

Preventive Home Visits in Norway

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Abstract

This paper evaluates the introduction of preventive home visits (PHV) for older people in Norway. PHVs have been introduced in several countries in different varieties. Their purpose is to support autonomy and independence as well as preventing disability and nursing home admissions but their actual effects are debated in the literature. This study contributes to the literature by exploiting a natural experiment in Norwegian municipalities. Hence, our study is population-based and follows subjects over a long time period, which is important since both public health interventions may not show immediate effect and also, the effect may decline over time. Results indicate that the introduction of a PHV programme significantly changes resource use away from nursing homes, while increasing the utilisation of home-based care. Further, PHVs lead to a decline in hospital admissions of 5 admissions per 100 inhabitants aged 80 and above. Mortality is reduced by 0.4 deaths per 100 in this age group.

1 Introduction

Demographic change is one of the most important challenges facing developed countries. Not only the number of older people increases continuously but also their share of the total population as well as the life expectancy at older ages. As it is unlikely that the increase in life expectancy is equal to the increase in healthy life expectancy, affected countries are expected to face a higher demand in long-term care in the decades to come (WHO, 2015).

One type of programmes aimed at reducing the number of older people receiving nursing home care, or at least preventing its further growth, are preventive home visits (PHV). PHV programmes have been introduced in several countries and the actual implementation might vary even within a country but a common aspect is the purpose of supporting autonomy and independence as well as preventing disability of the older population (Tøien et al., 2014). To achieve these goals, older people are visited – often by nurses – to evaluate their physical and mental health conditions as well as possible environmental problems, which is followed by recommendations regarding the solution of these problems and the prevention of new problems (van Haastregt et al., 2000).

In this study, we analyse the effects of the introduction of a PHV programme on two types of outcomes: first, we assess whether PHVs have the intended effect on resource use in the LTC sector. Second, we study the impact on hospital admissions and mortality among the oldest old. Applying a difference-in-differences approach to a dataset covering the period from 1992 to 2014, we find that PHV programmes have a large impact on both types of outcomes. The results indicate that – at least in the long run – a PHV introduction can reduce a municipality’s long-term care and especially nursing home care expenditure. Further, PHV programmes leads to a substitution between home-based and nursing home care of about 2.0 percentage points for the 80+ population. Both the hospital admissions (-5.13 admissions per 100 inhabitants 80+) and hospital days (-43.21 days per 100 inhabitants 80+) decrease, and mortality rates (-0.40 deaths per 100 inhabitants 80+) decline. Several robustness checks such as alternative treatment and control groups and random placebo tests corroborate these main results.

2 Related literature

Health promotion and disease prevention are widely covered topics in the economics literature. Kenkel (2011) reviews basic theoretical insights about prevention from human capital models and insurance models. Typically, prevention is considered as an investment that contributes to improved health or delayed health deterioration for older people. The demand for prevention is determined from dynamic optimization and may well be less than optimal from a societal perspective due to market failures such as ex ante moral hazard from health insurance and lack of consumer information. Both private and public insurers might then have an incentive to initiate policies that encourage consumers' prevention in order to reduce future health expenditures. However, both Russell (2009) and Hall (2011) show that less than 20 percent of the preventive options reviewed fall in the cost-saving category – 80 percent add more to medical costs than they save. Hence, for a majority of projects the important question is whether the health benefit and other benefits from prevention is sufficiently great to defend resources used. The answer depends on the result from a cost-benefit analysis and would in general vary between projects.

Even though prevention in general and screenings for certain diseases have attracted a lot of attention in the health economics literature, preventive home visits remains under-researched in economics. A growing literature analyses the effects of home visiting programmes for infants (Bhalotra et al., 2017, 2016; Hjort et al., 2017; Doyle et al., 2017). A typical finding in this literature is that home visiting programmes may have surprisingly large positive effects on later-life health and human capital. However, there is hardly any evidence on the effectiveness of PHVs for other age groups, such as older people. Instead, most previous evaluations come from fields such as medicine and especially geriatrics, nursing, epidemiology.

Within these disciplines, PHV programmes have frequently been evaluated during the past three decades. These studies present results from programmes in different countries such as the Netherlands (van Rossum et al., 1993), Switzerland (Stuck et al., 2000), Canada (Dalby et al., 2000), and Denmark (Kronborg et al., 2006). Almost all studies have been carried out as randomised controlled trials (RCT) to determine the causal effect of these visits. A large number of different outcomes is considered but the results show no clear tendency regarding effectiveness as they vary from beneficial effects to no

effects at all.

van Rossum et al. (1993) evaluate a RCT consisting of 580 individuals aged 75 to 84 and find both a lower mortality and hospital admission risk in the treated group but no effects on health outcomes. According to the authors, home visits are not beneficial for the whole elderly population but only to those individuals with poor health. Stuck et al. (2000) observe a total number of 791 participants aged 75 and above for three years and identify a reduction of disabilities for low-risk individuals. They state that the actual outcome might be influenced by the visitors' performance. 142 people at risk of sudden deterioration in health aged 70 and above took part in the RCT in Canada evaluated by Dalby et al. (2000). Unlike van Rossum et al. (1993), they cannot find an effect on the treatment group's mortality rate but only observe an improved vaccination coverage. The more recent study by Kronborg et al. (2006) has a different focus as it evaluates the effects of trained versus untrained visitors on the cost effectiveness of PHV measured as costs per active life years gained and is thus one of the few articles from an economic perspective. Although they find a significant improvement in active life years caused by trained visitors for 80 year old persons, a clear conclusion regarding the cost effectiveness cannot be drawn.

Several reviews of past RCTs on preventive home visits exist but also these evaluations of several independent trials come to different conclusions regarding the effects. Among the qualitative reviews, van Haastregt et al. (2000) do not find beneficial effects of PHV on physical and psychosocial functioning, falls, mortality, and admissions to institutions using results from 15 RCTs and recommend considering to discontinue the visits. However, Markle-Reid et al. (2006) come to the complete opposite conclusion in their analysis of 12 trials.

Reviews applying meta-analysis tend to find beneficial effects. A significant reduction in mortality and admission to long-term care is identified by Elkan et al. (2001) and confirmed by Stuck et al. (2002) for target persons with low risk of death (admissions) and younger old populations (mortality) if follow-up visits are performed. Besides the effect on mortality, Huss et al. (2008) observe a beneficial influence on functional status caused by preventive home visits. In contrast to the previous studies, Mayo-Wilson et al. (2014) does not identify consistent benefits on outcomes as mortality, the number of individuals who are institutionalised, hospitalised, and fell, as well as independent living, quality of life, and physical functioning evaluating 64 studies. However, they are not able

to exclude the possibility of effective programmes.

This study contributes to the literature in several ways. First, our study is population-based and exploits a natural experiment in Norwegian municipalities. This research design allows us to draw inference on a population of subjects much larger than those typically studied in RCTs. Second, our research design allows us to follow the subjects over a long time period. This is of great importance since many public health interventions tend to have effects that fade in the long run.

3 Institutional Background

3.1 Long-Term Care in Norway

In Norway, LTC is an integrated part of the extensive public health care system. In this system, services are universally available, predominately financed by general taxes and publicly provided (Magnussen et al., 2007; Karlsson et al., 2012). The ethical principle is that access to health and LTC services should be determined by health needs only (Ringard et al., 2013; Olsen, 2011).

The system is semi-centralized (Hagen and Kaarbøe, 2006). The central government determines the rules and regulations that define the legal bounds of public funding and provision, and the division of responsibility among government levels (Øien et al., 2012). Further, the central government is directly responsible for funding and provision of specialized health care services. The responsibility of funding and provision of primary care services is decentralized to the municipalities – the lowest level of government. Among the primary care services are social as well as community health services provided to persons with LTC needs.

The LTC services the municipalities are required to provide can be broadly divided into nursing and home-based care services. Nursing homes are medical institutions with around-the-clock skilled nursing and care services. They are strictly regulated with respect to staffing and service levels. The service must include all necessary health and care services, board and lodging. Home-based care includes home nursing, practical home help and community housing. Home nursing is a skilled nursing service provided to dependent persons living in their own homes or in community housing (Fjørtoft, 2012; Øien, 2014). Home helpers provide help with instrumental activities of daily living such as cooking

and cleaning. Community houses are adapted for persons in need of LTC, and are predominately for persons who are no longer able to live independently at home, but are not (yet) in need of nursing home care (Hagen et al., 2011; Øien, 2014). Individuals, or any person acting on behalf of an individual, must submit an application to the municipality to receive LTC services. Municipalities are restricted to allocating services according to health needs and independently of socioeconomic status and potential informal care provided by relatives (Ringard et al., 2013; Jakobsson et al., 2016).

The responsibility of municipalities to pay for LTC services is extensive. In 2010, public LTC expenses comprised 3.2 percent of GDP, which makes LTC the largest municipal sector in terms of share of total municipal spending Hagen et al. (2011). Norway is among the countries in the OECD that spends most on LTC as a share of GDP Francesca et al. (2011). The large economic burden of LTC and the fear that an ageing population will increase future demand for LTC, have led policy makers at different levels to focus more on measures that can prevent and postpone care needs. One such measure is preventive home visits.

3.2 Preventive Home Visits

PHVs are visits made by municipal care workers to older people living in the community. PHV is an outreach service. The municipalities distribute information about PHV to every individual in a target group, and ask whether the individual would accept a PHV or not (Førland and Skumsnes, 2017). This aspect makes PHV different from other municipal care services, in which individuals must submit an application to the municipality to get access to services. Another difference from the most common LTC services is that municipalities are not obligated by law to provide PHV, and therefore there are no central regulations defining the content of PHV. Central authorities are nonetheless encouraging municipalities to establish a PHV program. In 2016, The Ministry of Health issued a directive in which they emphasized municipalities' responsibility for promoting health and preventing diseases and injuries, and they announced the development of national guidelines for how to implement a PHV program (Norwegian Ministry of Health and Care Services, 2016).

All the PHVs we study have the explicit aim of preventing nursing home admissions and reducing the need for formal home-based care (Førland et al., 2015; Førland and

Skumsnes, 2017), but the actual execution varies slightly at the local level. Nevertheless, there are several commonalities in the implementation across municipalities. Visitors are primarily nurses, physiotherapists, or occupational therapists with extensive work experience and post-qualifying education (Førland and Skumsnes, 2017). The target group is most commonly individuals who are not receiving other LTC services and who are above a threshold of old age, usually 75 to 80 years or older (Førland and Skumsnes, 2014). Førland and Skumsnes (2017) define four models, which they underline are not mutually exclusive, of PHVs: health promotion visits, visits to detect health problems and care needs, visits to prevent fall and accident related injuries, and visits to give information about, and how to apply for, local LTC services.

In the 1980s and 1990s, the focus of PHV was to detect disease and care needs using various screening and diagnostic tests (Førland et al., 2015; Fagerström et al., 2009). Since the 2000s, the focus has moved away from the “sickness and problem-oriented perspective” towards the “individual health resource perspective” (Førland et al., 2015; Fagerström et al., 2009). The latter perspective involves identifying and enhancing older peoples’ health, social and home resources to make it possible to handle challenges of living independently in old age. This is done by structured conversation and observation of the home environment, during the home visit, to identify challenges the individual might have today or in the future to live at home. The challenges might be related to current health status, but just as much are challenges related to housework, house management, nutrition, and opportunities to engage in physical and social activity. The hope is that enabling the individual to deal with the challenges on one’s own will foster autonomy and independence, which will make it possible to maintain quality of life while living at home into high ages.

Another goal is early detection of health problems by improving health literacy in the older population. This will potentially enable older people to recognize early signs of functional decline that require health and care services. The individual is given information about available social and care services that might be helpful today or in the future.

Since it is not mandatory for municipalities to offer PHVs, whether and when a PHV program is implemented varies. A small number of municipalities implemented a PHV program already in the 1980s (Førland et al., 2015). The diffusion of PHV programmes was modest for many years. In 2003, roughly 8 percent of municipalities had implemented

a PHV program (Førland and Skumsnes, 2014). This proportion jumped to 24 percent in 2013, and roughly 47 percent of the introductions occurred after 2010 (Førland and Skumsnes, 2017). The main reason for the high jump was the shift of focus of central and local health authorities away from curative towards preventive health care, under the belief that preventive care is the solution to meet the health needs of an ageing population. In the next section, we describe how we exploit the variation in implementation of PHV programs, across time and space, to identify the effect of the PHV program on nursing home admissions.

4 Data and Method

In this section, the datasets used in this study are presented graphically and the corresponding descriptive statistics are provided. The first subsection gives an overview over the available data on preventive home visits (PHV) which is the treatment to be analysed and which defines the treatment and control groups. The outcome variables containing the cost, care service utilisation, hospital admission, and mortality indicators are introduced in the second subsection.

4.1 Treatment Assignment

The information on preventive home visits in Norway is based on a survey of all 428 Norwegian municipalities carried out in 2013. A total number of 386 municipalities (90.2% of all municipalities) answered the questionnaire and the answers of 378 municipalities (88.3% of all municipalities) are available. More than one fifth of all Norwegian municipalities (21.7%, 93 municipalities) stated to have already introduced a preventive home visits programme in or before 2013. 110 additional municipalities already had plans to introduce PHV so that 47.4% of the Norwegian municipalities can be expected to have a preventive home visits programme in the immediate future. The exact answering pattern of the municipalities is shown in Figure 1; Figure 2a provides a map of Norway highlighting municipalities with a PHV programme in 2013.

In order to get a homogenous treatment group with regard to the components of the treatment, we focus on municipalities which implemented PHVs targeting the oldest old (80+) population. This definition includes municipalities that offer their services

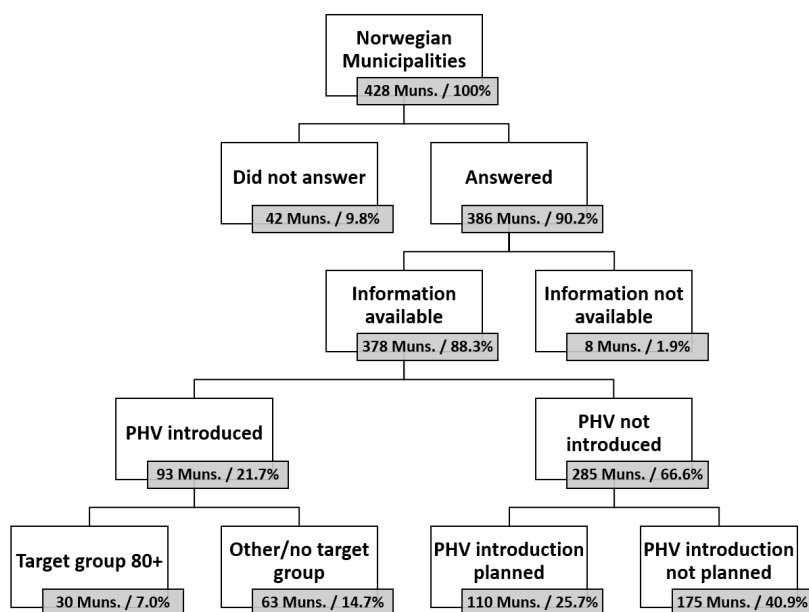


Figure 1: Answering Pattern of Municipalities

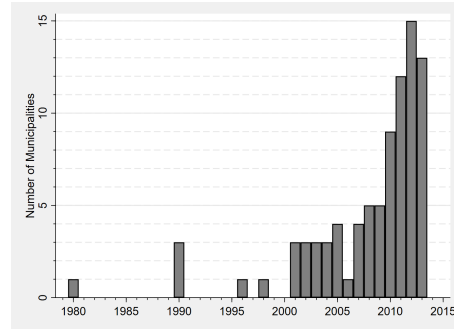
exclusively to all people at and above 80 years, as well as those municipalities where the service is only provided to individuals aged 80+ and only on demand. This group consists of 30 municipalities (7.0% of all municipalities). Figure 2b presents the years of PHV introduction of those potential treatment group municipalities.

A municipality is included in the analysis if the outcome variable (see below) is observed in all periods from 1992 to 2014.¹ The treatment group is defined as the group of municipalities that introduced a PHV programme after 1992 and before 2014 so that each municipality is observed in at least one period before and one period after the introduction of the treatment. Further, a treatment group municipality is excluded from the analysis if its population is larger than the largest control group municipality. This additional restriction is necessary for several reasons: first, the largest cities in Norway have LTC systems which are decentralised to district units, and thus the actual treatment assignment at the individual level cannot be recovered. In addition, these cities differ significantly from the other municipalities in terms of economic performance as well as demographic characteristics and thus the common time trend assumption required for the analysis is unlikely to hold.

¹from 2003 to 2014 in case of expenditure variables



(a) Municipalities with PHV Programme



(b) Year of PHV Introduction

Figure 2: PHV in Norway

The potential control group consists of 285 municipalities (66.6% of all municipalities) that did not introduce PHV, independently of whether the introduction is planned or not.²

4.2 Outcome Variables

In the empirical analysis, we consider two types of outcome variables, all of which are defined for the oldest old (80+) population. The first group of outcomes consists of variables which represent resource use in the LTC sector: real expenditure on nursing homes (*ExpNHC*) and for home-based care services (*ExpHBC*) – both in 1,000 NOK per 100 inhabitants; utilisation rates for nursing homes (*UtilNHC*) and home-based care (*UtilHBC*), respectively.³

The second group of outcomes capture the extent to which the PHVs had the desired effects on older people’s health: the number of hospital admissions (*HAdm*) and hospital days (*HDays*) per 100 inhabitants; and mortality rates (*Mort*) – measured in deaths per 100 inhabitants in the relevant age group and adjusted by the age composition in 2001. Corresponding summary statistics are shown in Table 1.

As the general aims of PHVs are allowing older people to remain in their own homes

²The exact definition of the treatment and control groups depends on data availability and the observed period so both groups can actually be smaller in the actual analysis. Further, different definitions of the groups are applied as robustness checks.

³*ExpNHC* and *ExpHBC* are observed in the period 2006-2014. All other outcomes are available from 1992 to 2014.

Table 1: Descriptive Statistics

	Obs.	Mean	Std. Dev.	Min.	Max.
ExpNHC	3540	902.117	436.989	93.191	3730.915
ExpHBC	3540	854.163	398.290	57.964	4422.275
UtilNHC	6578	17.427	6.710	0	88.235
UtilHBC	6072	38.345	8.201	4.692	95.349
HAdm	6831	57.013	17.956	12.195	275.109
HDays	6831	346.728	118.203	46.875	2887.732
Mort	6601	11.475	2.764	1.669	30.952

(Elkan et al., 2001)) and prevent or delay institutionalisation (Markle-Reid et al., 2006), we expect the introduction of a PHV programme to cause a significant shift from nursing homes to home-based care. However, as the visits might detect otherwise not discovered health or environmental problems, the increase in home-based care utilisation might outweigh the reduction in the use of nursing-home care. PHVs might not only lead to a short-run shift between services but also to a long run reduction in total utilisation due to preventive actions. As care utilisation decreases, the corresponding expenditures are also expected to diminish.

Preventive visits should also cause improvements in the individuals' health status and reduce the probability of accidents such as falls. Therefore, we expect PHV to reduce not only the number of hospital admissions but also the number of hospital days as healthier people might recover faster. For the same reason, the introduction of a PHV programme might lower a municipality's mortality rate.

4.3 Method

In this subsection, we present the econometric model for identifying a causal effect of the introduction of a preventive home visits programme on various municipality-level outcome variables indicating the use of home-based and nursing home services among older people.

Our basic difference-in-differences specification is

$$Y_{mt} = \lambda_t + \mu_m + \beta (\text{PHV}_m \times \text{Post}_{mt}) + \varepsilon_{mt} \quad (1)$$

where Y_{mt} indicates the outcome variable for municipality m in year t , λ and μ are sets of year and municipality dummies, PHV_m is a binary variable taking on the value 1 in case municipality m belongs to the treatment group and 0 otherwise, the dummy $Post_{mt}$ equals 1 for each post-treatment year t of m , and ε_{mt} is the error term. The standard errors are clustered at the municipality level and the regressions are weighted by the 80+ population size.

The identifying assumption is that in the absence of a PHV programme, the trajectory of the outcome Y_{mt} would have been parallel to the corresponding trends in the control group. If the identifying assumption holds, the DID estimate β represents the causal effect of the introduction of a PHV programme.

5 Results

5.1 Evidence Supporting Identification

As mentioned in the previous section, an identifying assumption is that in the absence of treatment, the treated municipalities would have followed a common time trend with the control municipalities. It is thus important to compare the treatment and control groups' time trends before the treatment. Therefore, we estimate event study graphs specified as

$$Y_{mt} = \lambda_t + \mu_m + PHV_Intro_{mt}\beta + \varepsilon_{mt} \quad (2)$$

where Y indicates the respective outcome variable for municipality m in year t , λ and μ are sets of year- and municipality-fixed effects, and PHV_Intro specifies a set of lags and leads regarding the year of PHV introduction with β as corresponding coefficient vector. Regressions are weighted by 80+ population and standard errors are clustered at the municipality level. In case the pre-treatment coefficients in β are close to zero, it appears plausible that treatment and control group municipalities would follow a common trend in the absence of treatment. The graphs are presented in Figures 3 to 6.

For utilisation (Figure 4), hospital stays (Figure 5) and mortality (Figure 6), pre-treatment differences are close to zero and statistically insignificant. LTC expenditure, on the other hand, exhibits positive deviations 5-7 years prior to the introduction of the PHV programme. This may indeed be the reason why the programme was considered in

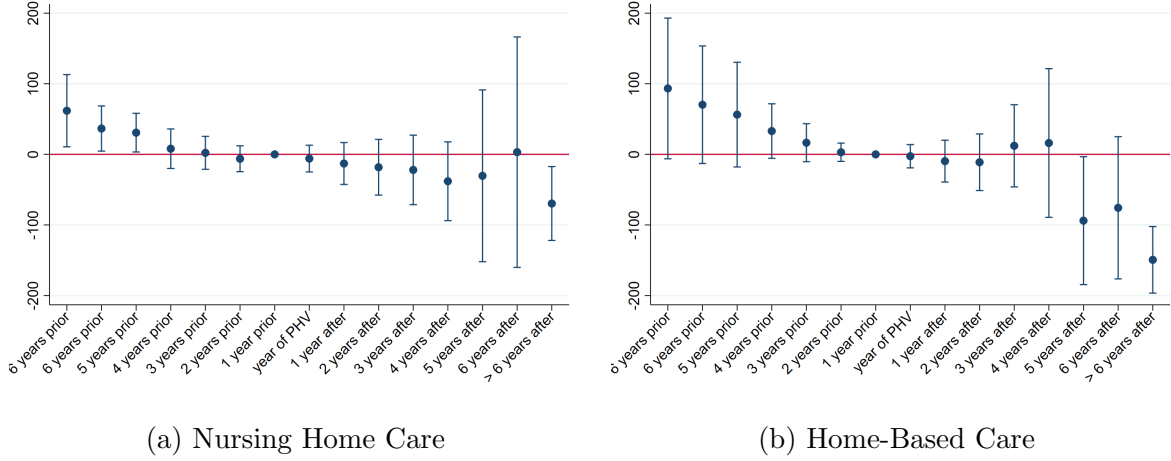


Figure 3: Event Study Graphs – Expenditure

Table 2: Pre-/Post-Treatment Comparison

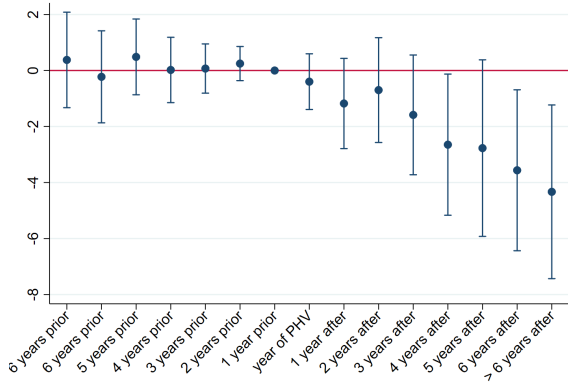
	Treatment			Control			
	Pre	Post	Diff.	Pre	Post	Diff.	Diff.-in-Diff.
ExpNHC	585.355	761.980	176.626	637.358	888.160	250.803	-74.177
ExpHBC	520.847	933.613	412.766	582.280	1098.955	516.675	-103.909
UtilNHC	19.354	13.078	-6.275	17.438	13.274	-4.163	-2.112
UtilHBC	33.396	34.738	1.341	37.743	34.762	-2.981	4.322
HAdm	53.863	55.825	1.962	52.440	59.752	7.312	-5.350
HDays	368.623	272.508	-96.114	359.547	296.123	-63.424	-32.690
Mort	12.687	9.244	-3.443	12.720	9.872	-2.848	-0.595

the first place. However it should be noted that expenditures remain flat around zero for at least 3-4 years prior to the introduction of the programme.

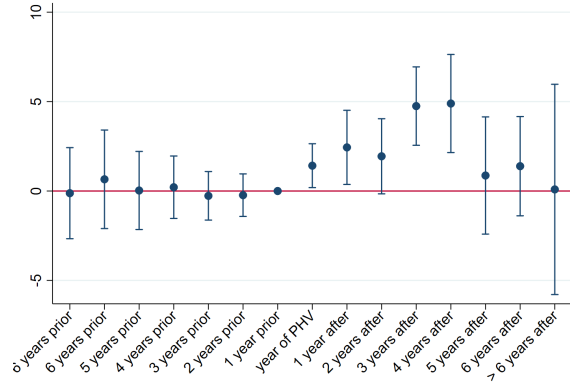
5.2 Main Results

A simple comparison of pre- and post-treatment outcome variable means by groups can give a first hint of the existence of a causal effect. As all treated municipalities introduced their PHV programme after 1995 and before 2014, the means of both treatment and control groups are compared for those two periods⁴. Table 2 contains the corresponding results where the means are weighted by the population size aged 80 and above.

⁴We do the comparison for 2004 versus 2014 for expenditure variables

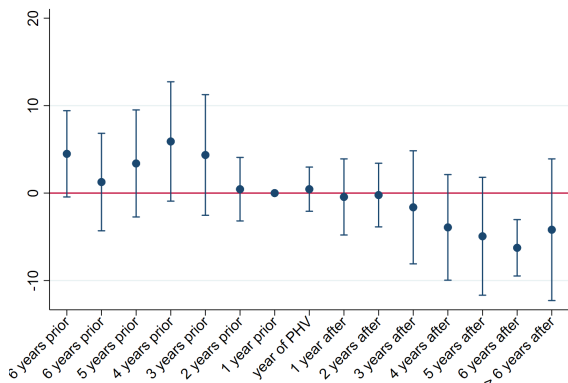


(a) Nursing Home Care

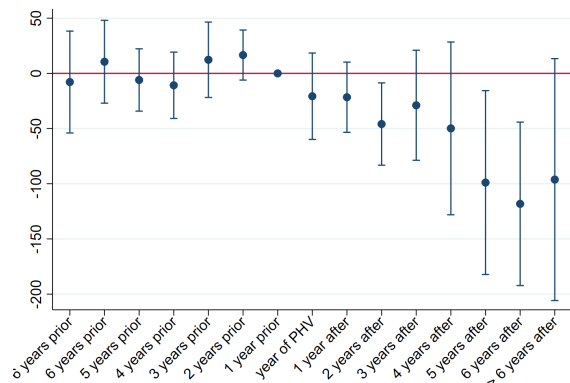


(b) Home-Based Care

Figure 4: Event Study Graphs – Utilisation



(a) Hospital Admissions



(b) Hospital Days

Figure 5: Event Study Graphs – Hospital Admissions

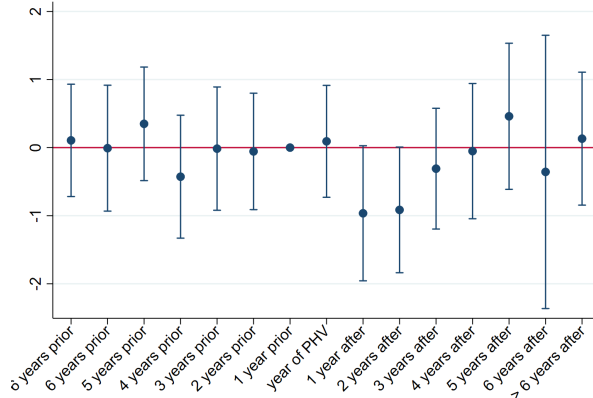


Figure 6: Event Study Graphs – Mortality

Table 3: Results

	Expenditures		Coverage		Hospital Admissions		Mortality
	<i>ExpNHC</i>	<i>ExpHBC</i>	<i>UtilNHC</i>	<i>UtilHBC</i>	<i>HAdm</i>	<i>HDays</i>	<i>Mort</i>
ATET	-37.402** (15.871)	-47.998 (30.229)	-1.982** (0.915)	2.181** (0.941)	-5.133** (2.376)	-43.221 (28.178)	-0.403** (0.173)
<i>N</i>	233	233	227	209	236	236	228
<i>NT</i>	2796	2796	5221	4807	5428	5428	5244

Municipality-level clustered standard errors in parentheses; * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

N: Number of municipalities; NT: Number of observations

LTC expenditure seems to have increased in the treatment group but this increase is smaller than in the control group. As expected, the utilisation of nursing home care was relatively reduced whereas a relative increase in home-based care utilisation could be observed. A reduction relative to the control group can also be found for hospital admissions and hospital days which is as well in line with our expectations. The reduction in the treatment group mortality is larger than in the control group mortality.

Next, we turn to results from a regression analysis according to specification (?). Results for all outcomes are provided in Table 3.

For outcome variables representing resource use in the LTC sector, we find clear evidence that the PHVs had the intended effect: nursing home utilisation is reduced by two percentage points whereas the utilisation of home-based care increases by the same amount. In relative terms, the reduction in nursing home use corresponds to a ten-percent

decline compared to baseline. However, expenditure is reduced for both types of services, even though the estimate is only statistically significant for nursing home expenditure; this reduction is about 6 per cent.

Concerning the outcome variables representing older people’s health, we find clear evidence suggesting reductions in hospital admissions – the reduction corresponds to 5 admissions per 100 population, or a ten-percent decline. Also mortality rates decline: the reduction by 0.4 percentage points corresponds to a relative decline by around 3 per cent.

5.3 Robustness Checks

We expose our results to a number of robustness checks. First, we re-estimate our models using a different definition of our treatment group. Then, we replace the classical statistical inference with design-based inference (Abadie et al., 2017): i.e. we randomly assign the treatment status to municipalities to obtain a distribution of the t statistics of the estimated coefficient.

5.3.1 Spillover Effects

One might argue that the effect on our outcome variables might not directly be due to the home visits but due to the existence of a programme in a broader sense, or due to seemingly irrelevant components of the programme. For example, the announcement of a PHV programme might make older people or their relatives search for information on different types of care more intensively, independently of whether they are in the target group or actually visited. In that case, our estimates would still have a causal interpretation, but the mechanism and thus the policy implications would be completely different. To test this hypothesis, we exclude our original treatment group from the analysis and replace it by all municipalities with a PHV programme that have a different or no special target group. The results can be found in Table 4.

As expected, all parameters are statistically insignificant and mostly small. The exception represents expenditure on nursing home care (*ExpHBC*). The imprecisely estimated coefficient for this variable suggests that PHVs not targeting older people may have crowded out LTC spending for this group. However, since all estimates are insignificant, some caution is required when interpreting these results.

Table 4: Spillover Effects from PHVs with Different Target Groups.

	Expenditures		Coverage		Hospital Admissions		Mortality
	<i>ExpNHC</i>	<i>ExpHBC</i>	<i>UtilNHC</i>	<i>UtilHBC</i>	<i>HAdm</i>	<i>HDays</i>	<i>Mort</i>
ATET	−20.884 (16.127)	0.870 (21.037)	0.435 (0.618)	−1.194 (0.944)	−0.915 (1.758)	−4.627 (11.869)	−0.182 (0.131)
<i>N</i>	278	278	265	244	275	275	265
<i>NT</i>	3336	3336	6095	5612	6325	6325	6095

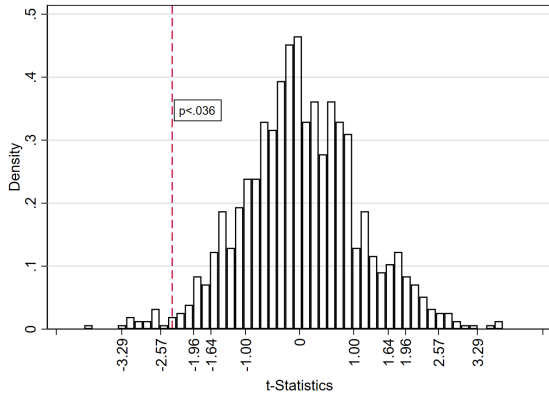
Municipality-level clustered standard errors in parentheses; * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

N: Number of municipalities; NT: Number of observations

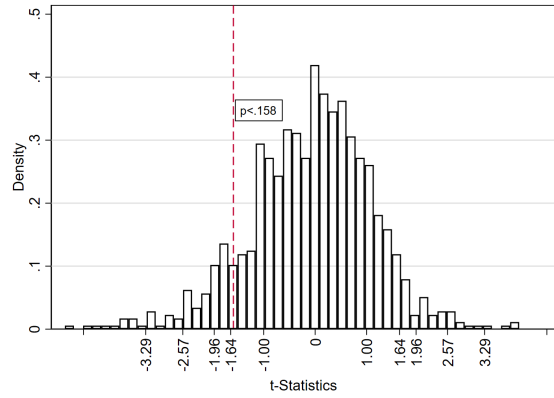
5.3.2 Design-Based Inference

As a further robustness check we consider another basis for inference and apply random placebo tests (Abadie et al., 2017). For the tests, we randomly assign both treatment group membership and year of treatment, estimate the DID parameters, and calculate the t statistics (cf. Fischer et al., 2017; MacKinnon et al., 2016). This is repeated 1,000 times to obtain the distributions of the test statistics. The size of the random treatment group is restricted to be equal to the real treatment group and the random treatment year distributions are identical as well. This is obtained by randomly sorting all municipalities, assigning for example the first 6 municipalities of the random order to the treatment group and all others to the control group, and then assigning a treatment year of for example 1996 to the first placebo treatment group municipality, 2001 to the second and so on until the structure of treated municipalities and treatment years matches to the original case. Figures 7 to 10 show the distribution of the t statistics (dashed line indicates the original t statistics) as well as the two-sided p values indicating the probability of exceeding t -statistics.

The results according to this alternative basis of statistical inference are very similar to those previously reported. The effects on utilisation – of nursing homes and home-based care (Figure 8) – remain significant at the 10 per cent level. Also the effects on hospital admissions and mortality remain significant, as well as the reduction in spending on nursing homes. Thus, randomisation inference would in general lead to the same conclusions as traditional statistical inference.

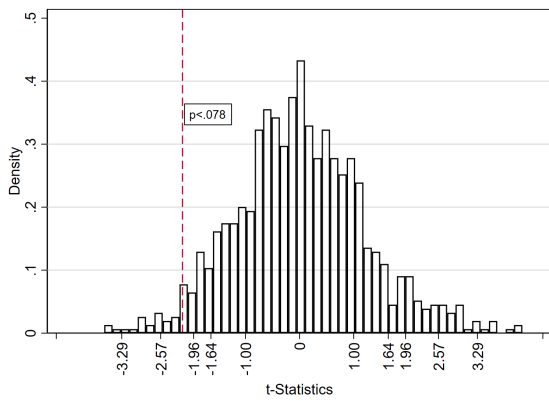


(a) NHC

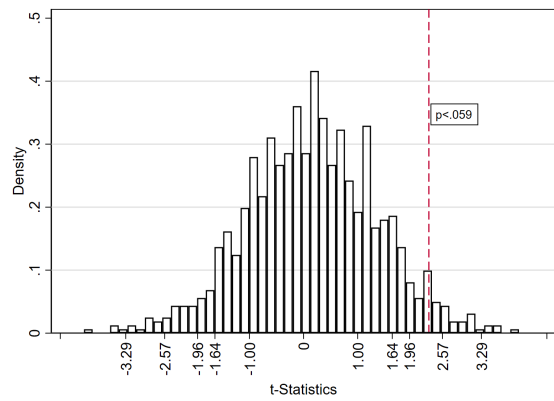


(b) HBC

Figure 7: Random Placebo Tests - Expenditure

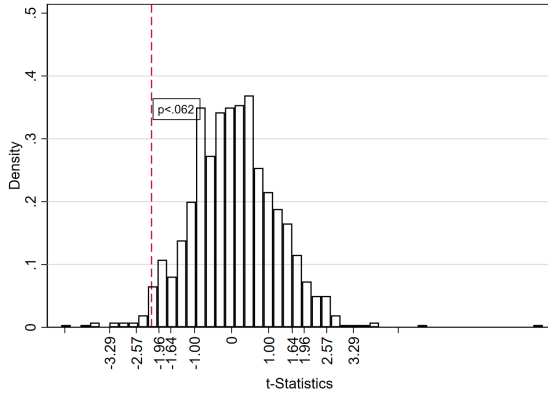


(a) NHC

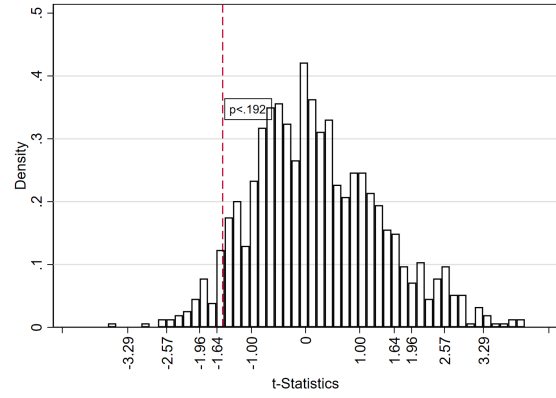


(b) HBC

Figure 8: Random Placebo Tests - Utilisation



(a) Hospital Admissions



(b) Hospital Days

Figure 9: Random Placebo Tests - Hospital Admissions

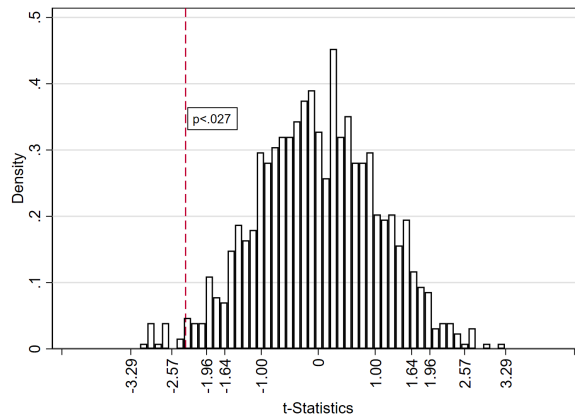


Figure 10: Random Placebo Tests - Mortality

6 Conclusion

In this study, we evaluated whether the introduction of a preventive home visits programme in the Norwegian LTC sector was effective in two senses: first, if it had the intended effect on utilisation of LTC services; and second, if there is evidence suggesting it also improved older people's health.

Concerning the first point, resource use in the LTC sector, our results unambiguously show that the introduction of PHVs was associated with a shift away from institutional care, with a corresponding increase in the utilisation of home-based services. The reduction of nursing home use corresponds to around 10 per cent of the baseline. The reduced reliance on institutional care is also visible in public spending on LTC: nursing home costs per capita decreased by 6 per cent. There is also some evidence suggesting a reduction in per capita expenditure on home-based services, at least a few years into the programme.

Concerning older people's health, hospital admissions are significantly reduced by 5 admissions per 100 inhabitants in the 80+ population. There is a corresponding reduction in average hospital days, even though it fails to reach statistical significance at conventional levels. Also mortality among the oldest old is reduced by PHV; the magnitude of the effect is 0.4 deaths per 100 inhabitants which is equivalent to a reduction by 3 per cent. This might not seem like a large effect, but it is of course remarkable if a relatively low-cost preventive programme can impact old-age mortality at such a rate.

However, as the actual implementations of the programmes are quite heterogeneous, it remains unclear which programme types are the most beneficial. A further unanswered but interesting aspect is what the impacts of the substitution between nursing home and home based care on older people's mental health and life satisfaction are. Finally, an important limitation of our study is that we have no information on informal care. It is possible, though unlikely, that the PHV affected older people's health through changes in the provision of informal care.

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