

South Ayrshire, East Ayrshire and Dumfries & Galloway

AREA BASED SCHEMES WALL INSULATION EVALUATION

2016 –
2018

Executive
Summary
Prospective
Study (Part 2)

June 2018





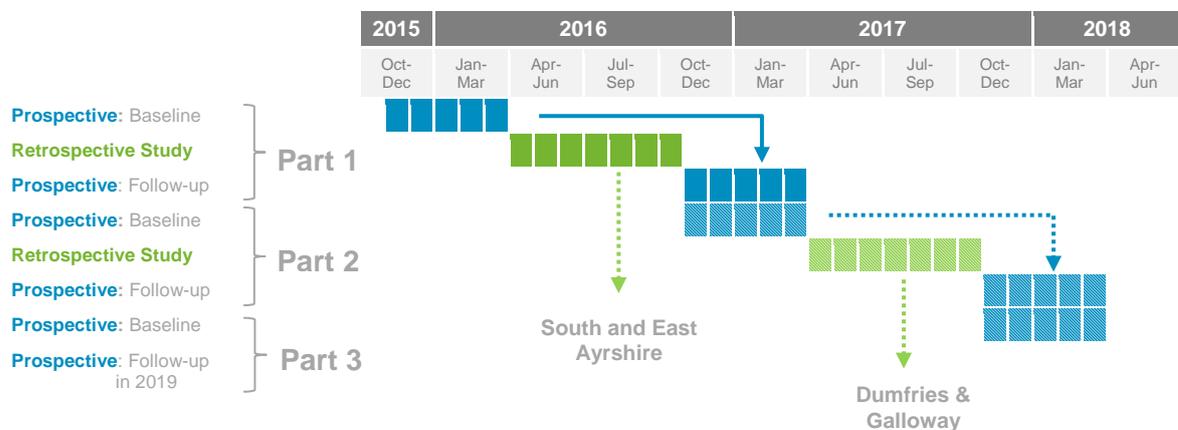
AREA BASED SCHEMES WALL INSULATION EVALUATION



Prospective Study (Part 2)

Introduction:

- This report summarises the recent findings of a wider evaluation, the aim of which is to investigate the impacts of insulation upgrades administered through the **Home Energy Efficiency Programmes for Scotland (HEEPS): Area Based Schemes (ABS)**.
- The project is a collaboration between the **Energy Agency; NHS Ayrshire and Arran (Public Health); South Ayrshire, East Ayrshire and Dumfries & Galloway Councils**.
- This part of the assessment (**Prospective Study – Part 2**) was conducted on a sample of households, located throughout South Ayrshire, East Ayrshire and Dumfries & Galloway, during the winters of **2016/2017** and **2017/2018**.



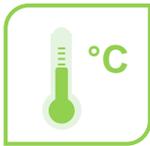
Methods:

- A total of **125 households** were originally recruited as part of the study. From this initial group, **94** of the households participated in the follow-up assessment. This gave a total of **27** households in South Ayrshire, **40** households in East Ayrshire and **27** households in Dumfries & Galloway.
- Due to the timescales of the works and the annual allocation of funding, it was not possible to include a control group in this phase of the study.
- Only households located in South Ayrshire and East Ayrshire were included in the health evaluation element of the study since these areas are included with the NHS Ayrshire and Arran regional health board.

- **Baseline** and **follow-up** assessments involved:



A household questionnaire (completed by a designated householder)
Individual health questionnaires (completed by all members of each household who wished to participate – South and East Ayrshire only)



A thermal comfort diary (completed over 1 week)
Environmental monitoring (selected households only – internal/external temperature, relative humidity and energy consumption data)



Energy Performance Certificates (EPCs) were also compiled for each property

Results:

Property Conditions

- The majority of households gave positive comments regarding improvements to the condition of their home. Of those who received the insulation upgrades, **98%** agreed that the **appearance of their home** had been improved and **75%** of those involved in street projects commented that the **neighbourhood** had 'improved a lot'
- There was a reduction in the number of households reporting issues with **cold spots and the lack of insulation in the property**.
- **Around half** of those who had reported previous issues with **condensation and dampness** found that the problems appear to have improved since the installation.
- There were 18 households (19%) who reported noticing a decrease in the level of noise following the insulation upgrades.
- Following the insulation upgrades, the **Energy Efficiency Ratings** of the properties increased on average by **8 points** and the number of properties which would be considered below the national average was reduced from **37%** to **13%**
- The **Environmental Impact Ratings** of the properties also increased on average by **10 points** and the number of properties which would be considered below the national average was reduced from **55%** to **17%**. This resulted in an average annual **CO₂ reduction** of **24%**.

EPC Data (Average Values)

	South Ayrshire			East Ayrshire			Dumfries & Galloway		
	Pre-install	Post-install	% Change	Pre-install	Post-install	% Change	Pre-install	Post-install	% Change
Primary Energy Indicator (kWh/m ² /year)	285	223	-22%	308	235	-24%	321	240	-25%
Energy Efficiency Rating (EER)	66	71	9%	59	67	14%	62	70	12%
% with EER below national average (61)	35%	4%	-	45%	18%	-	29%	14%	-
Environmental Impact Rating (EIR)	61	69	13%	56	66	18%	57	68	18%
% with EIR below national average (59)	52%	17%	-	65%	15%	-	61%	18%	-
Annual Fuel Costs (£)	£860	£660	-24%	£1,130	£880	-22%	£1,000	£780	-23%
Annual CO ₂ Emissions (tonnes)	3.7	2.7	-25%	5.0	3.8	-24%	4.5	3.4	-24%

Fuel Costs

- At the baseline stage, the majority (62%) reported that they were ‘always’ able to keep warm enough during winter and that they found it either ‘fairly easy’ or ‘very easy’ to pay their bills. While there were some increases in these figure at the follow-up stage with 77% now ‘always’ able to keep warm and 91% describing paying their bills as ‘very easy’, **stress and anxiety** regarding fuel expenditure was limited to a few individual cases.
- 39% reported that they had noticed a reduction in their fuel bills compared to the previous year. For those who did report such reductions, the estimated savings during winter were equivalent to around **£23 per month** on average. On the other hand, around a fifth of the group also reported an increase in their fuel bills. These figures are however subject to uncertainty due to difficulties in obtaining accurate data from the householders, fluctuations in energy prices and differences in weather conditions.
- Based on the **EPCs**, the **average saving in fuel expenditure** for the group was approximately **22%** although the figures for individual properties ranged between **2% and 39%**. This was equivalent to average savings of around **£230 per year**.
- Prior to the insulation, it was estimated that **48%** of those who provided sufficient income data would be classed as **fuel poor** based on modelled fuel expenditure. The theoretical savings calculated from the EPCs suggested that this had shifted to **31%** following the insulation upgrades. Going forward, these calculations will be revised to reflect the Scottish Government’s new fuel poverty definition.

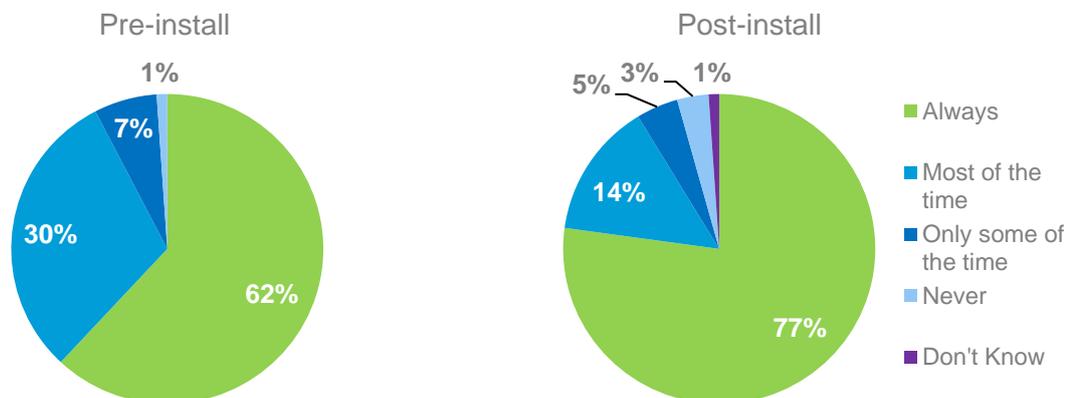
Occupant Behaviour

- The majority of households found that, following the insulation upgrades, their home now **heated up more quickly** (81%) and was able to **retain the heat more effectively** (86%). **Around half** of the participants also agreed that there was now a **more even distribution** of heat throughout the property.
- **39 households** reported a **reduction in the number heating hours** while **15** had **turned down their thermostat** and **10** had **adjusted their TRVs**.
- There were apparent reductions in the use of coping strategies such as **additional room heaters, electric blankets, hot water bottles** and **extra layers of clothing**.
- **23 households** had **smart meters** installed during the study period and **around a fifth** of households reported being **more energy conscious** since receiving the insulation.

Thermal Comfort

- There was an apparent increase in the number of households reporting that they were **“always” kept warm enough** during winter (increase from 62% to 77%).
- Following the insulation works, **75%** felt that the **overall temperature** had increased with **35%** describing their home as **“much warmer”**.

Does Your Heating Keep You Warm Enough During Winter?”



Environmental Monitoring

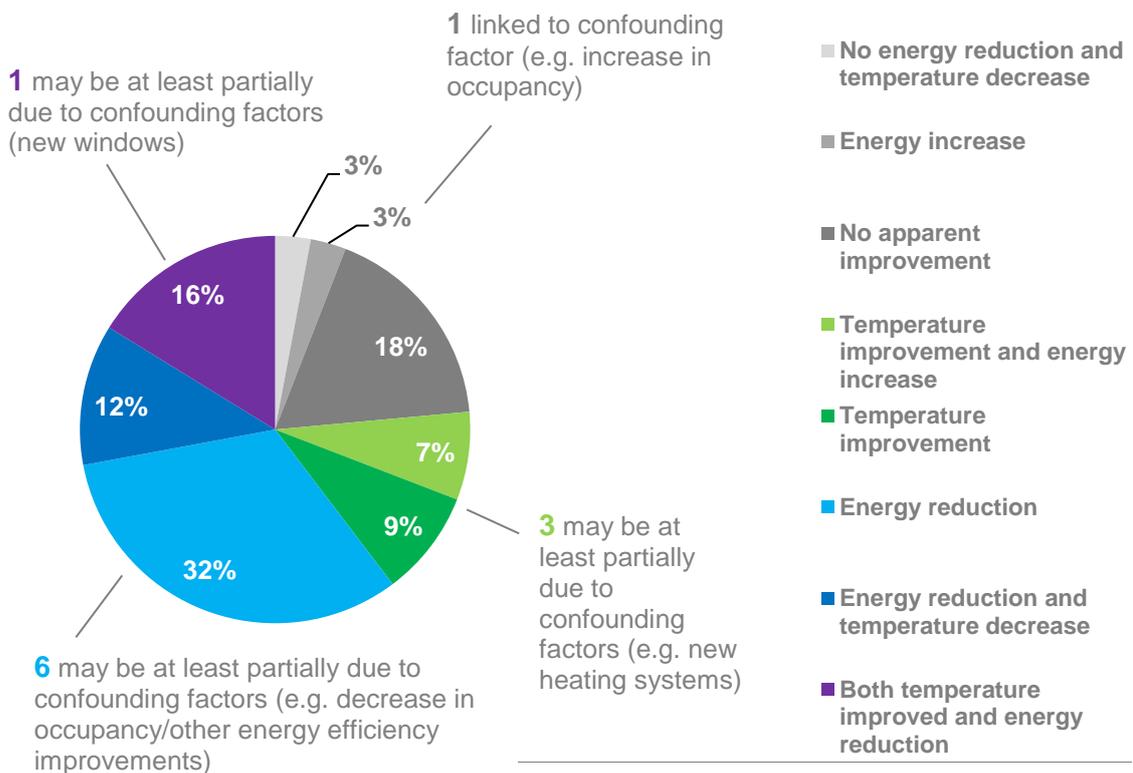
Prospective Case Studies (75 properties):

- This element of the study analysed the same group over two winters and compared the conditions in these 75 properties both before and after the insulation works.
- In comparing the mean daily consumption figures for the group as a whole, there was an apparent increase in consumption between the pre- and post-install periods (44 kWh per

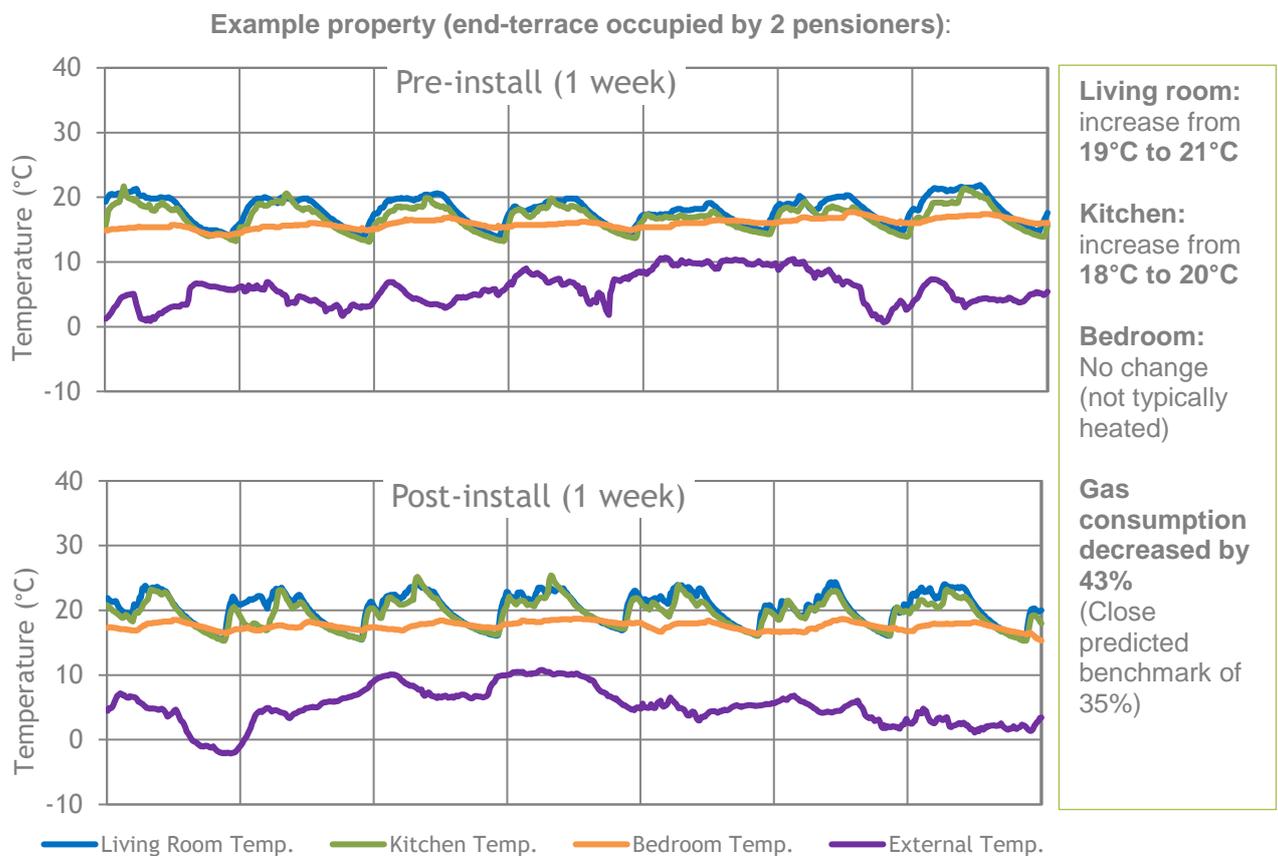
day compared to 50 kWh per day). However after adjusting for the weather conditions and heating degree days (HDD), there was an apparent decrease in the mean consumption values (5 kWh per HDD compared to 4 kWh per HDD). There was therefore a small but significant improvement in the energy performance of the properties once the colder conditions of the 2017/18 winter period had been taken into account.

- The majority of properties exhibited mean **relative humidity** values which were within the recommended range of 40 to 60%RH. There were however **15 households** where there was evidence of high relative humidity during the baseline assessment. Following the insulation upgrades, only **1 household** exhibited average relative humidity values which were above 65%RH.
- At the follow-up stage, nearly half of the group (44%) appeared to be experiencing a reduction in their energy consumption while 16% showed evidence of a temperature improvement in at least one room. A further 16% showed evidence of combined temperature and energy-efficiency improvements.
- In comparing these results to the predicted energy savings, 18% of the properties with sufficient data exhibited a saving which exceeded the predicted benchmark for that property type (based on EPC data). In these cases the occupants had typically made **additional behaviour changes** which reduced their consumption (e.g. reduction in thermostat setting or number of heating hours). Consumption was reduced by **18% - 47%** for these properties giving **average annual savings** of approximately **£300**.

Observed Changes from Environmental Monitoring



- A further 25% of properties achieved savings which were very close to the benchmark figures. In these cases gas consumption was reduced by **8 - 47%** giving **estimated annual savings of £130** on average.
- There were 31 (51%) properties where the savings were found to be below the predicted benchmark. This is likely due to the differences in weather patterns and the discrepancies between the EPC assumptions and the actual energy use profile of each dwelling. Further analysis using more accurate benchmarks, which take these factors into account, is currently being developed and will be updated in the near future.



Health

- There were **77 adults** who completed a pre- and post-install health questionnaire. Only participants from South Ayrshire and East Ayrshire were included in this part of the analysis and unlike our previous study, there was **no control group** for comparison. Statistical comparisons were therefore limited to comparisons between the pre- and post-install assessments.
- As with Part 1 of the study, there were few cases where the environmental conditions were thought to be dangerous to the health of the occupants or where fuel costs were seen as a major financial concern. While this does not prevent participants from benefitting from the

insulation, measurable impacts on either physical or mental health may be more difficult to detect when the baseline conditions are perceived to be adequate. Nonetheless, Part 2 also provided evidence of **proximal outcomes** (e.g. improved housing conditions, increased indoor warmth/comfort, increased pride in the home and reduced fuel bills) which have **known links to longer term health impacts**. This supports the theory that insulation retrofits can provide the initial steps in **health improvement pathways**. While our study was unable to measure some of the longer term outcomes, some observations regarding more immediate impacts on health are offered:

- There was an apparent improvement in the overall physical health scores, as obtained from the SF-36 questionnaire, where the mean values increased from 78 to 84. This was related primarily to improvements in the '*Role limitations due to physical health*' category.
- Statistically significant* improvements were found when **aggregated physical health and aggregated mental health scores** were correlated with **perceived warmth improvements**. More specifically, score increases were observed in the '*Role limitations due to physical health*', '*Emotional Well-being*' and '*Pain*' domains for those who also described their home as '*much warmer*'
- In addition to the SF-36 results, there were also nine anecdotal reports of **physical health improvements** which the participants linked to the intervention. This included six cases of improved **respiratory health** and four cases related to **pain reduction**. There were also four cases where parents reported improvements in their children's respiratory health due to the improved conditions within the home.
- There were a further 17 reports of improved **mood and mental well-being** which were typically linked to increased comfort and satisfaction with both the internal conditions and external appearance of the home.
- While there were no statistically significant changes in **recent health service use** based on self-reported data, an investigation of longer term health service use trends has also been performed and revealed some statistically significant findings. For example a **postcode level analysis** of hospital admissions for respiratory events has shown that areas which has previously received HEEPS:ABS funding have had lower admissions rates compared to both the local authority as a whole and to postcodes with similar characteristics.

Installation

- There were some mixed reports with regards to the installation process. Positive comments were made regarding the **efficiency** and the **work ethic** of specific contractors while negative comments were linked to issues with **mess, delays** and **communication**. Despite these issues, the majority (91%) stated that they would **recommend the scheme** to others.

Conclusions & recommendations:

Part 2 of the evaluation has continued to demonstrate the importance of understanding the **impacts** of the **HEEPS:ABS** programme rather than simply the number of measures or households reached. The results echo the findings of our previous study however the additional environmental monitoring which was conducted within Part 2 has provided further insight into the typical outcomes which may be expected for households receiving insulation upgrades and we have been able to gather data from a much wider range of property types. This was based on the recommendation from Part 1 that measured data should be captured wherever possible in order to measure actual performance. The health assessment also offered some additional findings regarding measured health improvements with small increases in overall physical health scores. As a response to one of recommendations from Part 1, which recognised the limitation of both the sample size and the follow-up period used in the health assessment, a new approach regarding health service use was adopted for Part 2 and this has provided some additional insight into longer term health trends using postcode level clinical data. Overall the reports were positive with the majority of participants stating that they would recommend the scheme to others. All of the households who were insulated reported an improvement in at least one of the anticipated outcomes. The insulation upgrades therefore appear to have contributed to:

- *Marked improvements* to the **appearance** of the properties/neighbourhoods and to the **general housing conditions**
- *Notable reductions* in **coping strategies** and changes in **how the home is used**
- *Modest improvements* in **perceived thermal comfort** and **measured internal temperatures**
- *Modest improvements* in **reported issues with condensation/dampness** and **measured relative humidity levels**
- *Modest reductions* in **actual energy requirements** based on **measured** data (after adjusting for differences in weather conditions)
- *Modest reductions* in **modelled fuel costs, energy requirements** and the number of households in **fuel poverty**
- *Modest improvements* to **physical and mental health scores** (linked to perceived warmth improvements) and further **anecdotal improvements** to physical and mental health
- *Apparent improvements* to **longer term health outcomes** through reduced **hospital admission rates** (particularly for respiratory related issues)

It is acknowledged that the study is still limited by the sample size, the diversity of building typologies included and in this case the lack of a comparable control group. All of these issues can be attributed to annual nature of the funding which limits the number of eligible properties which can be recruited each year, especially when it is preferable for the assessment periods to take place during the winter months. From our conclusions, the following recommendations and potential areas for further research are proposed:

- Despite the fact that the HEEPS:ABS programme is targeted at fuel poor areas, there were many cases where the baseline conditions were already satisfactory and the opportunity for potential improvement was somewhat limited. This was particularly apparent in the Dumfries and Galloway area due to the inclusion of properties with previous cavity wall insulation. Although this existing insulation was deemed to have failed and was therefore extracted prior to the new external insulation, the monitored data showed fewer improvements for this group since the pre-install measurements were gathered during a period where the wall already had insulation. **Where possible future targeting of project areas should prioritise properties with the lowest energy-efficiency ratings.**

- While EPCs provide a useful comparison of properties, the assumptions made as part of assessments do not always reflect the realities of actual performance. More robust benchmark models should be used going forward in order to evaluate the improvements more accurately. **Alternative benchmarks are currently being developed in partnership with the University of Strathclyde and will be revised in due course.**
- Households should continue to receive post-install advice on maximising the benefits of the insulation system however it would be useful to investigate to what extent this advice is being applied and the impact of any behaviour changes resulted from this advice. **This could be factored into next year's assessment by including an additional section in the questionnaire.**
- Occupant behaviour has been identified as an important factor in both fuel poverty status and the different responses to energy-efficiency measures. The case studies presented provide some initial explanations on the changes observed however there would be value in investigating occupant behaviours in more detail in terms of how household circumstances may influence decisions making, heating regimes and energy use. **This topic will be investigated as part of a new PhD project conducted in partnership with the University of Glasgow. The student will work alongside the Energy Agency and will be commencing from October 2018.**
- While Part 2 offered some additional housing typologies, these were again dictated by timescales of the 2016/17 programme and were therefore not representative of the overall population. Continued evaluation of future programmes would allow for alternative construction types and neighbourhoods to be investigated and compared. **A third cohort of participants from the 2017/18 programme has now been recruited for follow-up in 2019 and it is anticipated that a fourth cohort from the 2018/19 programme will be recruited from October 2018.**
- The statistical power of the health analysis is still limited by the size of the sample, the length of the follow-up period and the difficulties in identifying suitable control groups. It is recommended that health data collection is continued for future programmes and factored into an **aggregated study** combining data from all years of the programme. Where possible an additional **control group** who are earmarked for a future project should be engaged during 2019. The **postcode level health analysis** should also be continued and refined in partnership with the NHS (Ayrshire and Arran).

Some of the **previous recommendations** from **Part 1** have also been continued for **Part 2** given the similarity of some of the findings:

- The fact that more households were not lifted from fuel poverty highlights the need to **address other drivers** (fuel costs, income and how energy is used in the home) alongside any improvements to the energy-efficiency of the building itself.
- The impacts of the wall insulation may also be off-set by other factors such as inefficient heating systems or poor windows. A **'whole house approach'** may therefore be required in order for some properties to meet satisfactory standards. Where appropriate customers should be **signposted to other schemes** which may offer additional energy-efficiency improvements

This report was prepared by the Energy Agency in partnership with NHS Ayrshire & Arran, East Ayrshire, South Ayrshire Council and Dumfries & Galloway Council.

If you would like any further information on the study please contact:

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