind participant survey at baseline.

Table A.2: Health care utilization (IPW)

	Mean CG	*Treatment effect*	*Std. error*	*p-value (t-test)*
			Mother	
Hospital during Pregnancy and at Birth				
Any Admission at Birth/Pregnancy	1.00	-0.010	(0.01)	0.160
Nights in Hospital	11.50	1.342	(2.43)	0.581
Nights in Hospital (cond. on Admis.)	11.50	1.475	(2.45)	0.547
Hospital 0-2 (without Birth and Pregnancy)				
Any Admission after Birth	0.379	-0.086	(0.07)	0.207
Nights in Hospital	3.679	-1.028	(1.20)	0.394
Nights in Hospital (cond. on Admis.)	9.703	-0.675	(3.04)	0.825
Midwife Utilization (health insurance financed)				
Total Contacts	18.39	-0.123	(1.79)	0.945
Number of Contacts during Preg.	6.48	-0.923	(0.90)	0.305
Number of Contacts after Birth	11.80	0.830	(1.17)	0.480
Any Contact during Pregnacy	0.720	-0.078	(0.06)	0.233
Any Contact after Birth	0.822	0.061	(0.05)	0.242
Costs				
Costs Hospital	4821.5	240	(605)	0.692
Costs Presriptions	279.9	-100	(108)	0.358
Costs Midwifes (insur. financed)	506.0	39	(58)	0.501
			Child	
Hospital at Birth				
Any Admission at Birth	0.141	-0.029	(0.05)	0.570
Nights in Hospital	4.82	-3.281	(2.17)	0.131
Nights in Hospital (cond. on Admis.)	34.12	-20.38	(13.83)	0.153
Hospital 0-2 (without Birth)				
Any Admission	0.472	-0.050	(0.07)	0.501
Nights in Hospital	5.38	-0.822	(1.79)	0.646
Nights in Hospital (cond. on Admis.)	11.39	-0.589	(3.63)	0.871
Costs				
Total hospitalisation costs	5001.5	-2112	(1770)	0.234
Total medication costs	437.6	-57	(142)	0.686

Notes: The table reports results from an inverse probability weighting (IPW) approach for the same outcomes as in Table 3 of the paper. The table reports control group means (CG) and treatment effects (difference between IPW weighted treatment and control group means) for measures of health care utilization. See section 4 of the text for a description of the IPW approach, and Appendix Table A.9 for a more detailed definition of the variables. Number of observations are 220 for children, 244 for mothers.

Data Source: Administrative data from the AOK public health insurance.

Table A.3: Health outcomes from diagnoses and prescriptions (Child, IPW)

	Mean CG	*Treatment effect*	*Std. error*	*p-value (t-test)*
Birth outcomes				
Birthweight Below 2500g (Hosp.)	0.042	-0.012	(0.03)	0.647
Other Perinatal Conditions (Hosp.)	0.137	-0.030	(0.05)	0.569
Respiratory tract conditions				
Diseases of the Respiratory System (Hosp.)	0.199	-0.053	(0.06)	0.353
Nasal Decongestants (Presp.)	0.902	-0.010	(0.04)	0.818
Drugs for Obstructive Airway Diseases (Presp.)	0.423	-0.141	(0.07)	**0.053**
Cough and Cold Preparations (Presp.)	0.869	0.005	(0.05)	0.919
Antiasthmatic Drugs (Presp.)	0.251	-0.100	(0.06)	**0.097**
Antiasthmatic Drugs More Than Once (Presp.)	0.160	-0.085	(0.05)	**0.091**
Gastrointestinal diseases of digestive system				
Intestinal Infectious Diseases (Hosp.)	0.141	-0.011	(0.05)	0.831
Diseases of the Digestive System (Hosp.)	0.031	0.010	(0.02)	0.688
Drugs for Gastrointestinal Disorder (Presp.)	0.418	-0.055	(0.07)	0.445
Drugs for Constipation (Presp.)	0.196	-0.063	(0.06)	0.322
Antidiarrheals or Antiinflammatory Agents (Presp.)	0.375	0.160	(0.07)	**0.031**
Injuries, Poisoning				
Head Injuries (Hosp.)	0.092	0.029	(0.04)	0.512
Other Injuries, Burns, Corrosion, Poisoning (Hosp.)	0.009	0.029	(0.02)	0.123
Emollients and Protectives (Presp.)	0.339	-0.104	(0.07)	0.119
Dermatological conditions				
Antifungals for Dermatological Use (Presp.)	0.734	-0.110	(0.07)	0.120
Preparations for Wounds and Ulcers (Presp.)	0.188	-0.006	(0.06)	0.925
Corticosteroids, Dermatological Prep. (Presp.)	0.148	0.060	(0.06)	0.295
Mental health				
Mental and Behavioural Disorders (Hosp.)	0.023	-0.016	(0.02)	0.383
Psycholeptics - Calmatives (Presp.)	0.219	-0.008	(0.06)	0.895
Prescription of multipurpose drugs				
Painkillers (Presp.)	0.954	0.023	(0.03)	0.404
Antibacterials, Antibiotics for Systemic Use (Presp.)	0.550	0.045	(0.07)	0.545
Vitamins (Presp.)	0.453	0.096	(0.07)	0.201
Antiinflammatory Products (Presp.)	0.583	-0.024	(0.07)	0.750

Notes: The table reports results from an inverse probability weighting (IPW) approach for the same outcomes as in Table 4 of the paper. The table reports control group means (CG) and treatment effects (difference between IPW weighted treatment and control group means) for measures of health outcomes of children derived from hospital diagnoses (Hosp. = Any admission because of the indicated diagnosis) and medication prescriptions (Presp. = Any prescription in the first two years of life). See section 4 of the text for a description of the IPW approach, and Appendix Table A.9 for a more detailed definition of the variables. p-values below 0.1 are in bold. Number of observations: 220.

Data Source: Administrative data from the AOK public health insurance.

Table A.4: Health outcomes from diagnoses and prescriptions (Mother, IPW)

	Mean CG	*Treatment effect*	*Std. error*	*p-value (t-test)*
Birth complications				
Indications Related to Preg./Birth (Hosp.)	0.946	0.043	(0.02)	**0.077**
Complications at Delivery (Hosp.)	0.410	0.134	(0.07)	**0.061**
Complications of Fetus/Newborn (Hosp.)	0.109	-0.031	(0.04)	0.426
Fertility				
Second Birth (Hosp.)	0.048	0.053	(0.03)	0.125
Contraceptives (Presp.)	0.059	0.135	(0.10)	0.161
Respiratory tract conditions				
Diseases of the Respiratory System (Hosp.)	0.000	0.013	(0.01)	0.164
Nasal Decongestants (Presp.)	0.054	-0.043	(0.02)	**0.069**
Drugs for Obstructive Airway Diseases (Presp.)	0.082	0.018	(0.04)	0.668
Cough and Cold Preparations (Presp.)	0.076	0.032	(0.04)	0.467
Antiasthmatic (Presp.)	0.059	0.040	(0.04)	0.292
Antiasthmatic more than once (Presp.)	0.020	0.037	(0.03)	0.176
Mental health				
Mental and Behavioural Disorders (Hosp.)	0.046	-0.009	(0.02)	0.718
Psycholeptics - Calmatives (Presp.)	0.058	-0.058	(0.02)	**0.011**
Psychoanaleptics - Antidepressants (Presp.)	0.090	-0.037	(0.03)	0.270
Prescription of multipurpose drugs				
Painkillers (Presp.)	0.180	0.042	(0.06)	0.478
Antibacterials or Antibiotics (Presp.)	0.550	0.049	(0.07)	0.494
Vitamins (Presp.)	0.043	-0.016	(0.03)	0.569
Antiinflammatory Products (Presp.)	0.263	0.064	(0.06)	0.314

Notes: The table reports results from an inverse probability weighting (IPW) approach for the same outcomes as in Table 5 of the paper. The table reports control group means (CG) and treatment effects (difference between IPW weighted treatment and control group means) for measures of health outcomes of mothers derived from hospital diagnoses (Hosp. = Any admission because of the indicated diagnosis) and medication prescriptions (Presp. = Any prescription in the first two years of life). See section 4 of the text for a description of the IPW approach, and Appendix Table A.9 for a more detailed definition of the variables. p-values below 0.1 are in bold. Number of observations: 244.

Data Source: Administrative data from the AOK public health insurance.

Table A.5: Dental health outcomes (IPW)

	Mean CG	*Treatment effect*	*Std. error*	*p-value (t-test)*
		Mother		
Pregnancy				
Any Dental Visit	0.301	0.115	(0.05)	**0.026**
Any Prophylaxe	0.170	0.104	(0.04)	**0.022**
Any Therapy	0.169	0.024	(0.04)	0.563
Number Prophylaxies	0.260	0.263	(0.14)	**0.069**
Number Therapies	0.363	0.045	(0.12)	0.707
Child Age 0-2				
Any Dental Visit	0.655	0.065	(0.05)	0.202
Any Prophylaxe	0.502	0.022	(0.05)	0.690
Any Therapy	0.484	0.100	(0.05)	**0.065**
Number Prophylaxies	1.153	0.042	(0.18)	0.820
Number Therapies	2.512	0.219	(0.51)	0.667
		Child		
Child Age 0-2				
Any Dental Visit	0.206	0.035	(0.05)	0.515
Any Prophylaxe	0.201	0.040	(0.05)	0.455
Any Therapy	0.026	-0.026	(0.01)	**0.058**
Number Prophylaxies	0.350	-0.014	(0.09)	0.881
Number Therapies	0.154	-0.154	(0.08)	**0.064**

Notes: The table reports results from an inverse probability weighting (IPW) approach for the same outcomes as in Table 6 of the paper. The table reports control group means (CG) and treatment effects (difference between IPW weighted treatment and control group means) for dental health outcomes of mothers and children. See section 4 of the text for a description of the IPW approach, and Appendix Table A.9 for a more detailed definition of the variables. p-values below 0.1 are in bold. Number of observations are 328 for children, 365 for mothers.

Data Source: Administrative data from the KZV public dentists' association.

Table A.6: Maternal health behaviour and preventive utilization (Survey Data, IPW)

	Mean CG	*Treat. Effect*	*Std. error*	*p-value (t-test)*
Pregnancy		**Maternal Health Behavior**		
Smoking	0.389	0.020	(0.05)	0.666
Daily Smoking	0.291	0.014	(0.04)	0.743
Child in Room where Smoking	0.555	0.007	(0.05)	0.886
6 Months after Birth				
Smoking	0.634	-0.031	(0.04)	0.483
Daily Smoking	0.537	-0.016	(0.05)	0.722
Child in Room where Smoking	0.111	0.016	(0.03)	0.607
No Breastfeeding	0.220	0.026	(0.04)	0.552
Breastfeeding less than 31 Days	0.489	0.013	(0.06)	0.810
Any Sweeted Drinks	0.244	-0.031	(0.04)	0.424
Any Sweets	0.329	-0.014	(0.04)	0.754
12 Months after Birth				
Smoking	0.646	-0.016	(0.05)	0.749
Daily Smoking	0.500	0.055	(0.05)	0.297
Child in Room where Smoking	0.232	-0.034	(0.05)	0.452
Any Sweeted Drinks	0.463	-0.094	(0.05)	**0.069**
Any Sweets	0.853	-0.035	(0.04)	0.387
24 Months after Birth				
Smoking	0.604	0.017	(0.06)	0.763
Daily Smoking	0.527	0.039	(0.06)	0.510
Child in Room where Smoking	0.285	-0.026	(0.05)	0.631
Pregnancy		**Preventive Utilization**		
All Prenatal Screening Examinations	0.830	-0.023	(0.03)	0.507
6 Months after Birth				
Sum Vaccinations	9.365	0.029	(0.28)	0.918
Any Vaccination	0.996	-0.012	(0.02)	0.475
All 4 Postnatal Check Ups	0.885	0.010	(0.04)	0.790
12 Months after Birth				
Sum Vaccinations	6.508	0.085	(0.12)	0.493
Any Vaccination	0.971	0.011	(0.01)	0.428
All 6 Postnatal Check Ups	0.981	-0.011	(0.01)	0.453
24 Months after Birth				
Sum Vaccinations	10.869	0.232	(0.20)	0.253
Any Vaccination	0.994	0.006	(0.01)	0.319
All 7 Postnatal Check Ups	0.670	0.035	(0.06)	0.572

Notes: The table reports results from an inverse probability weighting (IPW) approach for the same outcomes as in Table 7 of the paper. The table reports control group means (CG) and treatment effects (difference between IPW weighted treatment and control group means) for maternal health behavior and preventive utilization. See section 4 of the text for a description of the IPW approach, and Appendix Table A.9 for a more detailed definition of the variables. p-values below 0.1 are in bold.

Data Source: Four waves of the Prokind participant survey

Table A.7: Maternal mental health and child health (Survey Data, IPW)

	Mean CG	*Treatment effect*	*Std. error*	*p-value (t-test)*
		Maternal Mental Health		
Pregnancy				
Depression	0.249	-0.037	(0.04)	0.359
Anxiety	0.333	-0.082	(0.04)	**0.056**
Stress	0.494	-0.073	(0.05)	0.110
6 Months after Birth				
Depression	0.172	-0.029	(0.03)	0.391
Anxiety	0.163	-0.027	(0.03)	0.425
Stress	0.363	-0.096	(0.04)	**0.027**
24 Months after Birth				
Depression	0.276	-0.134	(0.05)	**0.004**
Anxiety	0.170	-0.063	(0.04)	0.120
Stress	0.367	-0.124	(0.05)	**0.020**
		Child Health		
Pregnancy				
Birthweight	3237	79.80	(43.45)	**0.067**
Birth Before 37 Week of Gestation	0.043	0.033	(0.02)	**0.092**
Low Birth Weight (<2500g)	0.063	0.002	(0.02)	0.887
12 Months after Birth				
Any Accident	0.195	-0.010	(0.04)	0.814
Number of Accidents	0.229	0.003	(0.06)	0.954
Accident with Hospital Stay	0.059	0.020	(0.03)	0.479
24 Months after Birth				
Any Accident	0.352	-0.023	(0.06)	0.699
Number of Accidents	0.490	-0.031	(0.11)	0.772
Accident with Hospital Stay	0.106	0.025	(0.05)	0.589

Notes: The table reports results from an inverse probability weighting (IPW) approach for the same outcomes as in Table 8 of the paper. The table reports control group means (CG) and treatment effects (difference between IPW weighted treatment and control group means) for maternal mental health and child health indicators. See section 4 of the text for a description of the IPW approach, and Appendix Table A.9 for a more detailed definition of the variables. p-values below 0.1 are in bold.

Data Source: Four waves of the Prokind participant survey

Table A.8: Gender differences in child health outcomes from diagnoses and prescriptions

	Girls				Boys			
	Mean CG	*Treatment effect*	*p-values*		*Mean CG*	*Treatment effect*	*p-values*	
			perm.	*MHT*			*perm.*	*MHT*
Hospital at Birth								
Any Admission at Birth/Pregnancy	0.16	0.050	0.469	0.918	0.08	-0.030	0.611	0.845
Nights in Hospital	2.29	-0.029	0.984	0.984	4.78	-8.765	0.392	0.874
Nights in Hospital (cond. on Admis.)	14.32	-4.929	0.541	0.869	59.75	-84.500	0.505	0.911
Birth outcomes								
Birthweight Below 2500g (Hosp.)	0.05	0.023	0.573	0.816	0.02	-0.049	0.182	0.552
Other Perinatal Conditions (Hosp.)	0.12	0.042	0.477	0.856	0.12	-0.003	0.960	0.960
Hospital 0-2 (without Birth)								
Any Admission after Birth	0.45	0.021	0.826	0.969	0.45	-0.105	0.302	0.778
Nights in Hospital	5.03	1.474	0.599	0.947	7.55	-2.499	0.735	0.946
Nights in Hospital (cond. on Admis.)	11.28	2.804	0.628	0.957	16.78	-1.577	0.922	0.922
Respiratory tract conditions								
Diseases of the Respiratory System (Hosp.)	0.18	-0.041	0.577	0.983	0.16	0.023	0.763	0.939
Nasal Decongestants (Presp.)	0.87	-0.057	0.350	0.947	0.91	0.054	0.392	0.949
Drugs for Obstructive Airway Diseases (Presp.)	0.32	-0.241	**0.005**	**0.050**	0.36	-0.010	0.922	0.922
Cough and Cold Preparations (Presp.)	0.87	-0.023	0.711	0.976	0.85	0.076	0.315	0.941
Antiasthmatic Drugs (Presp.)	0.18	-0.109	0.139	0.725	0.23	-0.065	0.461	0.957
Antiasthmatic Drugs More Than Once (Presp.)	0.08	-0.121	**0.034**	0.277	0.15	-0.035	0.633	0.977
Diseases of digestive system								
Intestinal Infectious Diseases (Hosp.)	0.13	0.004	0.948	0.948	0.14	-0.052	0.483	0.961
Diseases of the Digestive System (Hosp.)	0.04	0.042	0.258	0.906	0.05	-0.039	0.430	0.964
Drugs for Gastrointestinal Disorder (Presp.)	0.41	0.028	0.750	0.935	0.40	-0.190	0.062	0.429
Drugs for Constipation (Presp.)	0.15	-0.067	0.327	0.936	0.12	-0.045	0.522	0.894
Antidiarrheals or Antiinflammatory Agents (Presp.)	0.52	0.225	**0.014**	0.132	0.43	0.067	0.501	0.935

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Table A.8 continued

	Girls				Boys			
	Mean CG	*Treatment effect*	*p-values*		*Mean CG*	*Treatment effect*	*p-values*	
			perm.	*MHT*			*perm.*	*MHT*
Injuries, Poisoning								
Head Injuries (Hosp.)	0.12	0.076	0.190	0.565	0.11	-0.020	0.759	0.759
Other Injuries, Burns, Corrosion, Poisoning (Hosp.)	0.02	0.030	0.166	0.592	0.05	0.043	0.312	0.666
Emollients and Protectives (Presp.)	0.34	-0.176	**0.047**	0.210	0.25	-0.031	0.732	0.925
Dermatological conditions								
Antifungals for Dermatological Use (Presp.)	0.72	-0.228	**0.004**	**0.026**	0.61	0.042	0.677	0.894
Preparations for Wounds and Ulcers (Presp.)	0.18	0.012	0.862	0.862	0.16	-0.060	0.444	0.830
Corticosteroids, Dermatological Prep. (Presp.)	0.18	0.061	0.383	0.855	0.17	0.081	0.277	0.804
Prescription of multipurpose drugs								
Painkillers (Presp.)	0.97	-0.027	0.418	0.934	0.97	0.073	0.154	0.684
Antibacterials, Antibiotics for Systemic Use (Presp.)	0.57	0.078	0.391	0.950	0.62	0.059	0.556	0.804
Vitamins (Presp.)	0.48	0.047	0.612	0.612	0.54	0.171	**0.096**	0.547
Antiinflammatory Products (Presp.)	0.61	-0.066	0.471	0.856	0.58	0.074	0.470	0.924
Costs								
Cost hospitalisation	3360.47	680.692	0.704	0.704	6055.16	-5472.711	0.399	0.784
Cost medication	371.40	159.094	0.375	0.844	516.60	-197.729	0.493	0.743

Notes: The table replicates the results for the child outcomes in Tables 3 and 4 separately for boys and girls. It reports control group means (CG) and treatment effects (simple mean difference between treatment and control group means) for health outcomes of children derived from utilization data, hospital diagnoses (Hosp. = Any admission because of the indicated diagnosis) and medication prescriptions (Presp. = Any prescription in the first two years of life). See Appendix Table A.9 for a more detailed definition of the variables. Reported p-values are for individual hypothesis tests using a permutation test and for a multiple hypothesis test (MHT) within a family of outcomes. Each bold heading denotes a family of outcomes for the purpose of MHT, and each family includes the subgroup outcomes for both boys and girls. p-values below 0.1 are in bold. Number of observations: 220.

Data Source: Administrative data from the AOK public health insurance.

Table A.9: Variable definitions

Variable	Where used	Definition
Hospital admissions		
Any Admission	T3 (mother, child)	Any hospital record in relevant period
Nights in Hospital	T3 (mother, child)	No. of night in hospital in relevant period
Nights in Hospital (cond. on Admis.)	T3 (mother, child)	No. of night in hospital, conditional on admission
Midwife Utilization		
Total Contacts	T3 (mother)	Total costs relating to health-insuranced financed midwifes
Number of Contacts during preg. / after birth	T3 (mother)	No. of contacts with health-insuranced financed midwifes in relevant period
Any Contact during preg. / after birth	T3 (mother)	Any contact with health-insuranced financed midwife in relevant period
Costs		
Cost hospitalisation	T3 (mother, child)	Total cost of hospital episodes in relevant period
Cost medication	T3 (mother, child)	Total cost of prescription medicationin relevant period
Costs Midwifes (heal. insur. financed)	T3 (mother)	Total costs relating to health-insuranced financed midwifes
Birth outcomes		
Birthweight Below 2500g (Hosp.)	T4 (child)	DRG code in hospital records for birth weight below 2,500g
Other Perinatal Conditions (Hosp.)	T4 (child)	Any ICD P code except ICD P05 and ICD P07 during first 7 days in hospital
Respiratory tract conditions		
Diseases of the Respiratory System (Hosp.)	T4 (child), T5 (mother)	ICD J0, J1, J2, J3, or J4 in hospital diagnosis
Nasal Decongestants (Presp.)	T4 (child), T5 (mother)	Any prescription within ATC R01
Drugs for Obstructive Airway Diseases (Presp.)	T4 (child), T5 (mother)	Any prescription within ATC R03
Cough and Cold Preparations (Presp.)	T4 (child), T5 (mother)	Any prescription within ATC R05
Antiasthmatic Drugs (Presp.)	T4 (child), T5 (mother)	Any prescription within R03AC or R03BA
Antiasthmatic Drugs More Than Once (Presp.)	T4 (child), T5 (mother)	More than one prescription within R03AC or R03BA
Gastrointestinal diseases of digestive system		
Intestinal Infectious Diseases (Hosp.)	T4 (child)	ICD A0 in hospital diagnosis
Diseases of the Digestive System (Hosp.)	T4 (child)	ICD K in hospital diagnosis
Drugs for Gastrointestinal Disorder (Presp.)	T4 (child)	Any prescription within ATC A03
Drugs for Constipation (Presp.)	T4 (child)	Any prescription within ATC A06
Antidiarrheals or Antiinflammatory Agents (Presp.)	T4 (child)	Any prescription within ATC A07
Injuries, Poisoning		
Head Injuries (Hosp.)	T4 (child)	ICD S0 in hospital diagnosis
Other Injuries, Burns, Corrosion, Poisoning (Hosp.)	T4 (child)	ICD Tin hospital diagnosis
Emollients and Protectives (Presp.)	T4 (child)	Any prescription within ATC D02

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Table A.9: Variable definitions - continued

Variable	Where used	Definition
Dermatological conditions		
Antifungals for Dermatological Use (Presp.)	T4 (child)	Any prescription within ATC D01
Preparations for Wounds and Ulcers (Presp.)	T4 (child)	Any prescription within ATC D03
Corticosteroids, Dermatological Prep. (Presp.)	T4 (child)	Any prescription within ATC D07
Mental health		
Mental and Behavioural Disorders (Hosp.)	T4 (child), T5 (mother)	ICD F in hospital diagnosis
Psycholeptics - Calmatives (Presp.)	T4 (child), T5 (mother)	Any prescription within ATC N05
Psychoanaleptics - Antidepressants (Presp.)	T5 (mother)	Any prescription within ATC N06
Prescription of multipurpose drugs		
Painkillers (Presp.)	T4 (child), T5 (mother)	Any prescription within ATC N02
Antibacterials, Antibiotics for Systemic Use (Presp.)	T4 (child), T5 (mother)	Any prescription within ATC J01
Vitamins (Presp.)	T4 (child), T5 (mother)	Any prescription within ATC A11
Antiinflammatory Products (Presp.)	T4 (child), T5 (mother)	Any prescription within ATC M01
Birth complications		
Indications Related to Preg./Birth (Hosp.)	T5 (mother)	Any ICD O, except O80-O84, in hospital diagnosis
Complications at Delivery (Hosp.)	T5 (mother)	Any ICD O60-O75 in hospital diagnosis
Complications of Fetus/Newborn (Hosp.)	T5 (mother)	Any ICD P code during first 7 days in hospital
Fertility		
Second Birth (Hosp.)	T5 (mother)	Any of following ICD after first birth: O031, O034, O48, O601, O602, O603, O630, O631, O680, O682, O690, O692, O698, O700, O701, O702, O711, O713, O714, O715, O718, O719, O756, O757, O80, O81, O82, Z380, Z381, Z390
Contraceptives (Presp.)	T5 (mother)	Any prescription within ATC G02B or G03A
Dental health outcomes		
Any Dental Visit	T6 (mother, child)	At least one date with a cost code
Any Prophylaxe	T6 (mother, child)	At least one dental fee for scaling of calculus, sealing of tooth fissures, individual oral hygiene informations, examination, (assessment of) oral hygiene status, local fluoridation
Any Therapy	T6 (mother, child)	At least one dental fee for tooth extraction, root canal treatment, restoration of a cavity, emergency visit, treatment of the oral mucosa, restoration with partial or full crown, cyst surgery/ cystectomy, abscess incision
Number Prophylaxies	T6 (mother, child)	Number of dates with one dental fee of prophylactic services
Number Therapies	T6 (mother, child)	Number of dates with one dental fee of therapeutic/ treatment services

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Table A.9: Variable definitions - continued

Variable	Where used	Definition
Maternal health behavior		
Smoking	T7 (mother)	Do you smoke? 1 if sometimes or daily
Daily Smoking	T7 (mother)	Do you smoke? 1 if daily
Child in Room where Smoking	T7 (mother)	Is child present in rooms where smoked? 1 if more often than not at all
No Breastfeeding	T7 (mother)	Did you breastfeed? 1 if answer "I have not breastfeed"
Breastfeeding less than 31 Days	T7 (mother)	How long did you breastfeed in days? 1 if answer "I have not breastfeed" or less than 31 days
Any Sweeted Drinks	T7 (mother)	Does your child drink sweeted juice? Does your child drink sweeted tea? 1 if one question is yes
Any Sweets	T7 (mother)	Does your child eat sweets? Does your child eat crisps? 1 if one question is yes
Preventive utilization		
All Prenatal Screening Examinations	T7 (mother)	Three prenatal screening examinations with ultrasound
Sum Vaccinations	T7 (mother)	Does your child has the following vaccinations? Sum of positive answers in a list of 7 to 10 vaccinations
Any Vaccination	T7 (mother)	Does your child has the following vaccinations? 1 if one positive in a list of 7 to 10 vaccinations
All 4 Postnatal Check Ups	T7 (mother)	Question for postnatal check up 1 to 4 whether conducted. 1 if mother states that postnatal check up 1 to 4 are conducted
All 6 Postnatal Check Ups	T7 (mother)	Question for postnatal check up 1 to 6 whether conducted. 1 if mother states that postnatal check up 1 to 6 are conducted
All 7 Postnatal Check Ups	T7 (mother)	Question for postnatal check up 1 to 7 whether conducted. 1 if mother states that postnatal check up 1 to 7 are conducted
Maternal mental health		
Depression	T8 (mother)	Depression Anxiety Stress Scales (DASS) indicate Moderate, Severe or Extremly Severe Depression.
Anxiety	T8 (mother)	DASS indicate Moderate, Severe or Extremly Severe Anxiety.
Stress	T8 (mother)	DASS indicate Moderate, Severe or Extremly Severe Stress.
Child health		
Birthweight	T8 (child)	Birthweight as recorded in maternal documents
Birth Before 37 Week of Gestation	T8 (child)	Week of gestation. 1 if less than 37th week of pregnancy
Low Birth Weight (<2500g)	T8 (child)	Birthweight of the child. 1 if less than 2500g
Any Accident	T8 (child)	Any Accident since birth with doctor visit
Number of Accidents	T8 (child)	Number of Accidents since birth with doctor visit
Accident with Hospital Stay	T8 (child)	Any Accident since birth with hospital visit

Table A.10: Share of psycholeptics prescriptions by subgroups

Overall	**0.06**
Stressors	
Risk factor stress at baseline	0.13
More than 5 risk factors at baseline	0.09
3-5 risk factors at baseline	0.04
Less than 3 risk factors at baseline	0.00
Social Isolation	
Less than 2 friends	0.22
Less than 5 friends	0.12
Social support scale: low	0.12
Social support scale: high	0.04

Notes: The table reports the control group mean for prescriptions of psycholeptics for subgroups with varying degrees of stressors related to social disadvantage, and varying degrees of social isolation. Prescriptions of psycholeptics are concentrated among individuals with more risk factors and with higher social isolation. Because no mother in the treatment group takes any psycholeptics (the negative of) these shares can be interpreted as subgroup-specific treatment effects.

Data Source: Administrative data from the AOK public health insurance and Prokind participant survey at baseline.

Table A.11: Maternal mental health, no change in home visitor (Survey Data)

	Obs.	*Mean CG*	*Treatment effect*	p-value
6 Months after Birth		***Maternal Mental Health***		
Depression	501	0.17	-0.030	0.340
Anxiety	501	0.16	-0.040	0.260
Stress	501	0.35	-0.090	**0.040**
24 Months after Birth				
Depression	344	0.27	-0.100	**0.030**
Anxiety	344	0.15	-0.040	0.240
Stress	344	0.38	-0.100	**0.080**

Notes: The table reports control group means (CG) and treatment effects (simple mean difference between treatment and control group means) for maternal mental health 6 and 24 months after birth for the sub-goup of mothers who did not experience a change in the home visitor. The corresponding effects for all mothers are in the top panel of Table 8. See Appendix Table A.9 for a more detailed definition of the variables. p-values from a standard t-test are reported. P-values below 0.1 are in bold.

Data Source: Prokind participant survey