Supplementary Information: On the modelling of emergency ambulance trips: The case of the Žilina region

Ľuboš Buzna[1,2] and Peter Czimmermann[1]

[1]*Department of Mathematical Methods and Operations Research, University of Žilina, Univerzitná 8215/1, Žilina, Slovakia*

[2]*Department of International Research Projects - ERAdiate+, University of Žilina, Univerzitná 8215/1, Žilina, Slovakia*

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S1. ALLOCATION OF EMERGENCY CASES TO STATIONS AND HOSPITALS

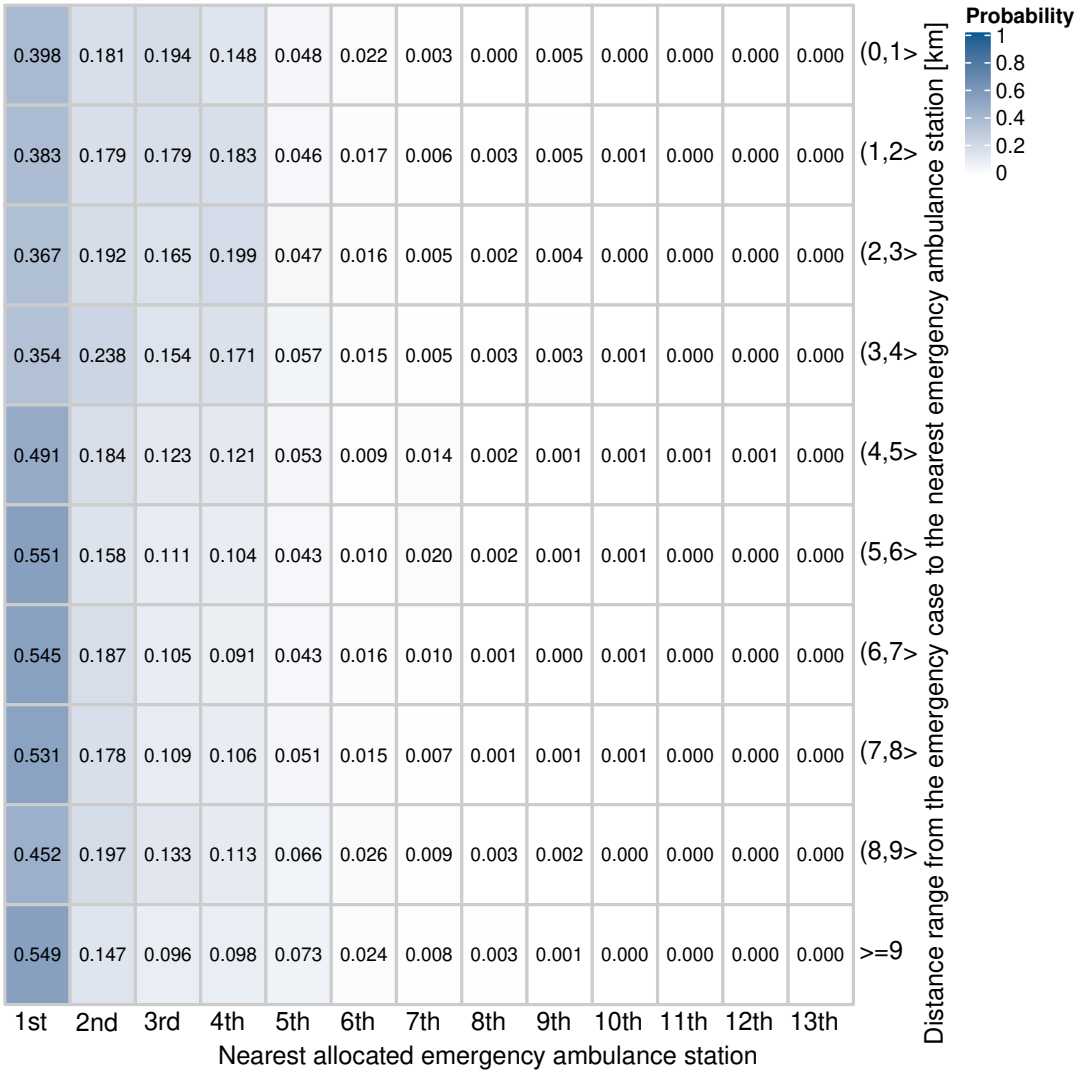

FIG. S1. The empirical probability distributions of emergency cases to be allocated to the k-th nearest ambulance station (in rows, we present a distribution for each range of the distance from the emergency case location to the nearest emergency ambulance station). In the evaluations, we used the road network distances.

S2. VALIDATION OF SPATIAL CHARACTERISTICS

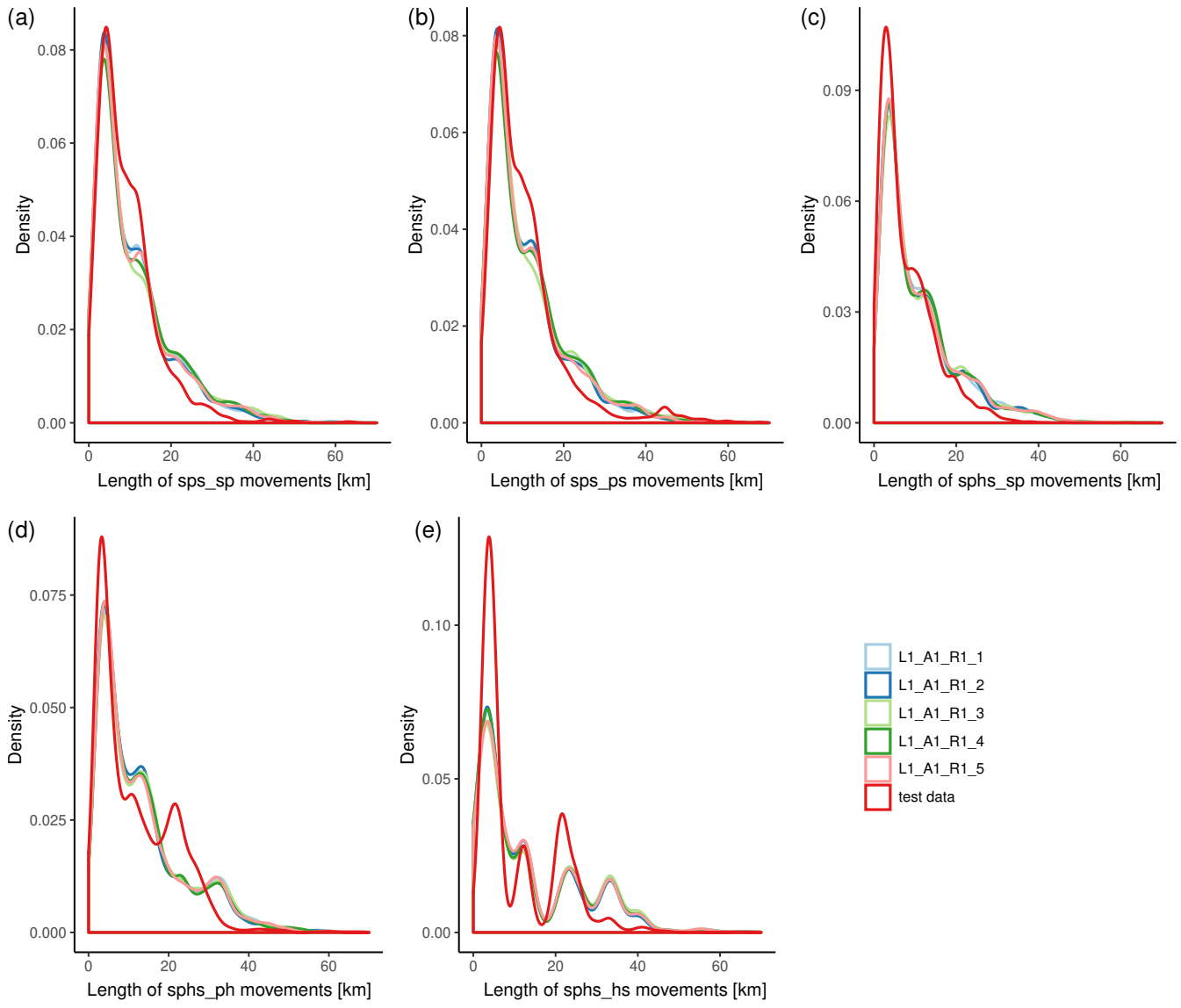

FIG. S2. The probability density functions of movement lengths. Each panel corresponds to a different movement type of "sps and "sphs" trips (indicated by the x-axis label). We present five independent sets of trips, all generated using default model settings, i.e. $L1\_A1\_R1$, and contrast them with trips in the test data.

S3. VALIDATION OF SPATIAL CHARACTERISTICS

TABLE S1. The results of the K-S test obtained by comparing five independent realisations of lengths of movements resulting from the default model $L1\_A1\_R1\_1$-$L1\_A1\_R1\_5$ with the length of movements in the test dataset. The value of D quantifies the difference between empirical distribution functions of compared datasets. P-value is the probability of concluding that compared datasets have different distributions, providing that the null hypothesis is correct. The value $D_{0.05} = 0.19$ is the threshold value of the K-S statistic at the significance level of $\alpha = 0.05$. In all cases $D < D_{0.05}$, hence, the hypothesis that samples are drawn from the same distribution is not rejected.

Model	Movement	D	p-value	Test result
L1_A1_R1_1	sps_sp	0.09	0.81	not rejected
L1_A1_R1_1	sps_ps	0.08	0.91	not rejected
L1_A1_R1_1	sphs_sp	0.15	0.21	not rejected
L1_A1_R1_1	sphs_ph	0.12	0.47	not rejected
L1_A1_R1_1	sphs_hs	0.07	0.97	not rejected
L1_A1_R1_2	sps_sp	0.08	0.91	not rejected
L1_A1_R1_2	sps_ps	0.09	0.81	not rejected
L1_A1_R1_2	sphs_sp	0.13	0.37	not rejected
L1_A1_R1_2	sphs_ph	0.11	0.58	not rejected
L1_A1_R1_2	sphs_hs	0.08	0.91	not rejected
L1_A1_R1_3	sps_sp	0.13	0.37	not rejected
L1_A1_R1_3	sps_ps	0.09	0.81	not rejected
L1_A1_R1_3	sphs_sp	0.15	0.21	not rejected
L1_A1_R1_3	sphs_ph	0.14	0.28	not rejected
L1_A1_R1_3	sphs_hs	0.12	0.47	not rejected
L1_A1_R1_4	sps_sp	0.10	0.70	not rejected
L1_A1_R1_4	sps_ps	0.12	0.47	not rejected
L1_A1_R1_4	sphs_sp	0.16	0.15	not rejected
L1_A1_R1_4	sphs_ph	0.14	0.28	not rejected
L1_A1_R1_4	sphs_hs	0.06	0.99	not rejected
L1_A1_R1_5	sps_sp	0.10	0.70	not rejected
L1_A1_R1_5	sps_ps	0.11	0.58	not rejected
L1_A1_R1_5	sphs_sp	0.15	0.21	not rejected
L1_A1_R1_5	sphs_ph	0.13	0.37	not rejected
L1_A1_R1_5	sphs_hs	0.09	0.81	not rejected

TABLE S2. The results of the K-S test obtained by comparing the length of movements generated by models with the length of movements in the test dataset. The value of D quantifies the difference between empirical distribution functions of compared datasets. P-value is the probability of concluding that compared datasets have different distributions, providing that the null hypothesis is correct. The value $D_{0.05} = 0.19$ is the threshold value of the K-S statistic at the significance level of $\alpha = 0.05$. In all cases $D < D_{0.05}$, thus the hypothesis that samples are drawn from the same distribution is not rejected.

Model	Movement	D	p-value	Test result
L1_A1_R2	sps_sp	0.09	0.81	not rejected
L1_A1_R2	sps_ps	0.12	0.47	not rejected
L1_A1_R2	sphs_sp	0.11	0.58	not rejected
L1_A1_R2	sphs_ph	0.12	0.47	not rejected
L1_A1_R2	sphs_hs	0.07	0.97	not rejected
L1_A2_R1	sps_sp	0.09	0.81	not rejected
L1_A2_R1	sps_ps	0.08	0.91	not rejected
L1_A2_R1	sphs_sp	0.15	0.21	not rejected
L1_A2_R1	sphs_ph	0.12	0.47	not rejected
L1_A2_R1	sphs_hs	0.13	0.37	not rejected
L1_A3_R1	sps_sp	0.09	0.81	not rejected
L1_A3_R1	sps_ps	0.08	0.91	not rejected
L1_A3_R1	sphs_sp	0.15	0.21	not rejected
L1_A3_R1	sphs_ph	0.09	0.81	not rejected
L1_A3_R1	sphs_hs	0.09	0.81	not rejected
L2_A1_R1	sps_sp	0.11	0.58	not rejected
L2_A1_R1	sps_ps	0.09	0.81	not rejected
L2_A1_R1	sphs_sp	0.15	0.21	not rejected
L2_A1_R1	sphs_ph	0.15	0.21	not rejected
L2_A1_R1	sphs_hs	0.07	0.97	not rejected
L3_A1_R1	sps_sp	0.09	0.81	not rejected
L3_A1_R1	sps_ps	0.11	0.58	not rejected
L3_A1_R1	sphs_sp	0.13	0.37	not rejected
L3_A1_R1	sphs_ph	0.14	0.28	not rejected
L3_A1_R1	sphs_hs	0.09	0.81	not rejected

S4. VALIDATION OF TEMPORAL CHARACTERISTICS

TABLE S3. The results of the K-S test obtained by comparing five independent realisations of duration of movements resulting from the default model $L1\_A1\_R1\_1$-$L1\_A1\_R1\_5$ with the length of movements in the test dataset. The value of D quantifies the difference between empirical distribution functions of compared datasets. P-value is the probability of concluding that compared datasets have different distributions, providing that the null hypothesis is correct. The value $D_{0.05} = 0.19$ is the threshold value of the K-S statistic at the significance level of $\alpha = 0.05$. In cases when $D < D_{0.05}$, the hypothesis that samples are drawn from the same distribution is not rejected.

Model	Movement	D	p-value	Test result
L1_A1_R1_1	sps_sp	0.13	0.66	not rejected
L1_A1_R1_1	sps_ps	0.34	0.00	rejected
L1_A1_R1_1	sphs_sp	0.10	0.70	not rejected
L1_A1_R1_1	sphs_ph	0.05	0.99	not rejected
L1_A1_R1_1	sphs_hs	0.37	0.00	rejected
L1_A1_R1_2	sps_sp	0.12	0.47	not rejected
L1_A1_R1_2	sps_ps	0.34	0.00	rejected
L1_A1_R1_2	sphs_sp	0.09	0.81	not rejected
L1_A1_R1_2	sphs_ph	0.07	0.97	not rejected
L1_A1_R1_2	sphs_hs	0.36	0.00	rejected
L1_A1_R1_3	sps_sp	0.13	0.37	not rejected
L1_A1_R1_3	sps_ps	0.35	0.00	rejected
L1_A1_R1_3	sphs_sp	0.09	0.81	not rejected
L1_A1_R1_3	sphs_ph	0.05	0.99	not rejected
L1_A1_R1_3	sphs_hs	0.40	0.00	rejected
L1_A1_R1_4	sps_sp	0.14	0.28	not rejected
L1_A1_R1_4	sps_ps	0.38	0.00	rejected
L1_A1_R1_4	sphs_sp	0.08	0.91	not rejected
L1_A1_R1_4	sphs_ph	0.06	0.99	not rejected
L1_A1_R1_4	sphs_hs	0.38	0.00	rejected
L1_A1_R1_5	sps_sp	0.15	0.21	not rejected
L1_A1_R1_5	sps_ps	0.38	0.00	rejected
L1_A1_R1_5	sphs_sp	0.09	0.90	not rejected
L1_A1_R1_5	sphs_ph	0.05	0.99	not rejected
L1_A1_R1_5	sphs_hs	0.37	0.00	rejected

TABLE S4. The results of the K-S test obtained by comparing the duration of movements generated by models with the length of movements in the test dataset. The value of D quantifies the difference between empirical distribution functions of compared datasets. P-value is the probability of concluding that compared datasets have different distributions, providing that the null hypothesis is correct. The value $D_{0.05} = 0.19$ is the threshold value of the K-S statistic at the significance level of $\alpha = 0.05$. In cases when $D < D_{0.05}$ the hypothesis that samples are drawn from the same distribution is not rejected.

Model	Movement	D	p-value	Test result
L1_A1_R2	sps_sp	0.12	0.47	not rejected
L1_A1_R2	sps_ps	0.39	0.00	rejected
L1_A1_R2	sphs_sp	0.07	0.97	not rejected
L1_A1_R2	sphs_ph	0.05	0.99	not rejected
L1_A1_R2	sphs_hs	0.37	0.00	rejected
L1_A2_R1	sps_sp	0.12	0.47	not rejected
L1_A2_R1	sps_ps	0.37	0.00	rejected
L1_A2_R1	sphs_sp	0.10	0.70	not rejected
L1_A2_R1	sphs_ph	0.30	0.00	rejected
L1_A2_R1	sphs_hs	0.43	0.00	rejected
L1_A3_R1	sps_sp	0.12	0.47	not rejected
L1_A3_R1	sps_ps	0.37	0.00	rejected
L1_A3_R1	sphs_sp	0.10	0.70	not rejected
L1_A3_R1	sphs_ph	0.10	0.70	not rejected
L1_A3_R1	sphs_hs	0.36	0.00	rejected
L2_A1_R1	sps_sp	0.10	0.70	not rejected
L2_A1_R1	sps_ps	0.38	0.00	rejected
L2_A1_R1	sphs_sp	0.10	0.70	not rejected
L2_A1_R1	sphs_ph	0.07	0.97	not rejected
L2_A1_R1	sphs_hs	0.37	0.00	rejected
L3_A1_R1	sps_sp	0.15	0.21	not rejected
L3_A1_R1	sps_ps	0.36	0.00	rejected
L3_A1_R1	sphs_sp	0.07	0.97	not rejected
L3_A1_R1	sphs_ph	0.14	0.28	not rejected
L3_A1_R1	sphs_hs	0.35	0.00	rejected

TABLE S5. The results of the K-S test obtained by comparing the duration of trips in the test dataset with five random realisations of the duration of trips generated by the default model $L1\_A1\_R1\_1$-$L1\_A1\_R1\_5$ (top) and with duration of trips generated by evaluated model versions (bottom). The value of D quantifies the difference between empirical distribution functions of compared datasets. P-value is the probability of concluding that compared datasets have different distributions, providing that the null hypothesis is correct. The value $D_{0.05} = 0.14$ is the threshold value of the K-S statistic at the significance level of $\alpha = 0.05$. In all cases $D < D_{0.05}$ and the hypothesis that samples are drawn from the same distribution is not rejected.

Model	Movement	D	p-value	Test result
L1_A1_R1_1	sps	0.06	0.93	not rejected
L1_A1_R1_1	sphs	0.12	0.14	no rejected
L1_A1_R1_2	sps	0.07	0.80	not rejected
L1_A1_R1_2	sphs	0.08	0.63	not rejected
L1_A1_R1_3	sps	0.05	0.96	not rejected
L1_A1_R1_3	sphs	0.10	0.27	not rejected
L1_A1_R1_4	sps	0.06	0.47	not rejected
L1_A1_R1_4	sphs	0.10	0.00	not rejected
L1_A1_R1_5	sps	0.09	0.47	not rejected
L1_A1_R1_5	sphs	0.12	0.11	not rejected
L1_A1_R2	sps	0.06	0.86	not rejected
L1_A1_R2	sphs	0.06	0.92	not rejected
L1_A2_R1	sps	0.05	0.96	not rejected
L1_A2_R1	sphs	0.08	0.54	not rejected
L1_A3_R1	sps	0.06	0.86	not rejected
L1_A3_R1	sphs	0.08	0.54	not rejected
L2_A1_R1	sps	0.05	0.99	not rejected
L2_A1_R1	sphs	0.11	0.22	not rejected
L3_A1_R1	sps	0.07	0.71	not rejected
L3_A1_R1	sphs	0.09	0.47	not rejected