

S2 Appendix.

Summary. In this supplementary information we apply the framework of our mathematical model for adherence to the TUMIKIA project [11–13] and write a brief analysis description for each age group and sex.

Introduction

In Figs a, b, c, d and e we plot the maximum likelihood as well as the limits of the marginalised 95% credible region for the conditional probabilities given treatment (filled points) or non-treatment (hollow points) in a previous round of the overall, male and female participants in the top, middle and bottom rows, respectively. In the left column the constant conditional probabilities between any given sequential pair of rounds have been inferred, which corresponds to the time-independent Markov model of the main text and Appendix S1. In the right column all possible round pair dependencies are considered (indicated by the arrows on the horizontal axis), where in each case the components corresponding to a given round were measured assuming all other respective rounds were inferred to be from past behaviour-independent adherence. In all plots, above each pair of components we have also provided the log-Bayes factors [16], defined by

$$\ln B_{nn'} = \ln \left(\frac{\mathcal{E}_{nn'}}{\mathcal{E}_{\text{ref}}} \right), \quad (1)$$

where the evidence for each pair $\mathcal{E}_{nn'}$ has been evaluated using the relations provided in Appendix S1 and the reference model evidence \mathcal{E}_{ref} has been set to that of time-dependent past behaviour-independent adherence for all components.

Results

In Figs a, b and c we present our results for the pre-SAC, SAC and 15-29 age groups of individuals in the TUMIKIA project. These age groups appear to be well-described by a time-dependent Markov model so past behaviour-dependent non-adherence is clearly present. This may be identified by the largest log-Bayes factor values being given in the red-coloured right column plots for all three sets of plots. However, the conditional probabilities in all groups appear to drift closer together by round 4 of treatment, which signals a gradual transition from past behaviour-dependent to independent adherence.

In Figs d and e we present our results for the 30-49 and 50+ age groups of individuals in the TUMIKIA project. The overall cohort, as well as the males and females in both age groups, appear to exhibit strong evidence of past behaviour-dependent non-adherence — in particular, they are all apparently well-described by a time-independent Markov model. These conclusions may be drawn both by the consistent distance between all of the values for the inferred conditional probabilities with the red points of the right column of plots, as well as the largest evidence (as measured by the log-Bayes factor in the top row of the plots) for a difference in conditional probabilities in the left column in both plots.

In all of the cohorts studied in Figs a, b, c, d and e, we report no evidence for the existence of dependencies between rounds that depart from a Markovian description (as can be inferred from the comparatively small log-Bayes factors for the blue and green conditional probabilities in the right column of all plots). This is an interesting, and

perhaps surprising, result regarding the nature of human behaviour in response to mass drug administration.

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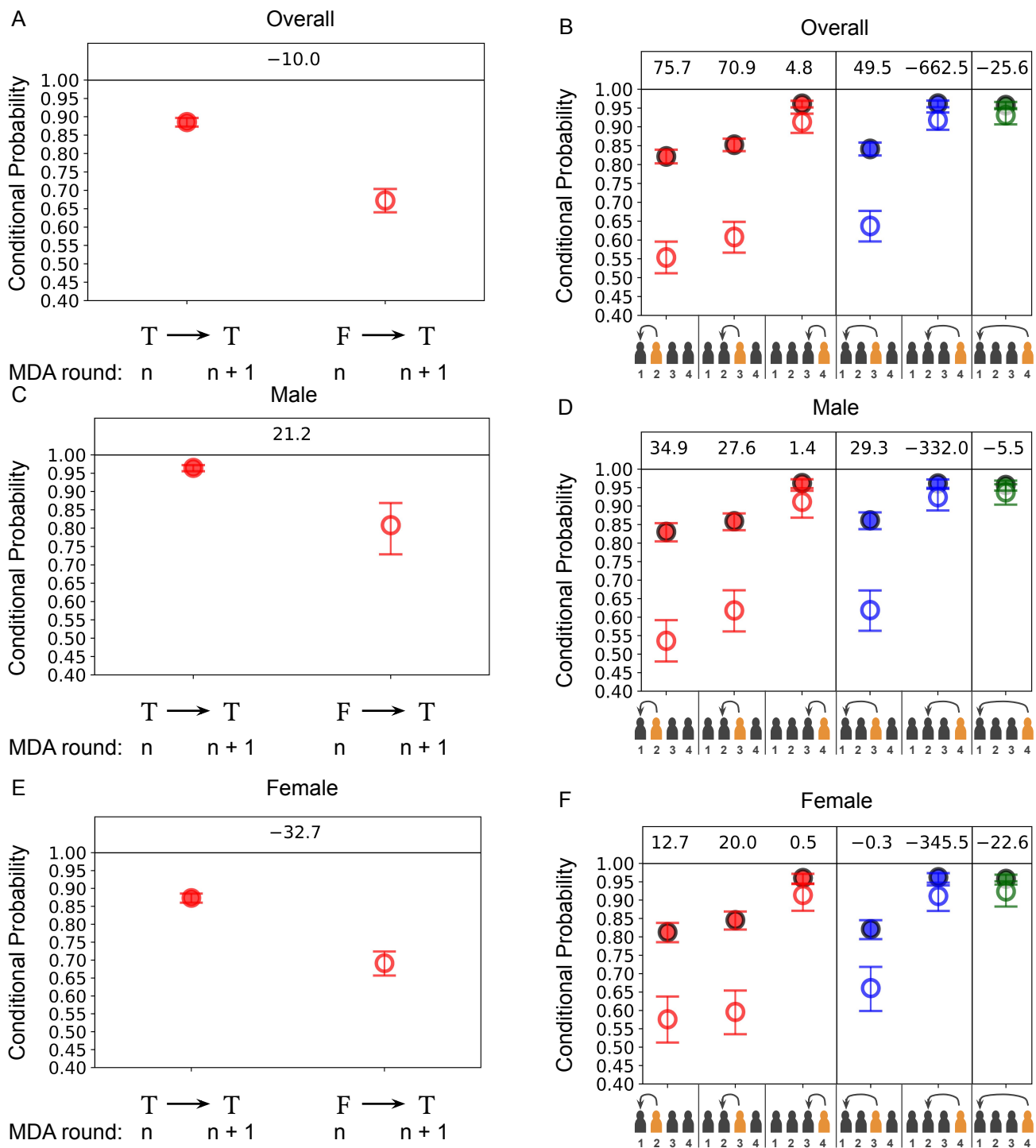


Fig a. *Left column:* The maximum likelihood as well as the limits of the marginalised 95% credible region for the conditional probabilities of receiving treatment for any given pair of sequential rounds (these are hence homogeneous in time and the process is Markovian) given treatment (filled points) or non-treatment (hollow points) in a previous round. *Right column:* The same as the left column but with allowed time dependence in the conditional probabilities of receiving treatment in each respective round (highlighted in orange on the horizontal axes). In each case the components corresponding to a given round were measured assuming all other respective rounds were inferred to be from time-dependent past behaviour-independent adherence and hence the likelihood is given in Appendix S1. Different colours for each point correspond to different lengths in time for the dependencies in behaviour. The datasets used are from the standard pre-SAC (0-4) age category from a cohort of individuals from the biannual treatment arm of the TUMIKIA project where the: top row corresponds to the overall group; middle row corresponds to the male sub-group; and bottom row corresponds to the female sub-group.

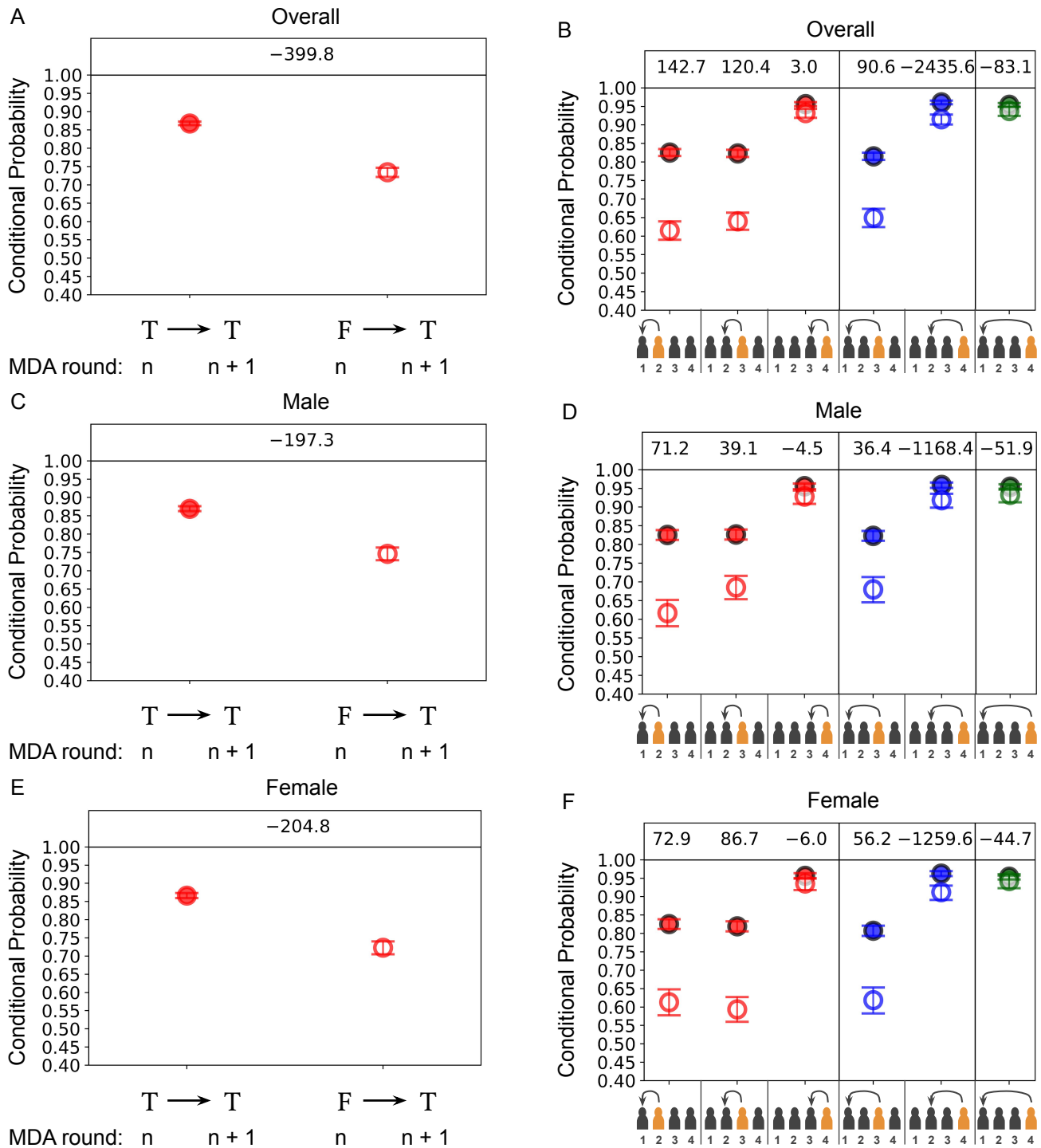


Fig b. *Left column:* The maximum likelihood as well as the limits of the marginalised 95% credible region for the conditional probabilities of receiving treatment for any given pair of sequential rounds (these are hence homogeneous in time and the process is Markovian) given treatment (filled points) or non-treatment (hollow points) in a previous round. *Right column:* The same as the left column but with allowed time-dependent in the conditional probabilities of receiving treatment in each respective round (highlighted in orange on the horizontal axes). In each case the components corresponding to a given round were measured assuming all other respective rounds were inferred to be from time-dependent past behaviour-independent adherence and hence the likelihood is given in Appendix S1. Different colours for each point correspond to different lengths in time for the dependencies in behaviour. The datasets used are from the standard SAC (4-15) age category from a cohort of individuals from the biannual treatment arm of the TUMIKIA project where the: top row corresponds to the overall group; middle row corresponds to the male sub-group; and bottom row corresponds to the female sub-group.

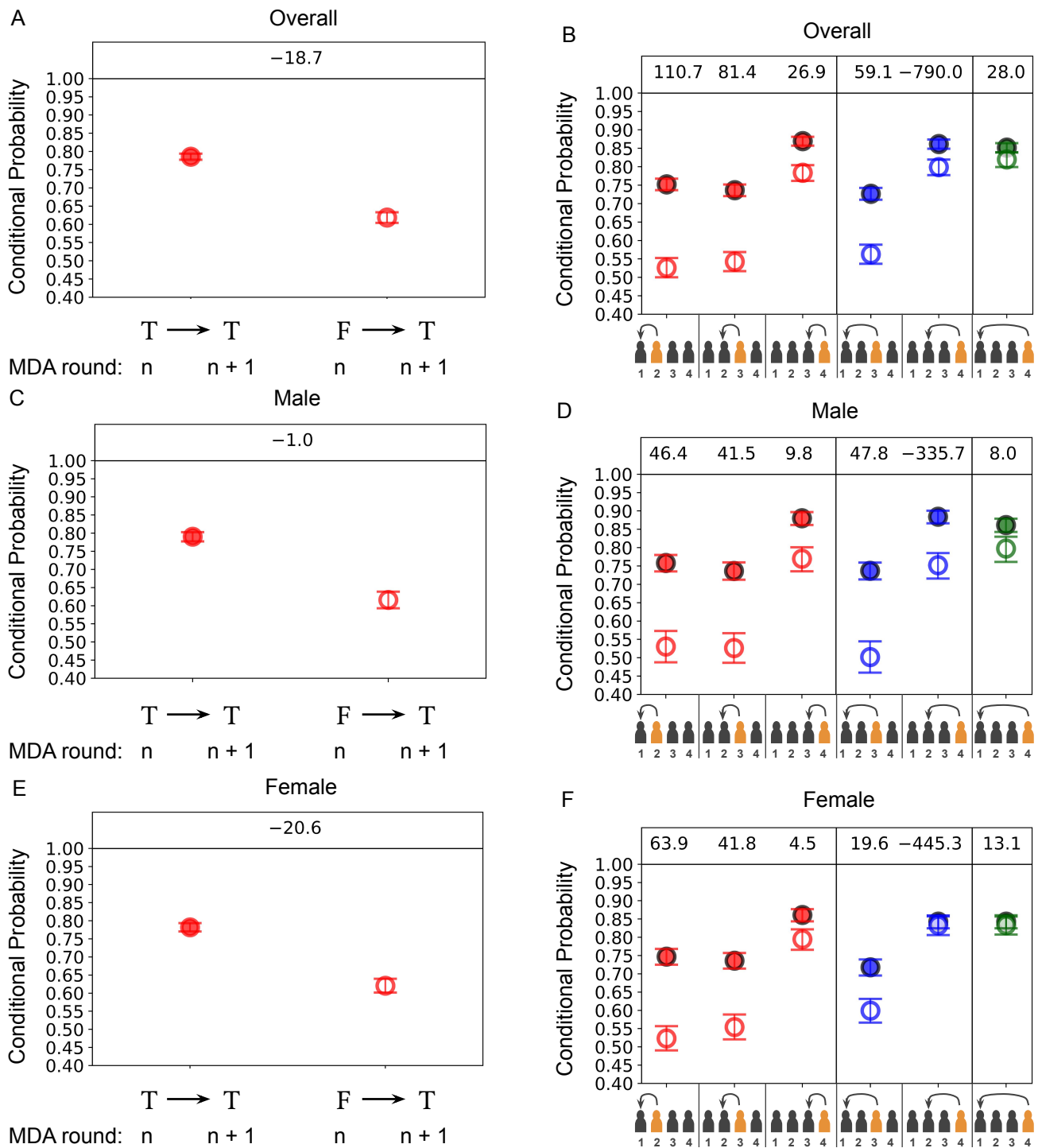


Fig c. *Left column:* The maximum likelihood as well as the limits of the marginalised 95% credible region for the conditional probabilities of receiving treatment for any given pair of sequential rounds (these are hence homogeneous in time and the process is Markovian) given treatment (filled points) or non-treatment (hollow points) in a previous round. *Right column:* The same as the left column but with allowed time-dependent in the conditional probabilities of receiving treatment in each respective round (highlighted in orange on the horizontal axes). In each case the components corresponding to a given round were measured assuming all other respective rounds were inferred to be from time-dependent past behaviour-independent adherence and hence the likelihood is given in Appendix S1. Different colours for each point correspond to different lengths in time for the dependencies in behaviour. The datasets used are from the 15-29 age category from a cohort of individuals from the biannual treatment arm of the TUMIKIA project where the: top row corresponds to the overall group; middle row corresponds to the male sub-group; and bottom row corresponds to the female sub-group.

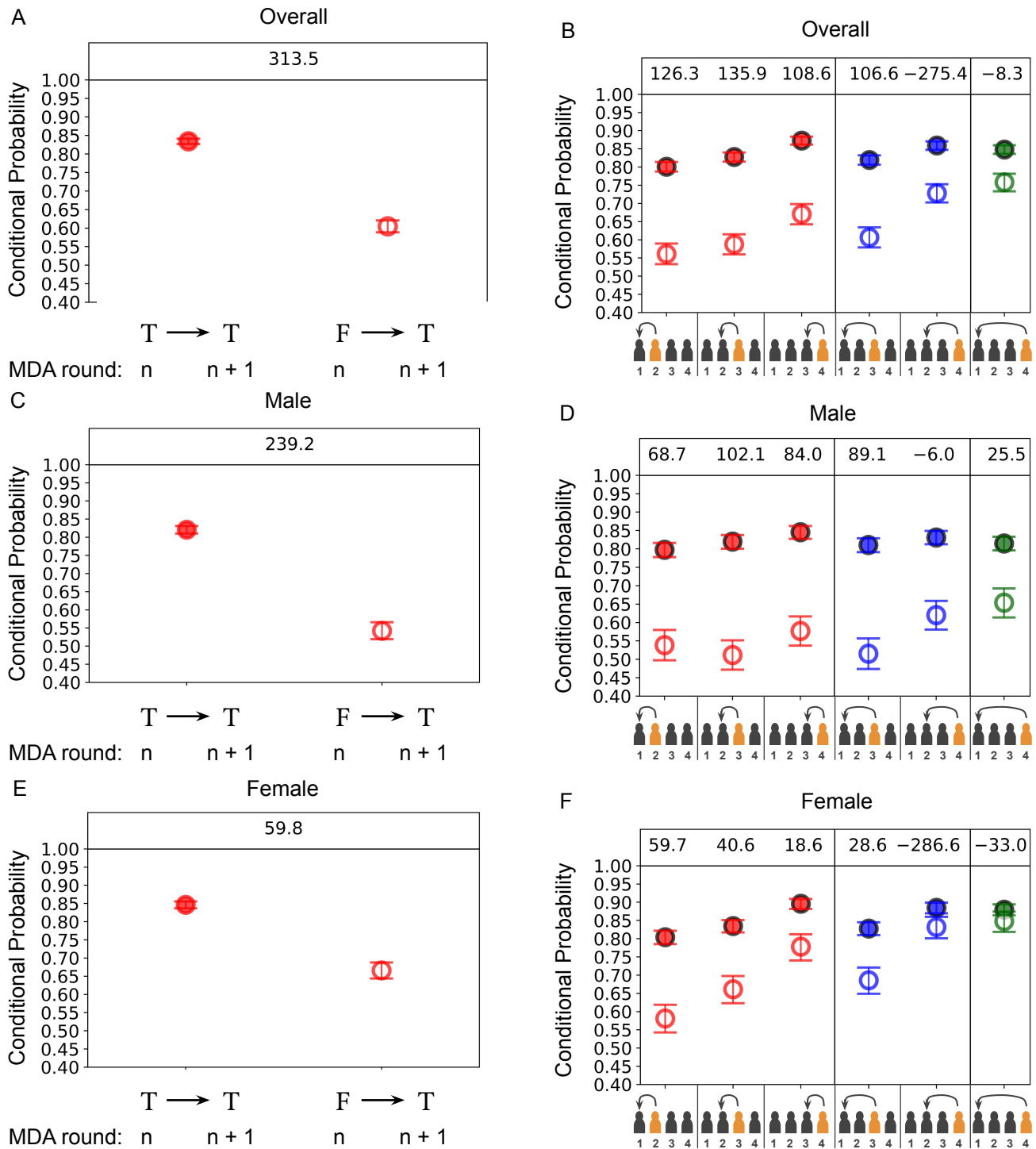


Fig d. *Left column:* The maximum likelihood as well as the limits of the marginalised 95% credible region for the conditional probabilities of receiving treatment for any given pair of sequential rounds (these are hence homogeneous in time and the process is Markovian) given treatment (filled points) or non-treatment (hollow points) in a previous round. *Right column:* The same as the left column but with allowed time dependence in the conditional probabilities of receiving treatment in each respective round (highlighted in orange on the horizontal axes). In each case the components corresponding to a given round were measured assuming all other respective rounds were inferred to be from time-dependent past behaviour-independent adherence and hence the likelihood is given in Appendix S1. Different colours for each point correspond to different lengths in time for the dependencies in behaviour. The datasets used are from the 30-49 age category from a cohort of individuals from the biannual treatment arm of the TUMIKIA project where the: top row corresponds to the overall group; middle row corresponds to the male sub-group; and bottom row corresponds to the female sub-group.

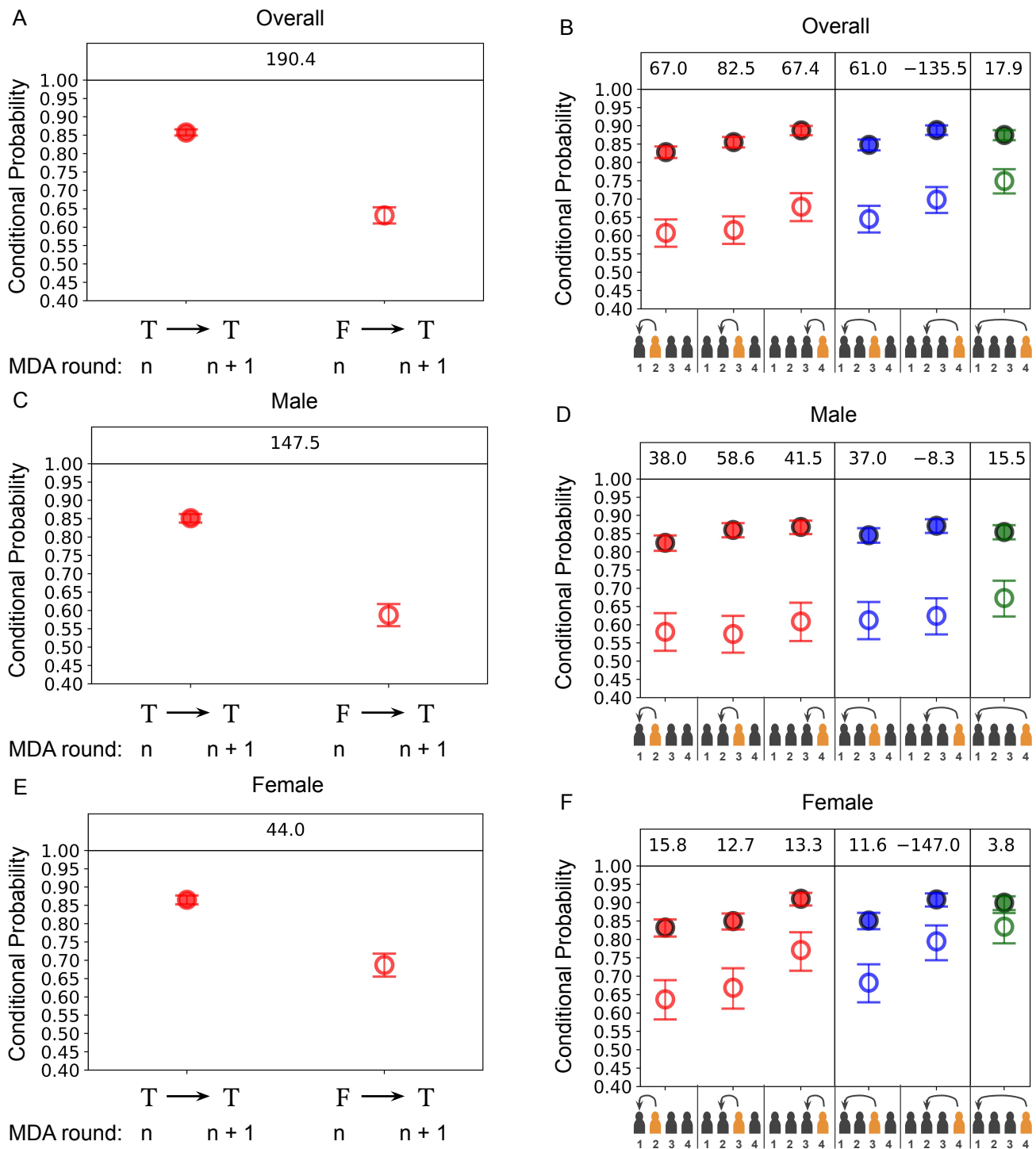


Fig e. *Left column:* The maximum likelihood as well as the limits of the marginalised 95% credible region for the conditional probabilities of receiving treatment for any given pair of sequential rounds (these are hence homogeneous in time and the process is Markovian) given treatment (filled points) or non-treatment (hollow points) in a previous round. *Right column:* The same as the left column but with allowed time dependence in the conditional probabilities of receiving treatment in each respective round (highlighted in orange on the horizontal axes). In each case the components corresponding to a given round were measured assuming all other respective rounds were inferred to be from time-dependent past behaviour-independent adherence and hence the likelihood is given in Appendix S1. Different colours for each point correspond to different lengths in time for the dependencies in behaviour. The datasets used are from the 50+ age category from a cohort of individuals from the biannual treatment arm of the TUMIKIA project where the: top row corresponds to the overall group; middle row corresponds to the male sub-group; and bottom row corresponds to the female sub-group.

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