School of Built Environment,
Energy and Environmental Engineering Research Group

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A SYSTEMATIC TIME-USE BASED APPROACH FOR ESTIMATING RESIDENTIAL ENERGY CONSUMPTION

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EPSRC Engineering and Physical Sciences Research Council

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WHY WORK MATTERS TO US?

- **Academic perspective:** to understand the way institutionally timed events come to regulate, order and organize activities into rhythms (at micro and macro level);
- **Methodological perspective:** to analyse the variation in sequences of activities taking place at times of peak electricity demand;
- **Policy perspective:** to encourage the development of time-use policies that target specific demographic groups during specific time periods, for specific events, in specific geographical regions and for specific equipment use.

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OBJECTIVE

The aim of this study is to examine energy-related behaviours and to determine if they are influenced by the consumer's time-use behaviour.

- **How duration and timing of the work patterns affects the cohesion between energy related activities?**
- **How *time-use behaviour* influences residential electricity consumption?**
- **How the connections between energy-relevant activities impact the configuration of the day?**

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LITERATURE

Time-use behaviour dimensions	**Activity location**	**Activity time and duration**	**Activity sequencing**	**Activity appliance usage**
Activity location		De Lauretis et al. 2017	Sekar et al. 2018	Yamaguchi et al. 2020
Activity time and duration	Torriti et al. 2020		McKenna et al. 2016	Torriti et al. 2015
Activity sequencing	Mattioli et al. 2016	McKenna et al. 2020		Palm et al. 2018
Activity appliance usage	Yilmaz et al. 2020	Anderson et al. 2018	Ramírez-Mendiola et al. 2019	

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ENERGY-RELEVANT ACTIVITY

Authors	Activities	Time Use Data
Richardson et al. 2010	Washing, Ironing, House cleaning, Laundry, Watching TV, Cooking	UK Time Use Survey 2010/2011
Torriti 2017	Preparing food, Washing, Cleaning, Washing clothes, Watching TV, Computer	UK Time Use Survey 2010/2011
Anderson et al. 2018	Laundry	UK Time Use Surveys from 1974, 1983/1985, 2000/2001 and 2014/2015
Ramírez-Mendiola et al. 2019	Absence, Sleep, Generic active, occupancy TV watching, Food preparation, Laundering, Dish washing, ICT related	UK Time Use Survey 2014/2015
Torriti et al. 2020	Washing, Ironing, House cleaning, Laundry, Watching TV, Cooking	UK Time Use Survey 2014/2015

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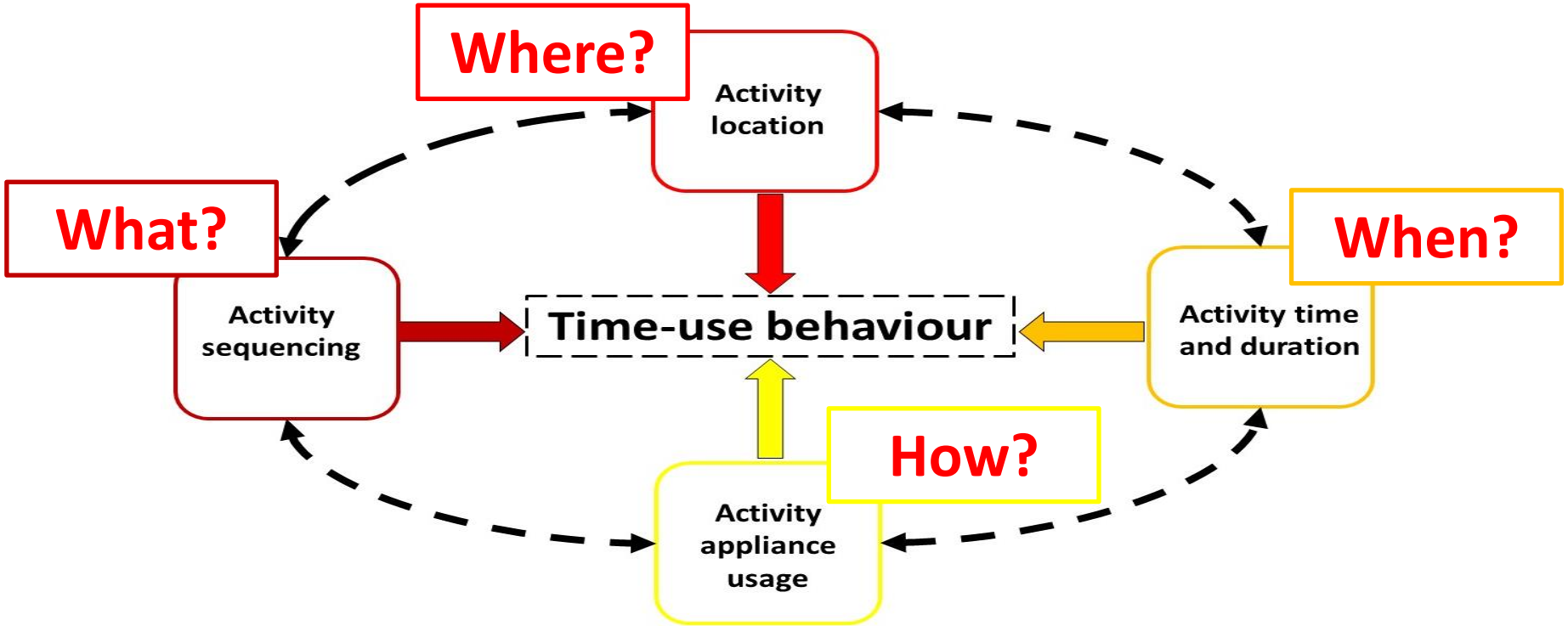
TIME-USE BEHAVIOUR



METHODOLOGY

Time-use diaries (TUD) and week-long work dairies

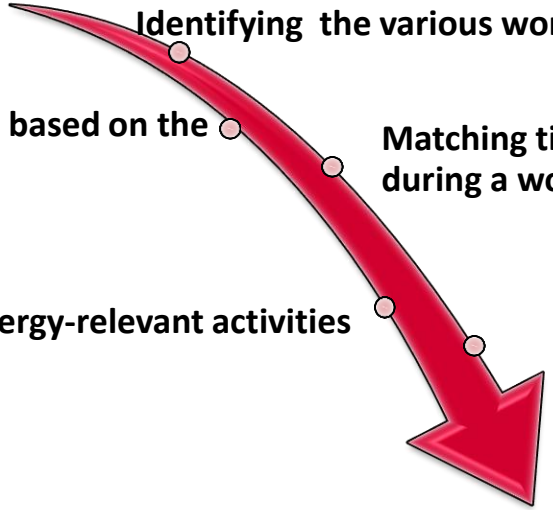
Identifying the various work patterns that occur on a weekly basis

Dividing the sample into 2 categories based on the weekly duration of work patterns

Matching time-use dairies that were completed during a work day

Identifying energy-relevant activities

Measuring and to visualizing the location, timing and duration, sequencing and appliance usage of energy-relevant activities



Investigate the causal effect of time-use behaviour on residential energy consumption

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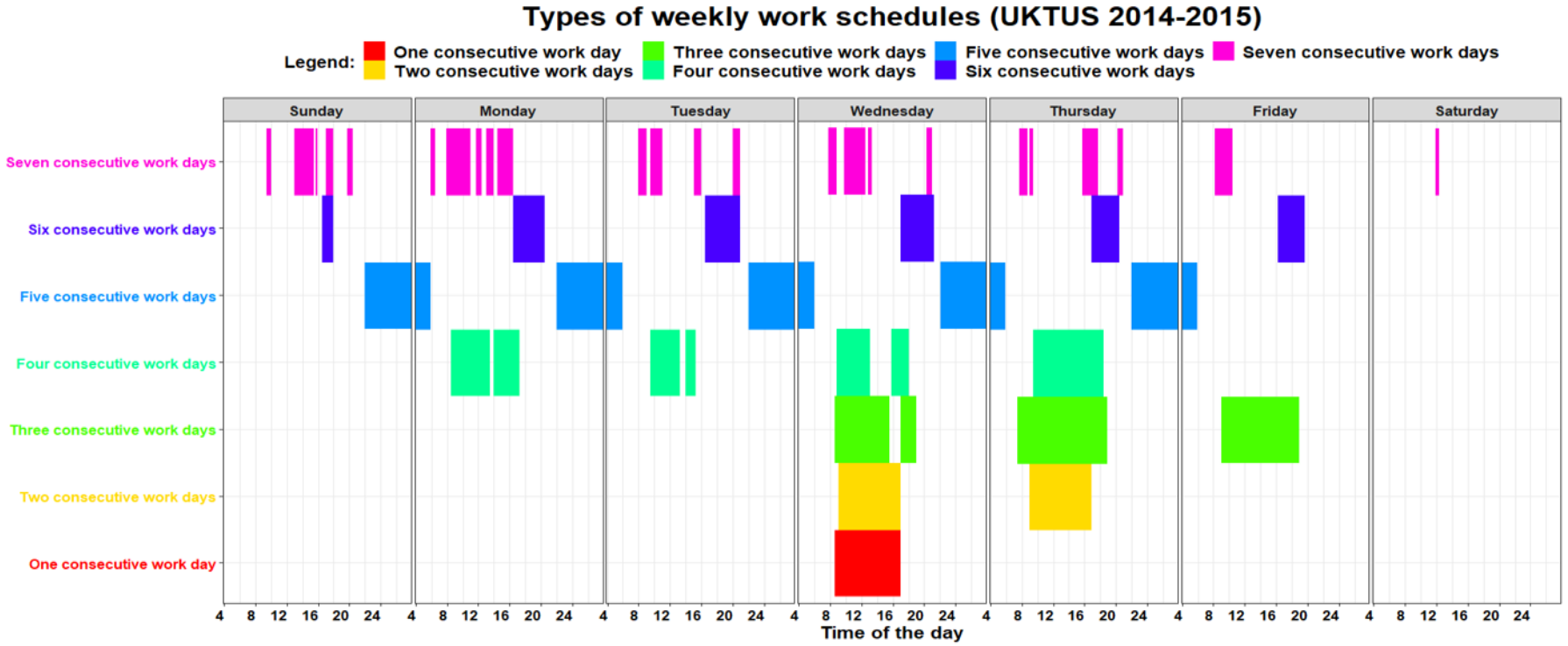
METHODOLOGY



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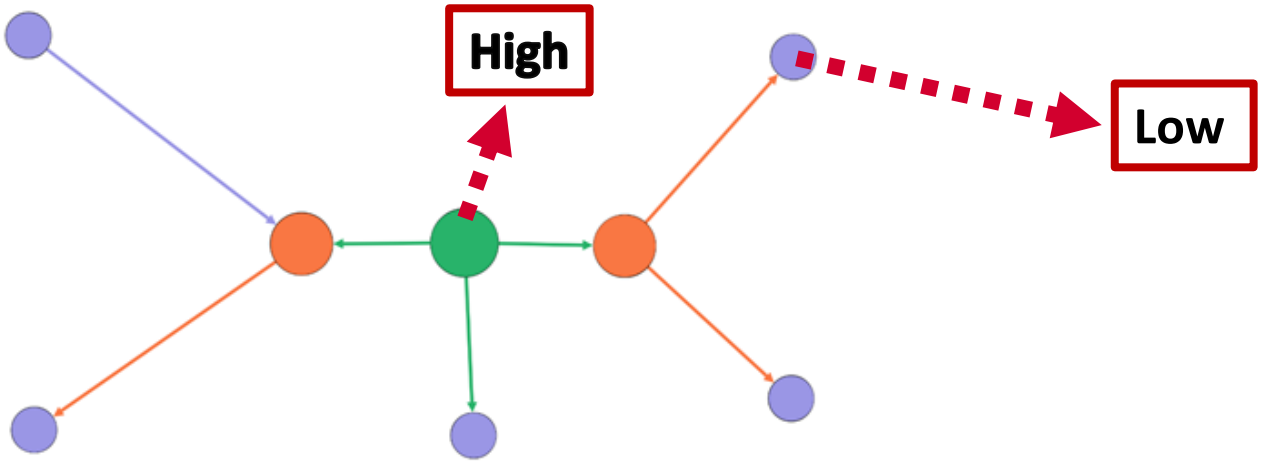
METHODOLOGY

KEY METRIC: BETWEENNESS CENTRALITY



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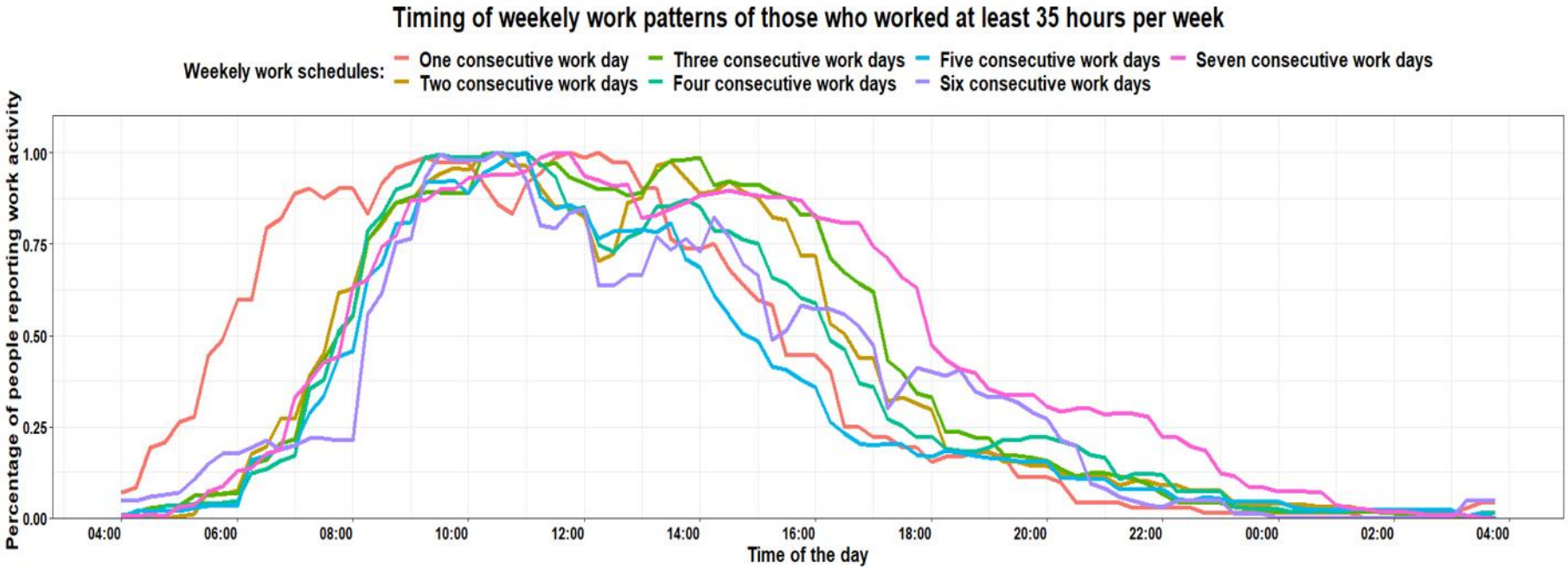
RESULTS: ACTIVITY LOCATION



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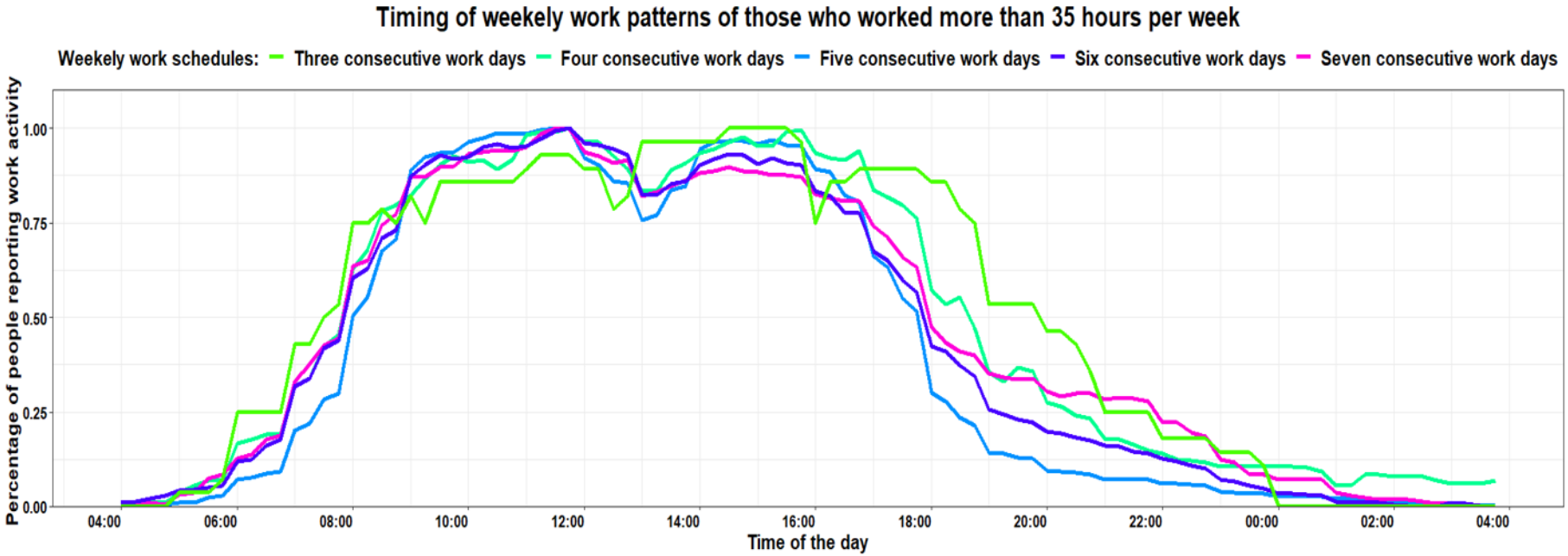

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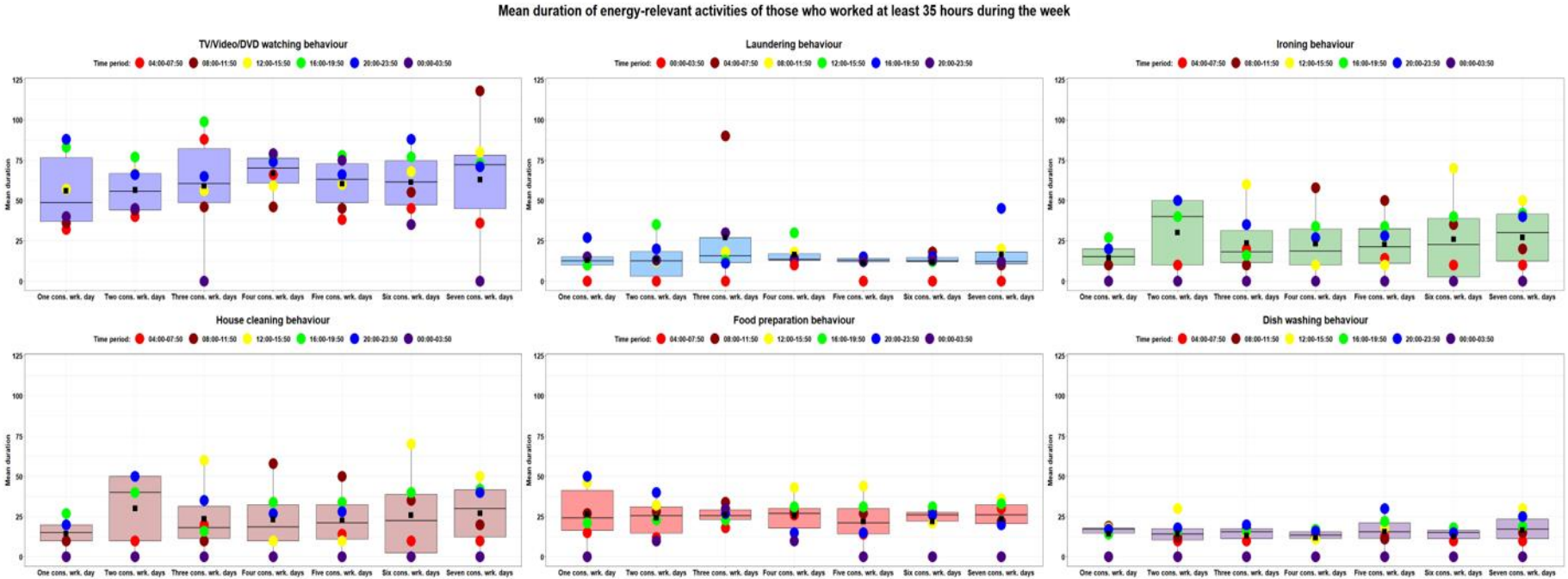
RESULTS: ACTIVITY DURATION



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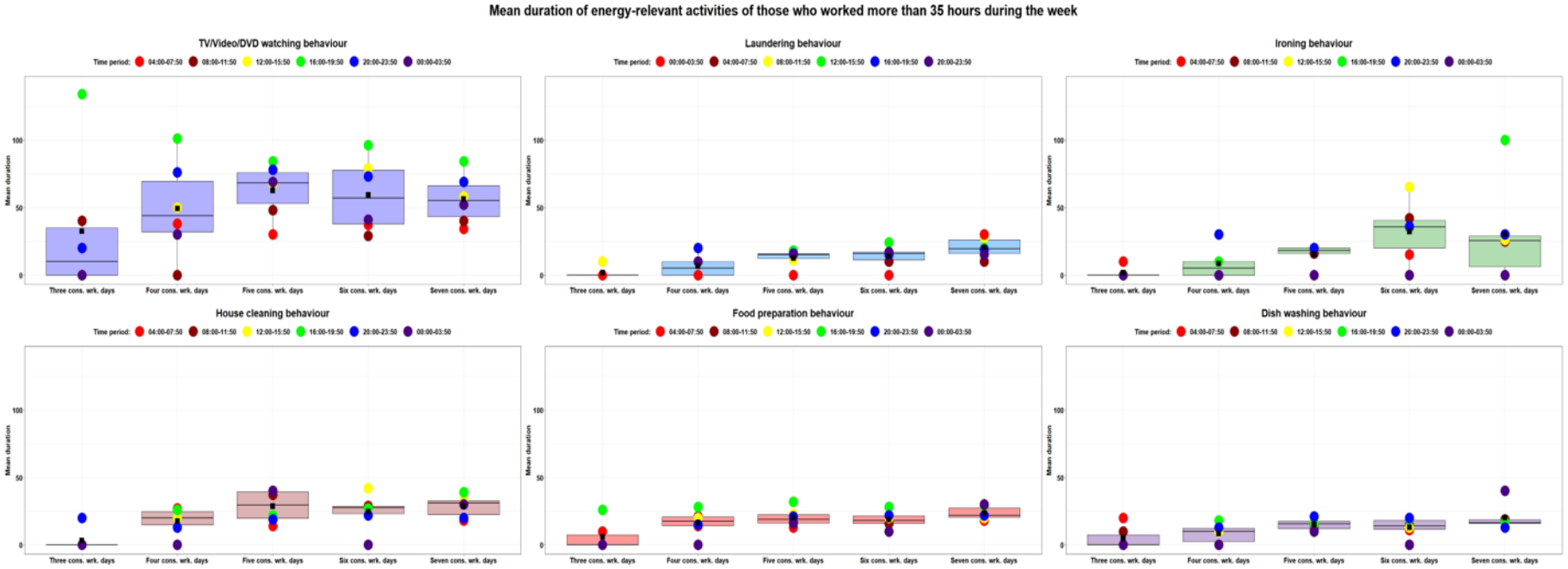
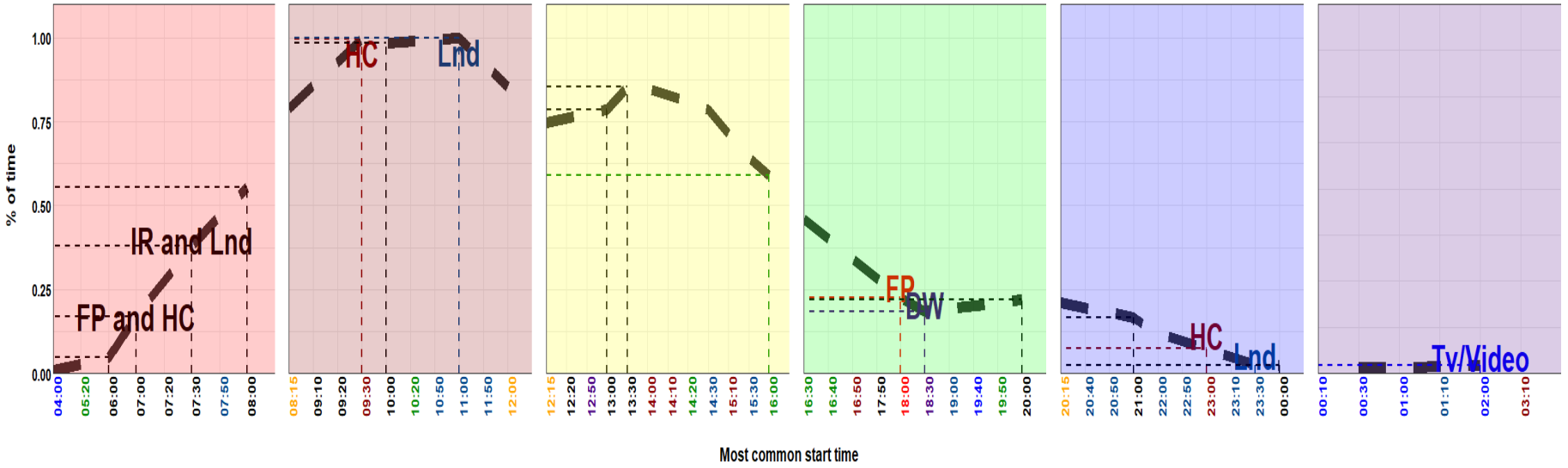


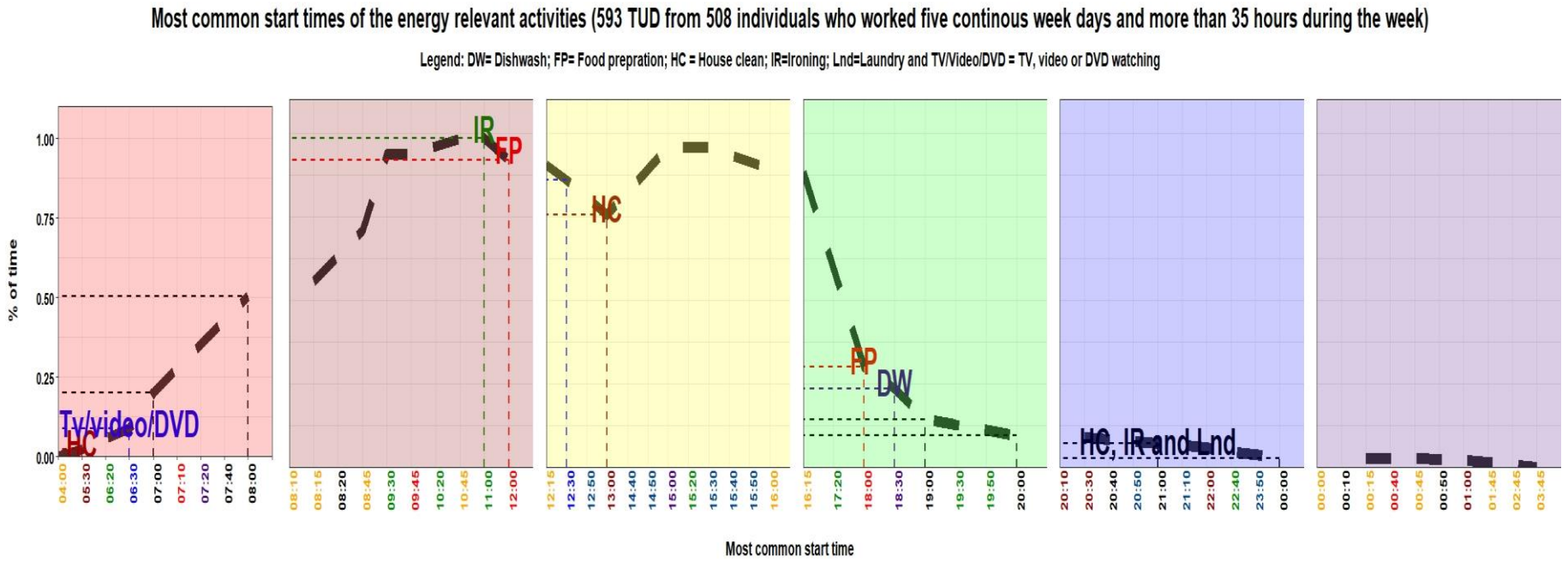
RESULTS: ACTIVITY TIMING

Most common start times of the energy relevant activities (198 TUD from 162 individuals who worked four continous week days and at least 35 hours during the week)

Legend: DW= Dishwash; FP= Food prepration; HC = House clean; IR=Ironing; Lnd=Laundry and TV/Video/DVD = TV, video or DVD watching



RESULTS: ACTIVITY TIMING



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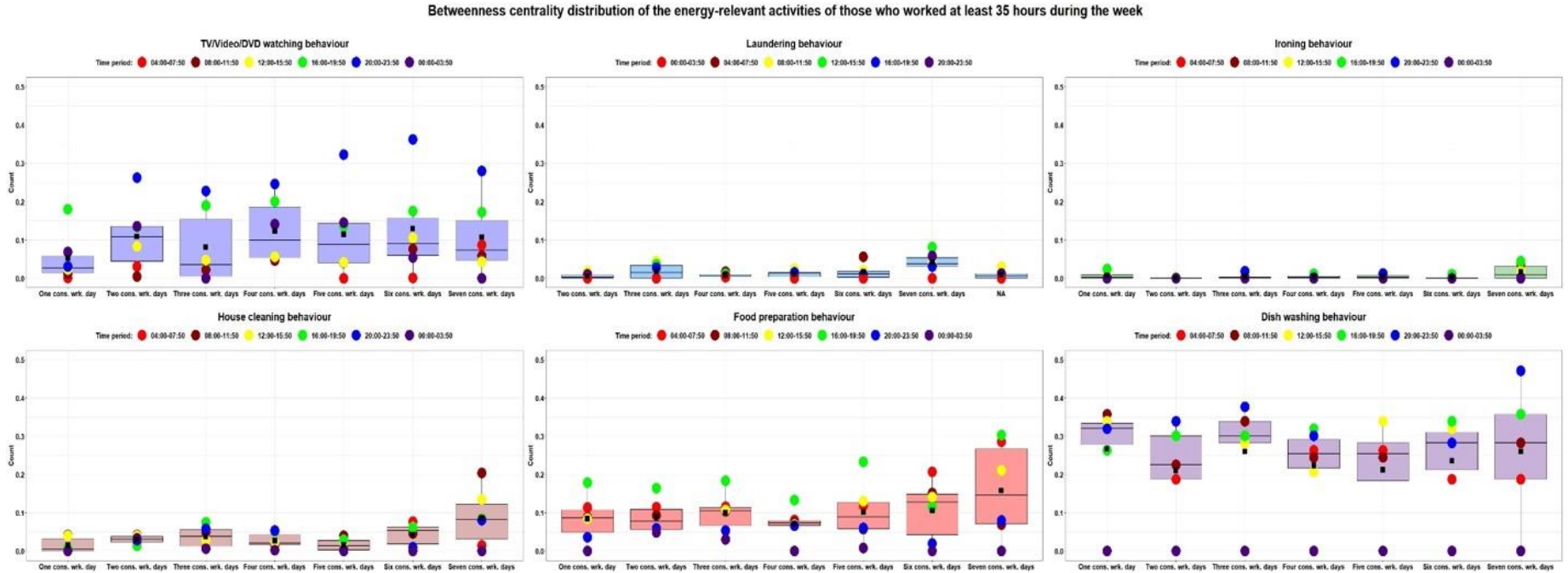
RESULTS: ACTIVITY SEQUENCING



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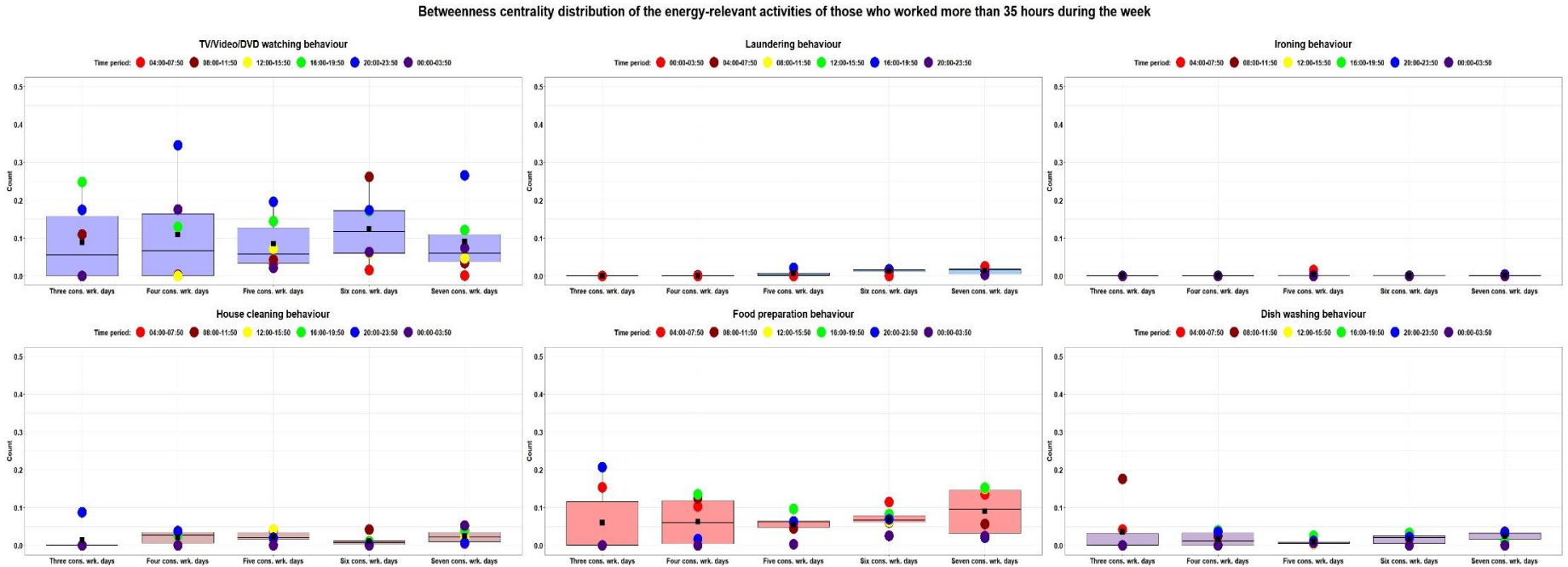
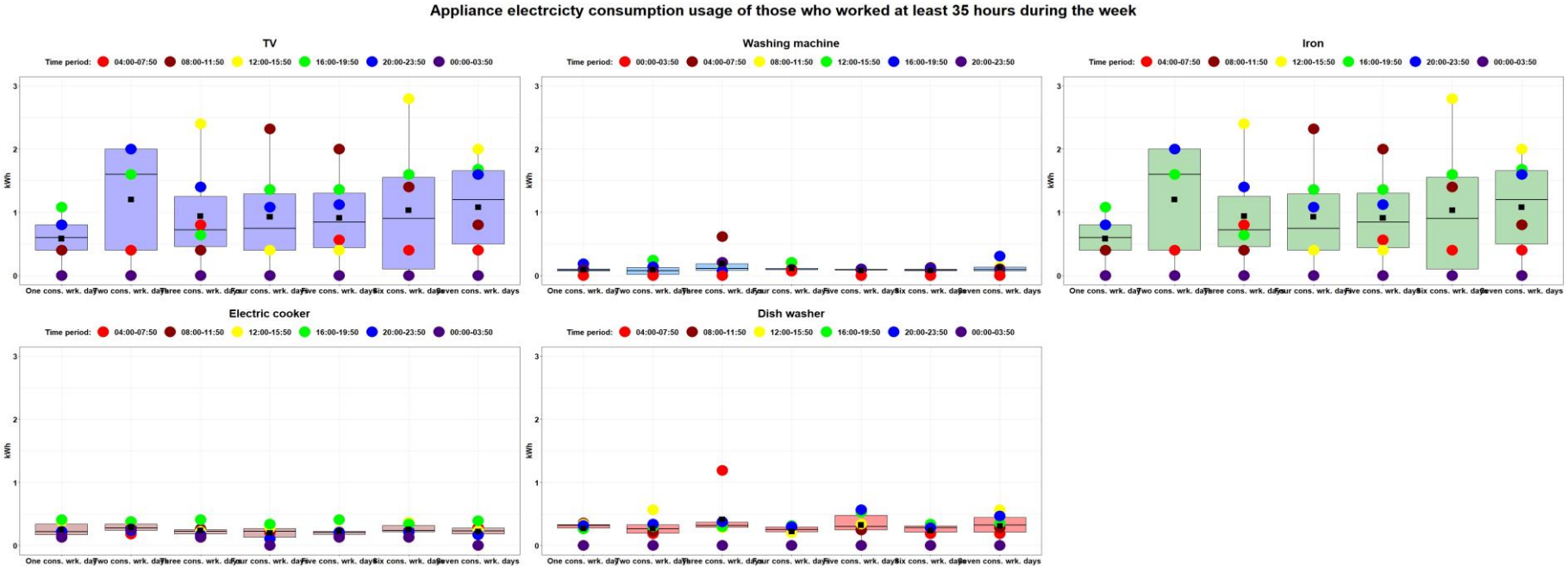


RESULTS: ACTIVITY APPLIANCE USAGE



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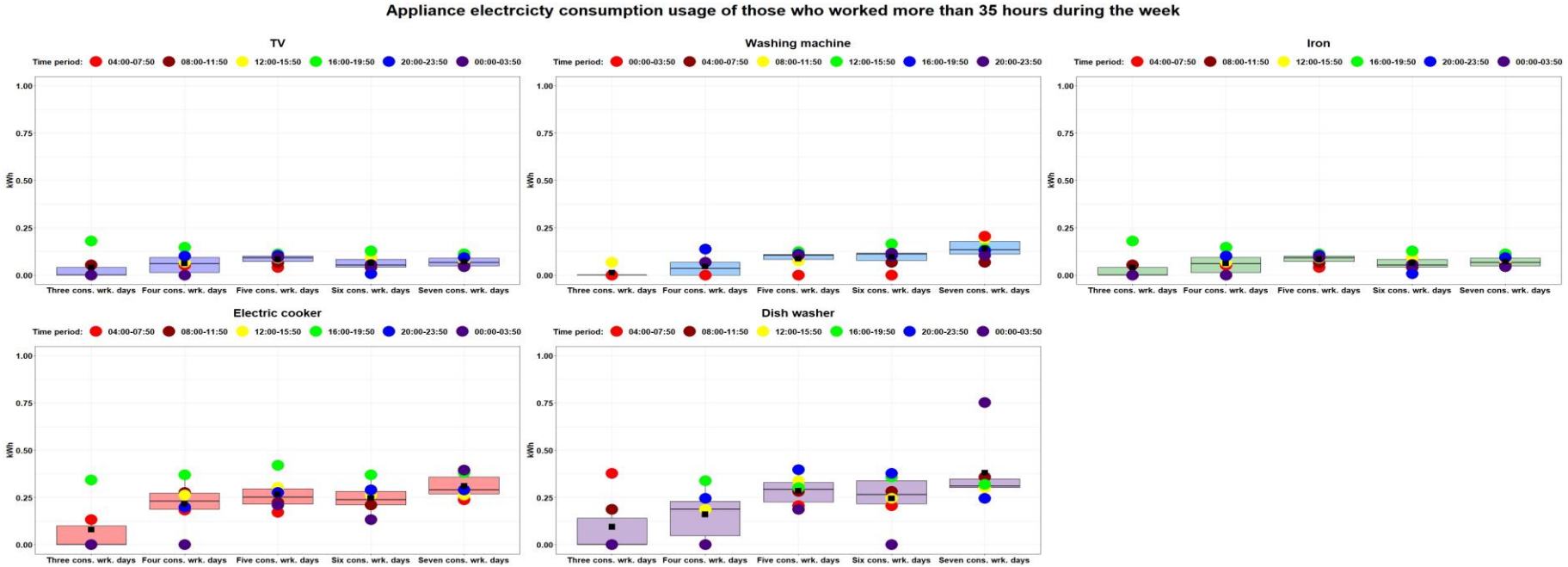
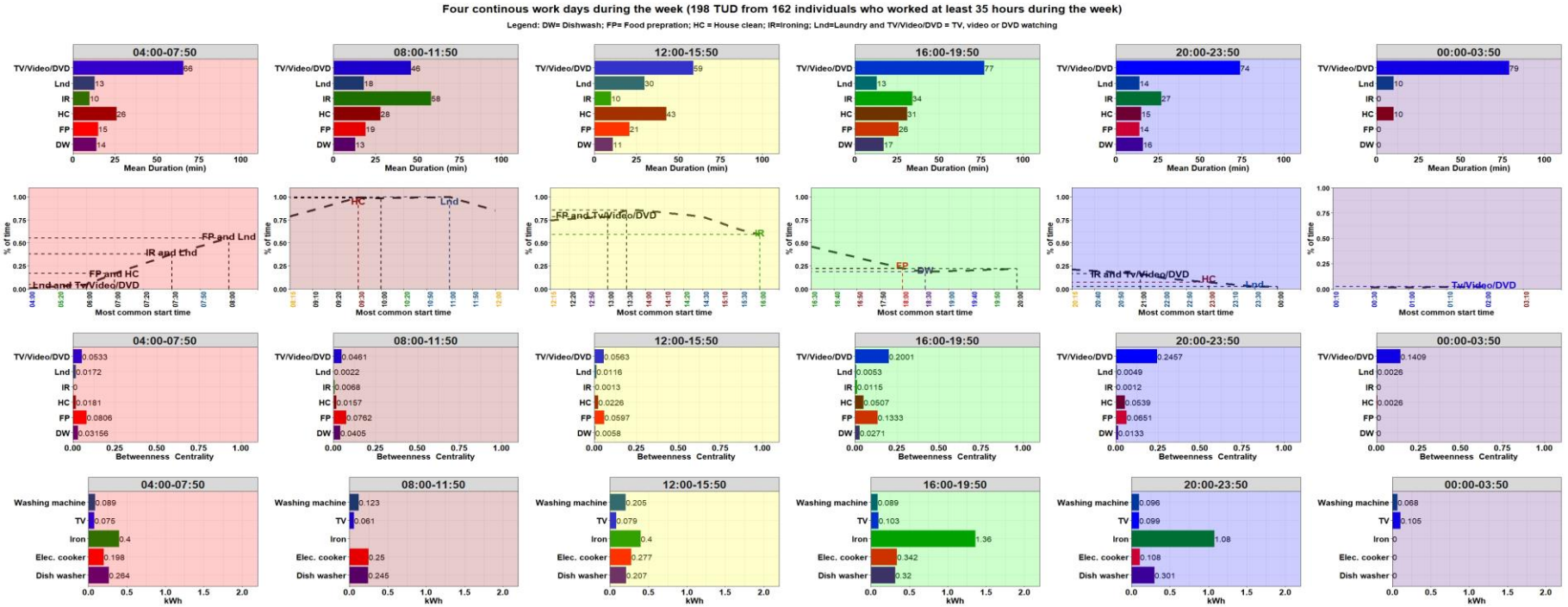


RESULTS: TIME-USE BEHAVIOUR



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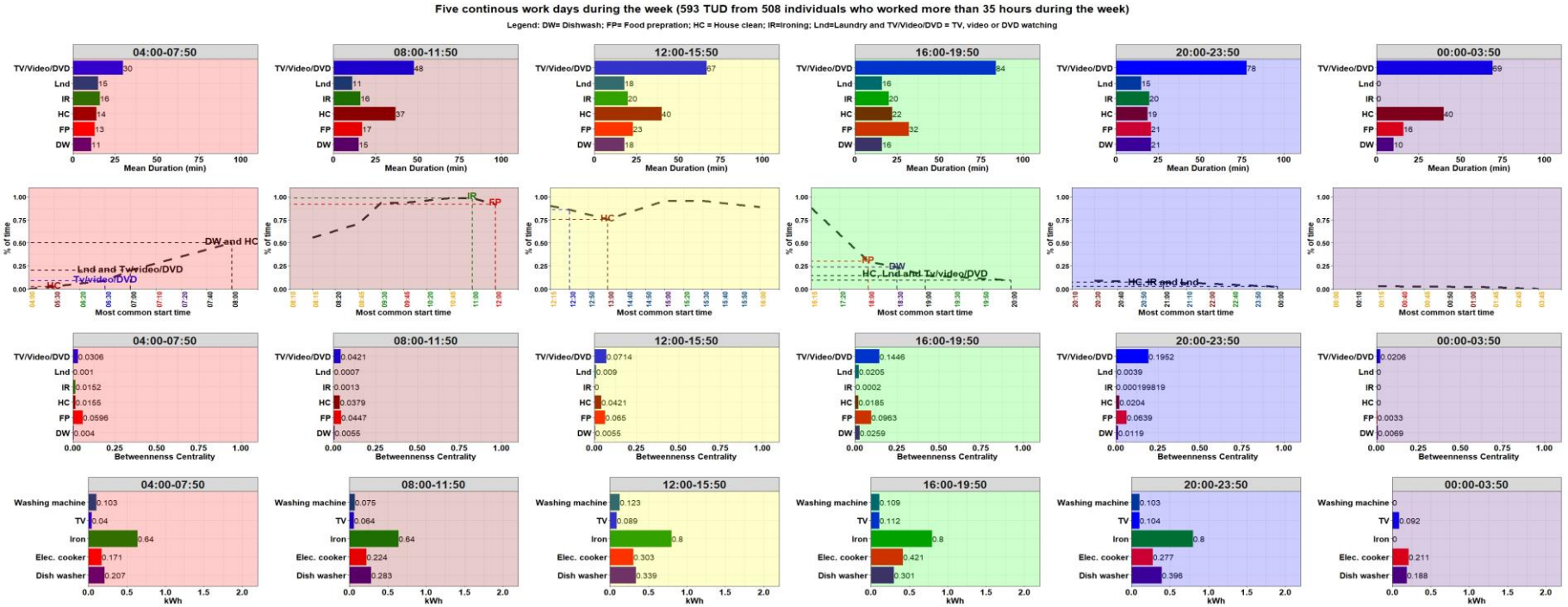

CONCLUSION

Academic perspective: The causal effect between time-use behaviour and residential energy consumption may be influenced by employment status.

Methodological perspective: Our framework provides a structure for addressing the causal relationship between time-use behaviour and residential energy consumption.

Policy perspective: The development of policies that cover the four dimensions of time-use behaviour would allow policy-makers to target specific groups of the residential population and steer their behaviours in order to achieve energy savings.

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THANK YOU FOR YOU ATTENTION!

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