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AN EVALUATION OF A PHYSICAL ACTIVITY PROGRAMME DESIGNED FOR ELDERLY PEOPLE

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Summary

This study is an assessment of a programme of physical activity for the elderly. The programme offers to residents of retirement homes several physical activities designed to avoid falls, and light gym regimes. The programme is evaluated using a randomised controlled trial protocol in around 30 retirement homes in Europe. The results show a clear reduction in falls and a significant improvement in subjective health indicators. A cost-benefits analysis suggests that the introduction of such programmes could be very positive, thanks to the reduction of costs generated by falls by old people in residence, notwithstanding the benefits for their wellbeing. ■

- The assessment of the HAPPIER programme of physical activity for older people was done using the randomised controlled trial method.
- The impact of the programme led to a reduction in the propensity to fall: on average one fewer mild fall every year and one fewer accidental fall every 18 months.
- The programme also had a significant positive impact on subjective indicators of the health and wellbeing of residents.
- The cost-benefit analysis of the programme showed a net benefit.



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With the increase in life expectancy, the care of old and dependent people in special residences has grown significantly. In the face of this daunting new phenomenon, the quality of life of older people living in institutions and the cost of their care have become urgent questions. The study presented here investigated the benefits of physical activities on the general state of mental and physical health of old people in residence, through the evaluation of the impact of a sport programme designed for old people.

A programme of physical activity for the elderly

For 17 years, the social enterprise Siel Bleu has been developing and implementing programmes of physical activity for old people living in institutions, with the aim of promoting active ageing, and preventing risks and chronic illness linked to ageing and dependence. In 2012, Siel Bleu, with support from the European Union and Danone-Ecosystème, introduced **an evaluation protocol for a programme of physical activity adapted for residents of retirement homes**, called Healthy Activity and Physical Program Innovations in Elderly Residences (HAPPIER).

The HAPPIER protocol offers four types of physical activity, each corresponding to a certain level of physical and mental autonomy:

1. *Prevention of falls*: This programme is proposed for individuals still in possession of their mental faculties and capable of moving by themselves and without help, at least within their residence. These people nevertheless occasionally need assistance to go to the toilet or to get dressed.
2. *Gymnastics on a chair*: A programme offered to individuals not suffering from senility but who have serious difficulties walking. These people have intact mental faculties; they maintain partial autonomy of movement, but may need a walking stick or frame to get around. Their risk of falling is very high (a priori, more than once a month). They need help every day, several times a day, in activities linked to their physical care (see Figure 1).
3. *Alzheimer's gymnastics*: This activity is designed for residents suffering from senility but who have no difficulty walking. This group includes residents suffering from Alzheimer's disease, or another form of dementia; they still have their motor skills and can move themselves around and fulfil basic daily physical needs.
4. *Gymnastics around the table*: This programme is for those individuals suffering from both Alzheimer's disease or another form of dementia and locomotive difficulties. These people need help with most daily physical actions.

For each group, the programme offers seven categories of physical exercise: resistance, endurance, flexibility, balance, memory, communication and relaxation. The duration and intensity of each exercise varies depending on the group and the abilities of the participants. The physical practice sessions are organised in groups of fewer than 10 people, under the direction of a physical educator, a specialist in physical activity for older people and a member of Siel Bleu, and watched by a supervisor of the residential centre and a medical researcher.

Figure 1: – Extract from the HAPPIER programme brochure



Methodology of the evaluation

The assessment of the HAPPIER programme was carried out using the now-standard method of identifying causality with the help of **controlled experiments**. This involves measuring the impact of an action on a treatment group and comparing it with a control group that serves as a "counter-factual". The impact is measured by the "**double-difference**" between the variation that affected the treatment group over time and the variation of the control group. We thus measure a variable of interest (patient health, for example) before implementing the protocol and at the end of it, in each of the two groups. The effect of the programme is estimated from the difference in the change in the state of health of the two groups. This method allows us to be sure that the association between the HAPPIER protocol and residents' health does indeed reflect a **causal relationship**.

The programme took place over 12 months, starting January 2013, in 32 retirement homes in four countries (Belgium, Spain, France and Ireland).

The course of the experiment was as follows:

- The population sample for the study was comprised of willing residents of more than 75 years of age, declared by a medical certificate to be fit for participation. Excluded were residents not willing to participate, and whose life expectancy was less than six months in the doctor's opinion, or whose participation was counter-indicated.

1. The HAPPIER protocol was developed by Siel Bleu, in collaboration with INSERM (Patricia Dargent), the laboratoire santé-environnement-vieillessement (SEV: EA 2506, UFR des sciences de la santé Simone Veil, UVSQ) and the École des Hautes Études en Santé Publique, particularly Mathieu de Stampa (SEV and the Sainte Perine Hospital) and Chloe Gerves (SEV and the SHSC department of the École des Hautes Études en Santé Publique), supervised by their thesis directors, Joël Ankré (SEV and Sainte Perine Hospital) and Martine Bellanger (EHESP). It was implemented by Chloe Gerves, and Jean-Daniel Muller and Guillaume Lefebvre of Siel Bleu. The project was supported by the European Commission (convention VS/2011/0059) in line with its commitment to promote active ageing and solidarity between generations (PROGRESS).

- Within each retirement home, **residents eligible for treatment were randomly divided into two groups**. Only those residents drawn by lot were eligible for a physical activity adapted to their condition. They constituted the treatment group while the others constituted the control group.
- Among the individuals treated, some received one hour of physical activity per week, others two hours, depending on the retirement home.

To reiterate: in each country, each of the four programmes was proposed to the treatment group (chosen in random fashion in each retirement home), at a rate of one hour per week in one residence and two hours in another, thus eight retirement homes per country for a total of 32 retirement homes.

Checking conditions for the experiment's validity

In order to be able to analyse the results, it was necessary first to ensure that the composition of the control and treatment groups were indeed generally the same at the start (at T₀), before the experiment began (which in principle should be the case since all the groups were chosen randomly). In fact, from the point of view of the socio-demographic characteristics of the residents, as the outcome measures revealed, the composition of the two groups was identical. Almost none (four out of 43, to be exact) of the measured indicators presented any statistically significant difference across the two groups. The conditions of the assessment were therefore met. In the particular case of this protocol, it was also necessary to ensure that the residents who disappeared from the sample were not affected in a specific way by the treatment. That could be

the case if they were in less good health at the beginning, and therefore more likely to die. The greatest risk would be that the physical exercise accelerated the death of residents, by demanding too much effort from them. We investigated this hypothesis, using information on the death of residents in the course of the period. Happily, the analysis showed that the probability of death was not higher in the treatment group than in the control group. We also checked that the probability of death was not higher for residents who did two hours of activity than for those who did only one hour.

Measuring the impact of the treatment

This is a matter of measuring the different changes in residents' health over time, as a result of the treatment - that is, the adapted physical activity. The table below illustrates clearly the identification method. In this table, the number of falls per person and per semester is estimated by group and by period. The first column shows that at T₀ (that is, before any resident has participated in the programme), the number of minor falls was not significantly different between the treatment and control groups. However, the difference became statistically significant at T₁. Reading the table line by line, we see that the number of falls rose in statistically significant manner between T₀ and T₁ in the control group, but not in the treatment group. In total, the last case, at bottom right of the table, is the difference between these two differences: it shows that the treatment reduces the number of falls by 0.293 in the treatment group compared with the control group. Thus, **the exercise programme prevents around one fall every 18 months per resident**.

Table 1: Description of the experiment groups

	Belgium	Spain	France	Ireland	TOTAL
T₀					
Effective total T ₀	117	114	107	116	454
With information on no. of hours *	111	111	107	116	445
T ₀ control	52%	50%	50%	50%	
T ₀ Treatment 1h	25%	27%	20%	23%	
T ₀ Treatment 2h	23%	23%	30%	27%	
T₁					
Effective total T ₁	94	98	93	105	390
With information on no. of hours *	94	98	93	105	390
T ₁ control	52%	49%	52%	51%	
T ₁ Treatment 1h	22%	25%	18%	22%	
T ₁ Treatment 2h	26%	26%	30%	27%	
T₂					
Effective total T ₂	76	92	87	89	344
With information on no. of hours *	72	92	87	89	340
T ₂ control	50%	49%	48%	55%	
T ₂ Treatment 1h	23%	27%	21%	24%	
T ₂ Treatment 2h	27%	24%	31%	21%	
TOTAL	287	304	287	310	1188

Note: In Belgium, 117 residents were initially selected (in T₀) to participate in the programme. Fifty-two per cent of these residents were assigned in random fashion to the control group, 25 per cent to the first treatment group (one hour of physical activity per week) and 23 per cent to the second treatment group (two hours of physical activity per week). At the end of the first wave of the experiment, (T₁), 94 of the 117 residents initially presented were interviewed. At the end of the second wave (T₂), the number of residents interviewed was 76.

NB : Some residents did not participate in the programme in all of the waves (T₀, T₁ et T₂).

Sources : IPP Report n°6, January 2015

Table 2: Impact of treatment on the number of minor falls per person in T₁, by semester

	T ₀	T ₁	Difference T ₁ - T ₀
Control group	0,586*** (0,096)	0,884*** (0,153)	0,298*** (0,181)
Treatment group	0,656*** (0,095)	0,661*** (0,097)	-0,005 (0,136)
Diff. treatment - control	0,070 (0,135)	-0,223** (0,180)	-0,293* (0,160)

Note : Before the implementation of the exercise programme (T₀), the number of minor falls per person per semester was 0.656 among residents of the treatment group and 0.586 among the control group, that is, an insignificant gap of 0.07. After the programme, the average number of falls among the treatment group fell significantly below that of the control group (-0.223).

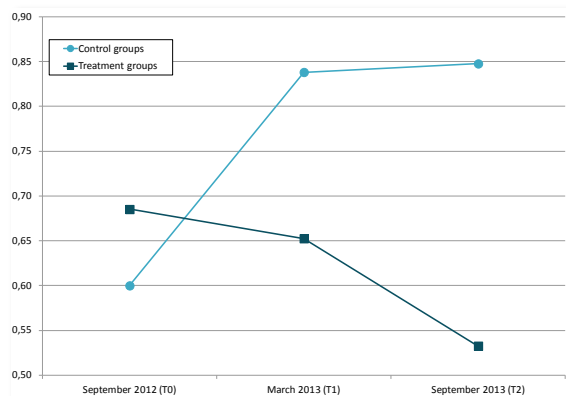
NB : Standard deviations in parentheses. * Significant effect at 10 per cent, ** Significant effect at 5 per cent, *** Significant effect at 1 per cent.

Sources : IPP Report n°6, January 2015

The results obtained by this method can also be represented graphically, as shown in Figure 2.

We compare the change over time in the number of minor falls in the control group (turquoise line) and in the treatment group (dark blue line).

Figure 2: Impact of the HAPPIER programme on the number of minor falls per person per semester



Note : This graph shows the change over time in the number of the number of minor falls per person per semester in the two groups of the HAPPIER programme experiment.

Sources : IPP Report n°6, January 2015

Results of the assessment

Evaluation of the HAPPIER programme involves not only the physical capacities of residents, in particular the number of falls they suffer, but also measures of health and well-being, as well as the impact that the programme has on retirement home supervisors.

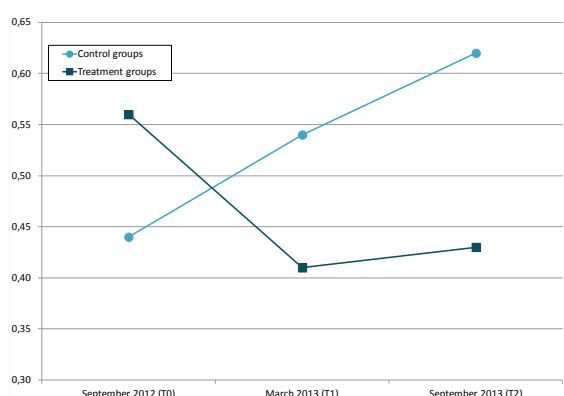
The reduction in falls

The most spectacular result of the programme is in the reduction of the number of falls, a high risk for elderly people. Similarly to Figure 2, Figure 3 illustrates the impact of the programme on the number of accidental falls. **As well as reducing the number of minor falls by one fall per resident every 18 months, the programme also prevents**

one accidental fall every 18 months for each participant. Furthermore, it prevents one serious fall every five years.

The programme also improves the static equilibrium of residents and reduces the risk of losing their balance during mobility tests. The ability to remain standing on one foot grows slightly in the treatment group. Between one-quarter and one-third of people succeed in this exercise in the control group, while the proportion increases over time and by around 44 per cent in the treatment group. Figure 3 makes clear the impact on the risk of falling while making a half-turn, which is seriously lowered in the Timed get up and go tests that test loss of balance while walking, rising from a chair and walking, and turning:

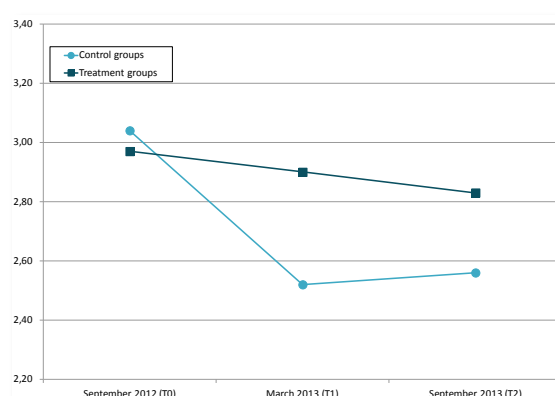
Figure 3: Impact of the HAPPIER programme on the number of accidental falls per person per semester.



Note : This graph shows the change over time in the number of accidental falls per person per semester among the residents of the two groups of the HAPPIER programme experiment.

Sources : IPP Report n°6, January 2015

Figure 4: Risk of falling while turning (Timed get up and go, on a scale of 1 to 5)



Note : This graph shows the change over time in the risk of falling while turning (measured by the Timed get up and go type test) among residents in the two groups of the HAPPIER programme experiment.

NB: The scale of the risk of falling test from standing position varies from 1 to 5 (1: no instability; 2: slow execution; 3: hesitation; 4: unsteady or stumbling walk, or compensatory arms and trunk movements; 5 : at permanent risk of falling). A score higher than 3 or a time to complete the task of more than 20 seconds indicates a serious risk of falling

Sources : IPP Report n°6, janvier 2015

Effects on residents' well-being

The evaluation of the HAPPIER programme also measured its impact on a certain number of indicators of health and wellbeing of the participants. These measures are subjective, in the sense that they relate to resident responses about their perceptions of their state of health and wellbeing; they reveal the impact of the programme on broader factors, beyond « objective » measures.

The programme has a positive influence on the subjective indicators of health collected in the EuroQol questionnaire (see Figure 5), in particular residents' evaluations of their general state of health and of its evolution over the course of the year. The programme improves the state of health score by 0.252 points, and increases it to more than 2 (on a scale of 1 to 3) for the treatment group, which indicates that **the majority of residents who participate in the programme feel that their state of health has improved**. (The exact question was : "Compared with my general level of health in the past 12 months, my state of health today is: 1 (worse) ; 2 (about the same) ; 3 (better) ").

Regarding the general score for state of health as assessed by residents themselves ("Give a score between 0 and 10 for your state of health – with 0 being the worst state of health imaginable and 10 the best "), the treatment raises this score by more than half point on the scale of 0 to 10.

The programme reduces by around 15 per cent the prevalence among residents of a "feeling that life is empty" (Geriatric Depression Scale). In the treatment group, the proportion of residents who feel that their life is empty is 29 per cent before treatment and 16 per cent afterwards.

The programme also **has a positive effect on the scores given by residence staff, especially in relation to how residents' perform daily actions and their levels of physical and verbal aggressiveness (Aggressive Behavior Scale).**

The effects on supervisors

The impact of the program on supervisory staff and doctors cannot be evaluated using the same method. Indeed, they were not allocated in random fashion to the treatment and control groups; on the contrary, they take care of all residents (treated or not). Analysis of descriptive statistics show, however, a strong appreciation of the programme among the supervisors.

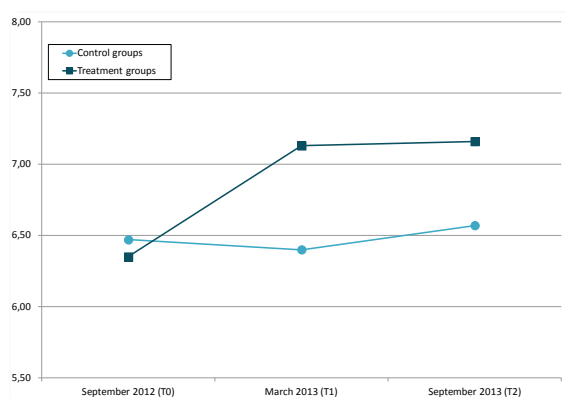
- More than 80 per cent of residence care staff believe that their work conditions are improved by the programme, especially daily life within the establishment and the meaning of their work.
- A majority of the staff see an improved good mood and a lesser degree of aggression among the residents.

Moreover, while consulting doctors were initially unenthusiastic about this type of programme, the majority were convinced by the experiment *a posteriori*.

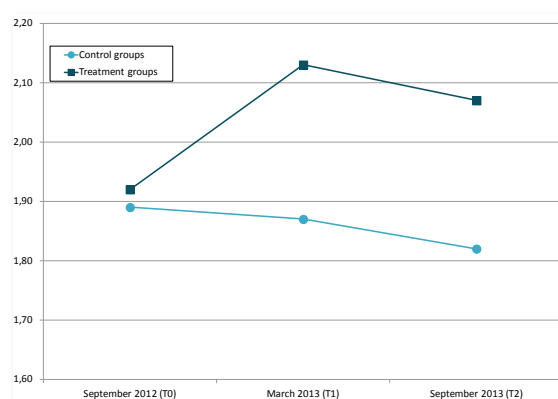
- They agree, unanimously, that the adapted physical activity programme is a preventive health strategy.
- They support its wider implementation at a rate of two hours per week for older people, no matter what their degree of dementia or physical disorder.
- They regret the lack of funding for this kind of non-pharmaceutical care.

Figure 5 : Impact of the HAPPIER programme on residents' perceptions of their state of health.

(a) Subjective indicator of well-being (on EuroQol scale of 0 to 10)



(b) Change in my state of health over the past 12 months



Note : These figures show the change over time in residents' perceptions of their state of health, according to two measures of well-being : (a) the EuroQol questionnaire (figure on the left), marked on a scale of 0 to 10; (b) residents' perceptions of changes to their state of health over the last 12 months (figure on the right), in response to the following question: « Compared with my general level of health in the past 12 months, my state of health today is: 1 (worse) ; 2 (about the same) ; 3 (better) ».

Sources : IPP Report n°6, January 2015

Differential impact depending on the groups

The analysis reveals some significant differences between countries, from the point of view of outcome measures and the impact of the treatment. The effect of the programme is particularly strong in Spain, except in the reduction of number of falls.

Other differences according to residents' characteristics to be noted are:

- **The youngest group of residents** (less than 83 years old) **gain particular benefit from the programme**, as the scores for capacity and performance in actions of daily life show, as well as for the exercises of balance when in motion.
- **The group of residents who are the least heavy** (BMI less than 21.9) **also benefit more from the programme**, especially in relation to the number of accidental falls and the EuroQol mental health scores. In this case, the exercise programme prevents almost one minor fall every six months.
- **The programme seems to have a particularly strong impact on people with walking difficulties** (in comparison with those with dementia).
- **The results in self-reported mental health (EuroQol and GDS scores) are the same in the groups of residents who do not suffer any senility**, that is, groups H1 and H2. This warning is useful in cases where senility prevents correct responses to questions.

Thus, the analysis reveals that the programme brings benefits for both mental and physical health. The practice of an adapted physical activity programme brings undeniable improvement in wellbeing to elderly people. **It is essentially a preventive action**, insofar as it prevents the worsening of their state of psychological and physical health and the increased risk of falling.

Implications for public policy

While the regular practice of adapted physical activity results in significant gains in mental and physical health and the general

wellbeing of the elderly, we still need to assess the extent to which the costs of such programmes justify the benefits they bring. We recall the seriousness for old people of the risk of falling, especially for those who live in institutions. Falls and their complications represent the most serious and most frequent health problems for the elderly: they are the origin of half of the injuries suffered by people over 65 years of age and one-third of the reasons for hospitalisations and hospital mortality. In France, people more than 75 years old represent one-fifth of health care expenditure, though they make up only one-tenth of the population. The cost of falls among them represents around half of the total cost of health care expenditure for that section of the population.

In France, the various estimations available indicate a fall rate of between 1.5 and 1.7 per year in retirement homes, at a cost of around 1.5 billion euros per year, for around 500,000 people in living in retirement homes, which is an average cost per fall of between 2,000 and 3,400 euros, according to a recent report by the independent national health research authority (*la Haute Autorité de la Santé*). *Siel Bleu* estimates the cost of the adapted physical activity programme at 158 euros per year per retirement home resident. The programme reduces by one-third the number of falls per resident, starting at 1.5 falls, which is one half-fall fewer per resident per year. The cost of a fall varies between 2,000 to 3,400 euros. The savings per resident and per year then ranges from, at the low end of the scale, $0.5 \times 2000 - 158 = 842$ euros to, at the high end, $0.5 \times 3400 - 158 = 1542$ euros. Taking the total number of residents of retirement homes in France, that is, half a million, we arrive at **a total net benefit per year of between 421 million and 771 million euros..**

To this public expenditure benefit must be added the improvement in wellbeing of the elderly in residence. While it is difficult to quantify this effect in monetary terms, it is no less important an element in the public discussion about the utility of the general introduction of such practices to retirement homes.

Reference

IPP Report n°6 - January 2015, *Evaluation d'un programme d'activité physique adapté à un public de personnes âgées.*

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