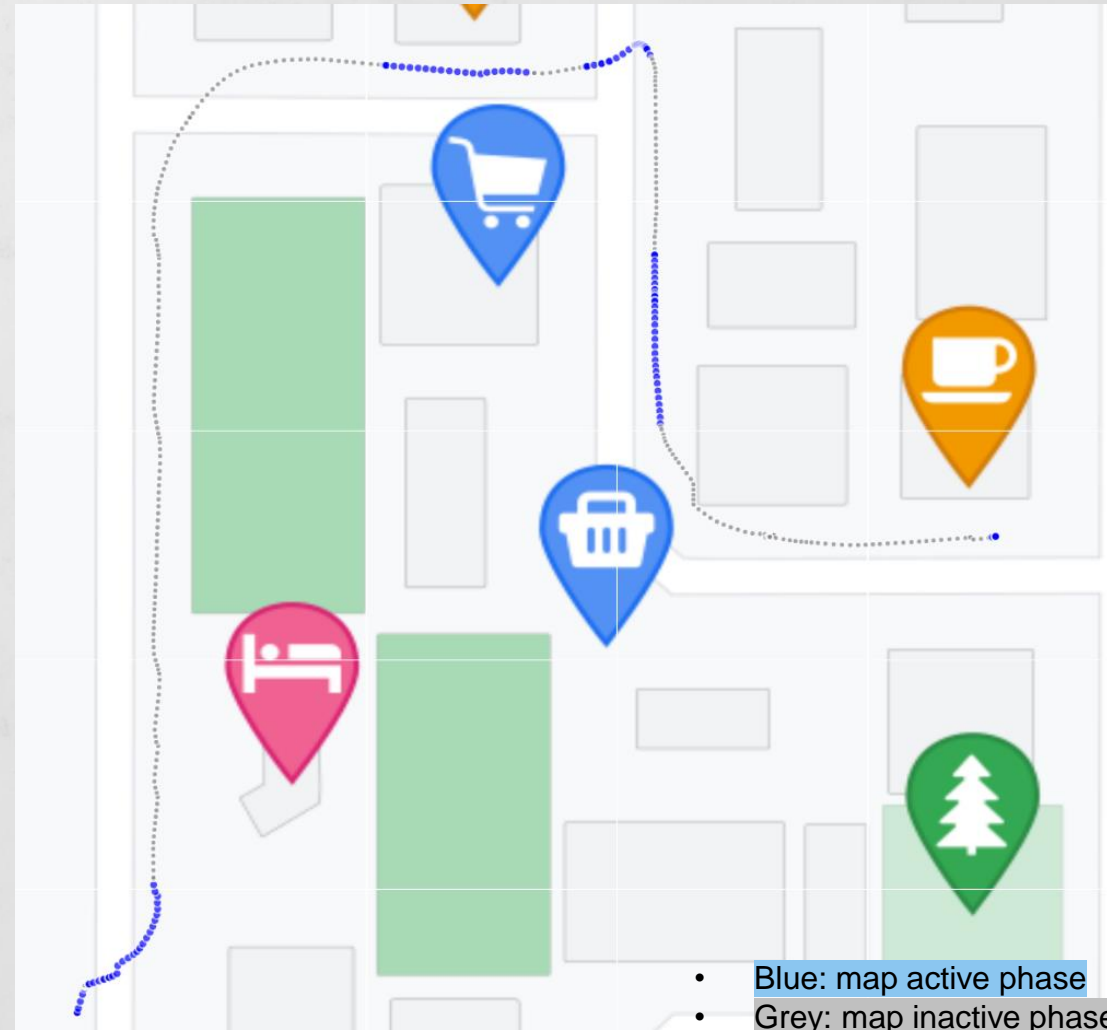


## Research Question:

1. What are **trajectory factors** (e.g., intersections, turns, length etc.) that influence pedestrian **map checking behavior**, and how do these factors affect the map checking behavior?
2. What are the differences in map-checking behavior between heavy and light traffic density conditions?

## Indicator of map checking behavior in this case:

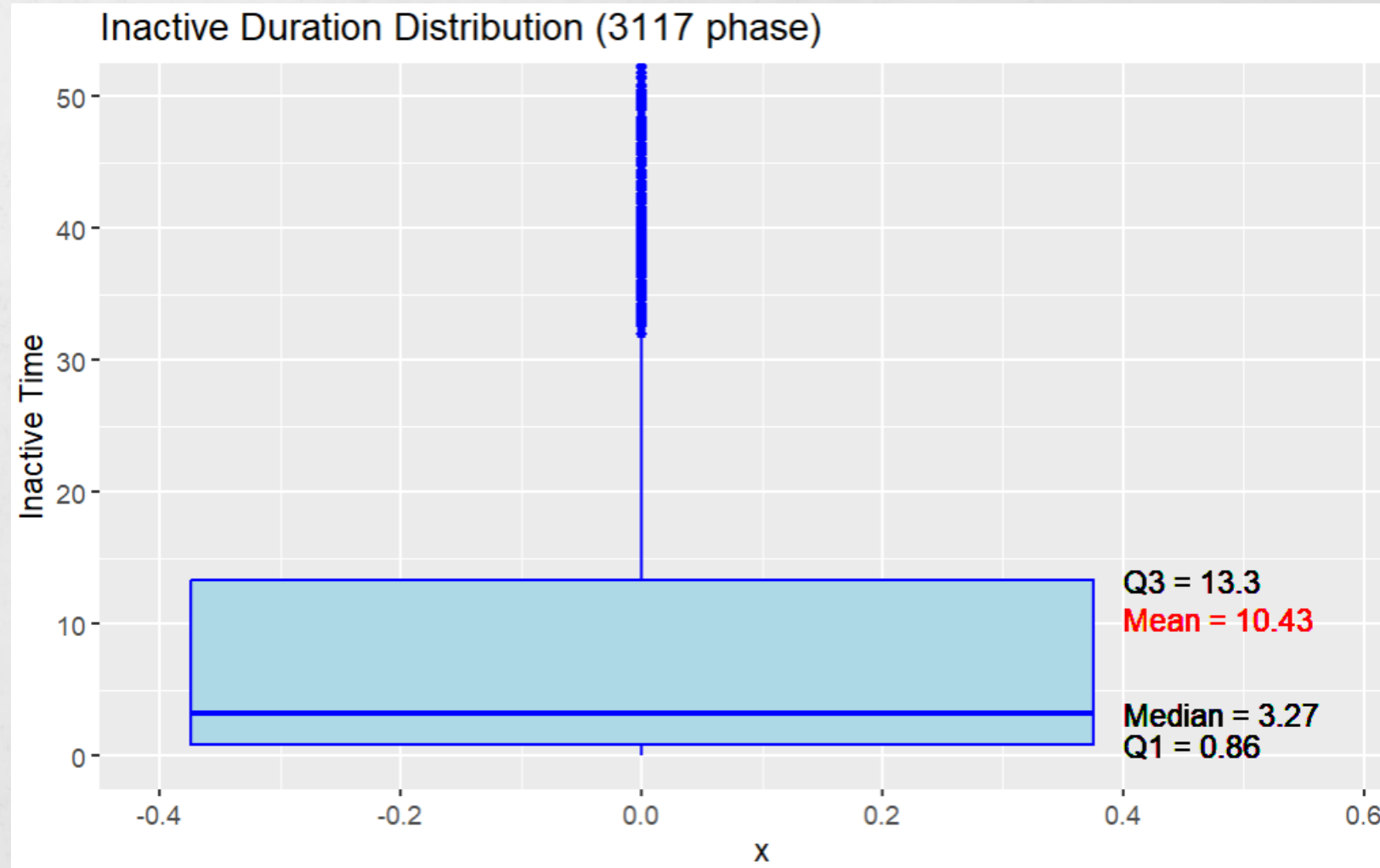
- Duration of each mobile map inactive phase
- Why?
- *If we know the duration of each mobile map inactive phase, it can help achieve automatic map activation or other forms of navigation prompts.*



## Research questions adjustments:

1. What are **trajectory factors** (e.g., intersections, turns, length etc.) that influence pedestrian **map checking behavior**, and how do these factors affect the map checking behavior?
2. What are the differences in map-checking behavior between heavy and light traffic density conditions?
1. Which properties of the **environment** impact **duration of each mobile map inactive phase** in a map-assisted pedestrian navigation session?
2. Which of properties of **wayfinders** have an impact on **duration of each mobile map inactive phase** in a map-assisted pedestrian navigation?
3. Which of **map interactions** have an impact on **duration of each mobile map inactive phase** in a map-assisted pedestrian navigation?

## Descriptive:



Independent Variable metrics:

Wayfinder	Environment	Map interaction
gender	Traffic_density	map_type
age	if_cross_road	if_pan
sbsod_score	if_pre_cross_road	if_selflocation
mobile_map_using_frequency	if_shortcut	if_follow
	num_poi	if_zoom
	segment_length	
	route_completion_rate	

Dependent Variable :

The duration of each map inactivity

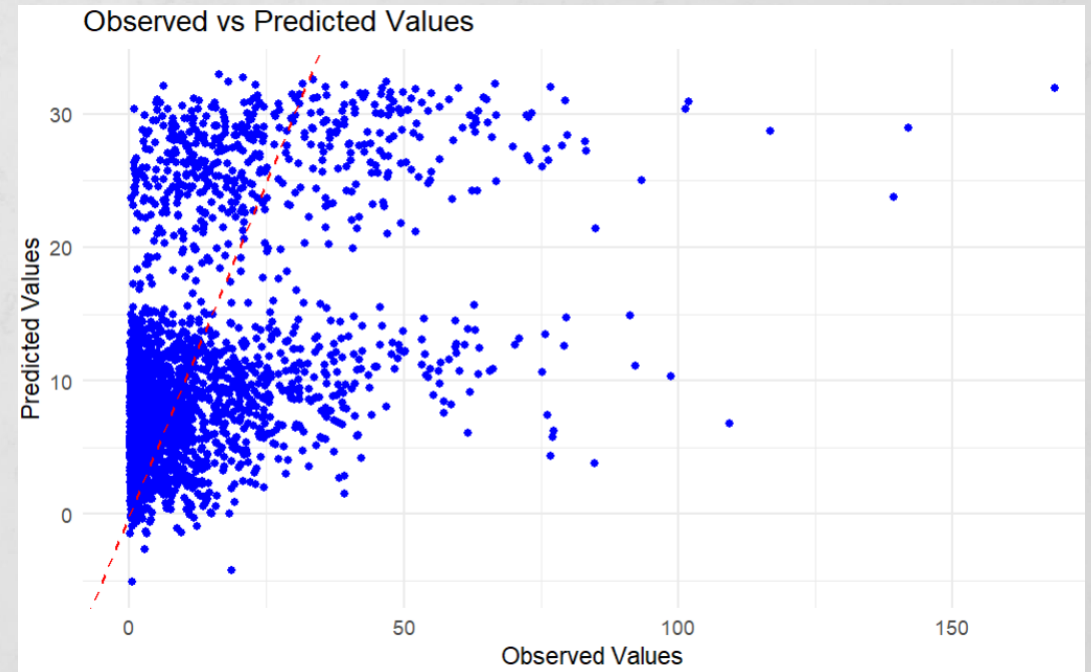
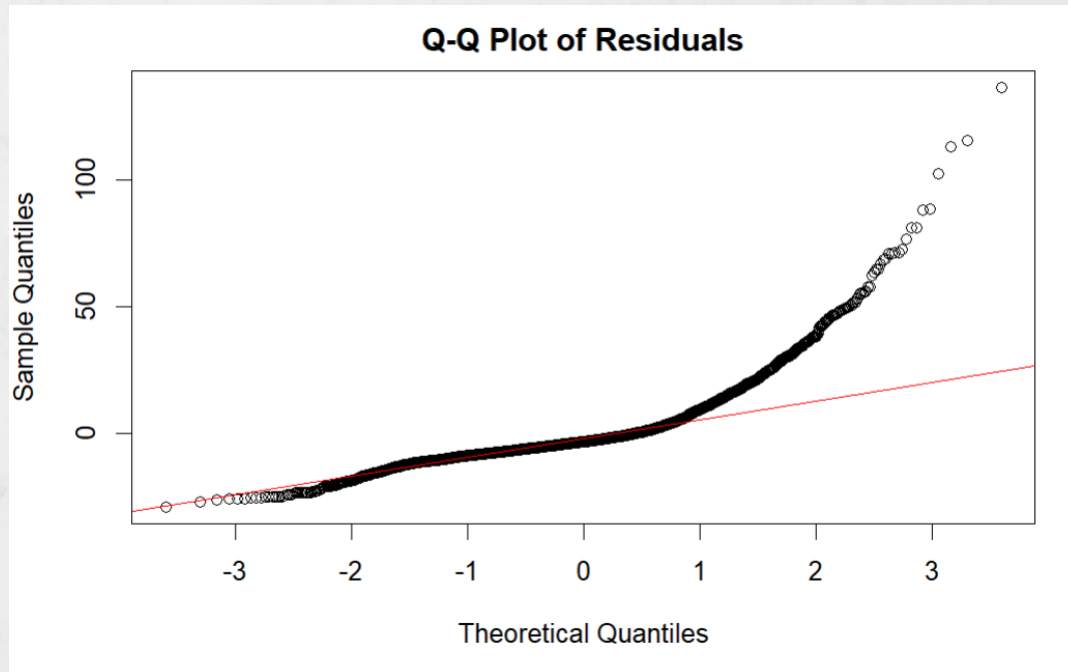


# Why survival analysis?

## Ordinary linear regression:

Wayfinder	$\beta$	p	Environment	$\beta$	p	Map interaction	$\beta$	p
<i>age</i>	1.80548	0.000125	<i>Traffic_density</i>	1.20512	0.016657	<i>if_follow</i>	-5.37718	0.002824
<i>sbsod_score</i>	1.73167	3.69e-13	<i>if_cross_intersection</i>	17.24221	< 2e-1	<i>map_type</i>	0.23975	0.630537
<i>mobile_map_using_frequency</i>	-1.75111	0.000200	<i>if_pre_cross_intersection</i>	1.91026	0.007193	<i>if_pan</i>	-0.17795	0.819914
<i>gender</i>	0.53554	0.367696	<i>route_completion_rate</i>	-6.97748	8.13e-14	<i>if_selflocation</i>	1.94606	0.782931
			<i>if_shortcut</i>	0.01729	0.977283	<i>if_zoom</i>	-1.02105	0.174546
			<i>num_poi</i>	tbd	tbd			
			<i>segment_length</i>	tbd	tbd			

## Ordinary linear regression:



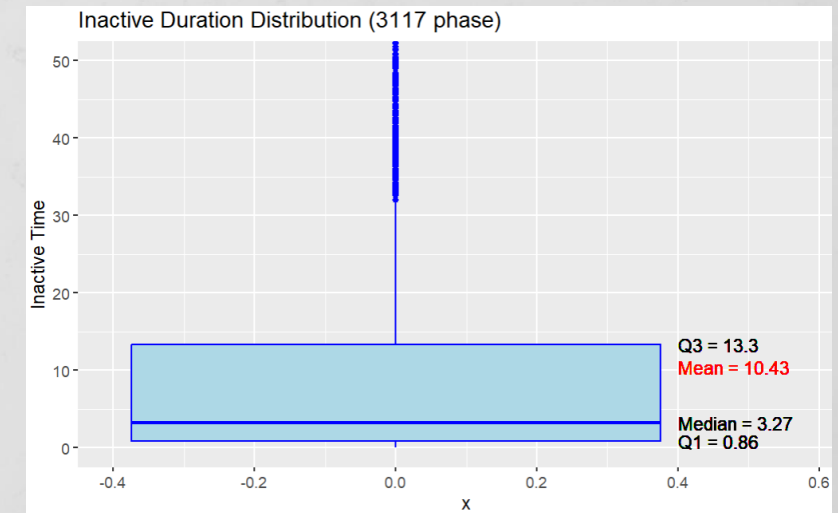
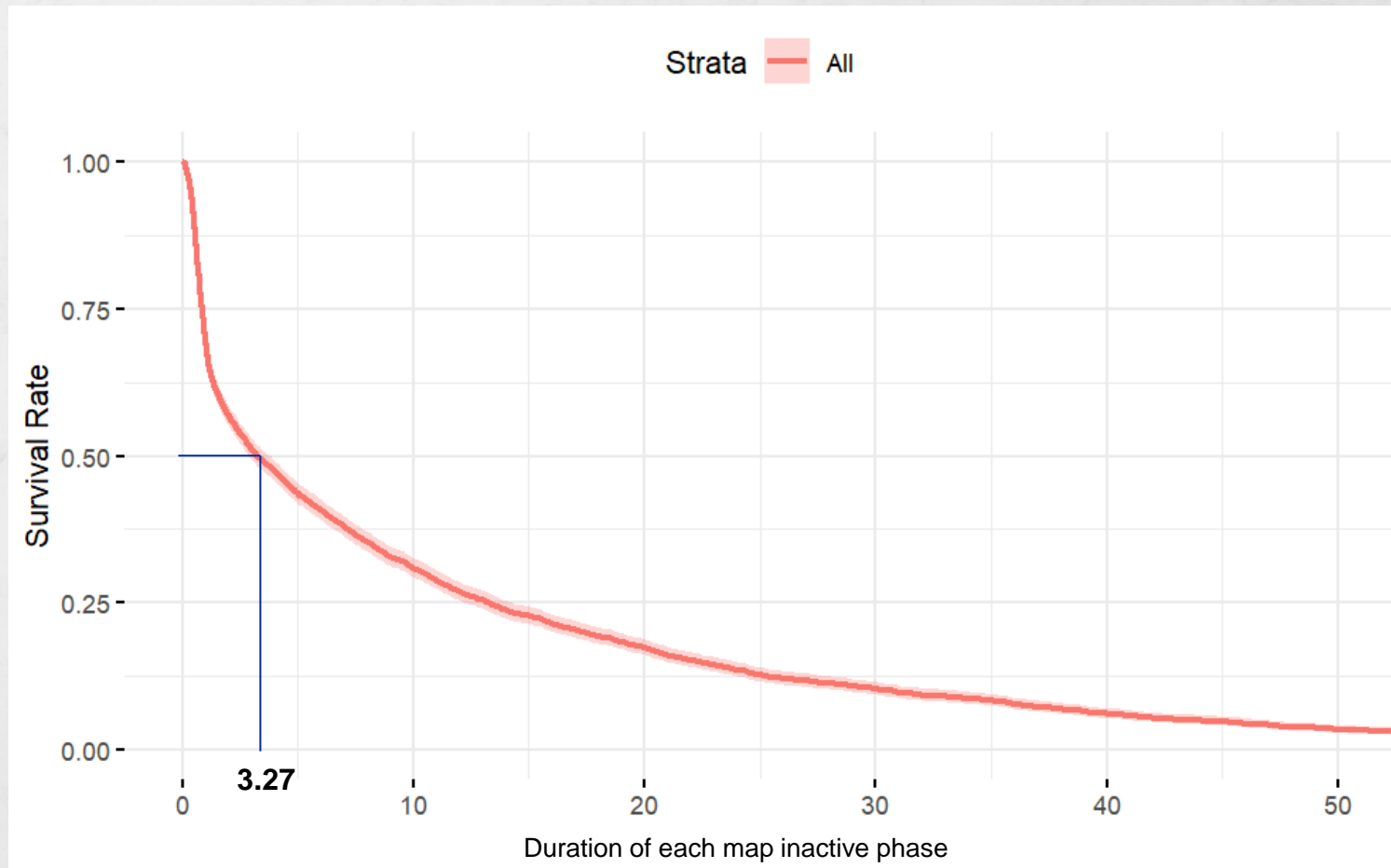
Adjusted  $R^2 = 24.22$



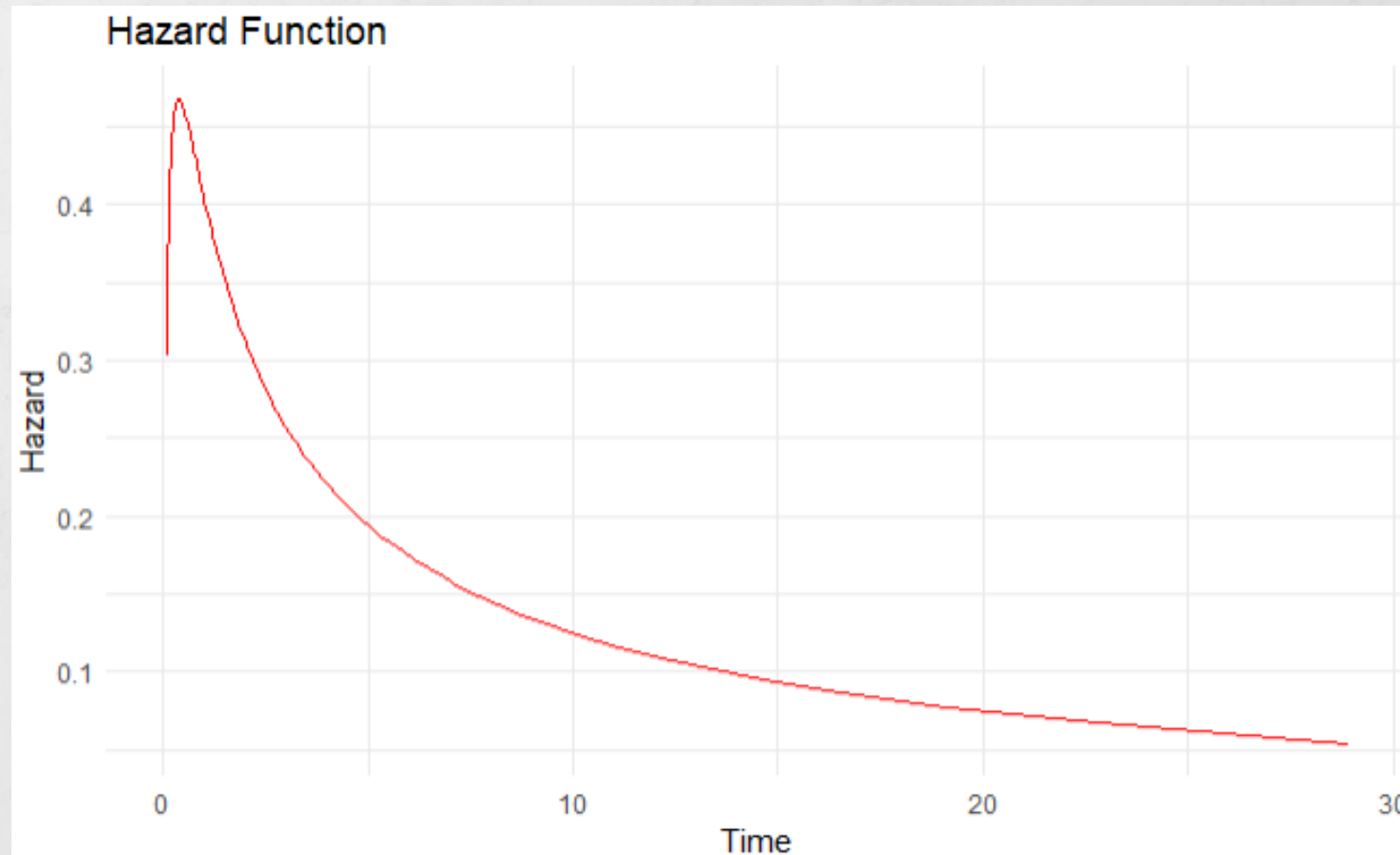
## Why survival analysis:

1. Less restricted by model assumptions.
2. Covariate effects over time. (For instance, a factor may have little effect on shorter durations, but a large effect on longer durations.)
3. Interpretation of results: Survival curve, hazard functions, hazard ratio, etc.
4. Robust to choose when to automatic active the mobile map or give other types navigation aids.  
**For different covariates set, the predicted outcome is not a specific number, it is survival curve. (Comparing with linear model that we give covariates to it, and it returned a specific value.)**

## Survival analysis(KM curve):



## Survival analysis(Hazard function):



## Survival Analysis (model selection):

Proportional hazards model: the covariates have a constant multiplicative effect on the **hazard function**.

**Accelerated failure time (AFT):** effect of the covariates on the hazard function is multiplicative on the time scale, thus not constant. More plausible alternative (Giannopoulos, 2017)

## Survival Analysis results:

Wayfinder	Exp( $\beta$ )	p	Environment	Exp( $\beta$ )	p	Map interaction	Exp( $\beta$ )	p
<i>age</i>	1.153955	0.0019	<i>Traffic_density</i>	1.1765054	0.0010	<i>if_follow</i>	0.673645	0.0253
<i>sbsod_score</i>	1.243211	<2e-16	<i>if_cross_intersection</i>	5.9758095	<2e-16	<i>map_type</i>	0.948879	0.2835
<i>mobile_map_using_frequency</i>	0.835751	0.0001	<i>if_pre_cross_intersection</i>	1.1501770	0.0448	<i>if_pan</i>	0.923867	0.3021
<i>gender</i>	1.172570	0.0064	<i>route_completion_rate</i>	0.7601516	0.0027	<i>if_selflocation</i>	1.357681	0.6592
			<i>if_shortcut</i>	1.0095016	0.8739	<i>if_zoom</i>	1.041577	0.5810
			<i>num_poi</i>	tbd	tbd			
			<i>segment_length</i>	tbd	tbd			

$\beta$  : coefficients ( $\beta$ ) represent the effect of covariates on the (log-transformed) survival time.

Exp( $\beta$ ): if exp( $\beta$ ) = 1.5, the expected survival time is 1.5 times longer for a one-unit increase in the covariate.



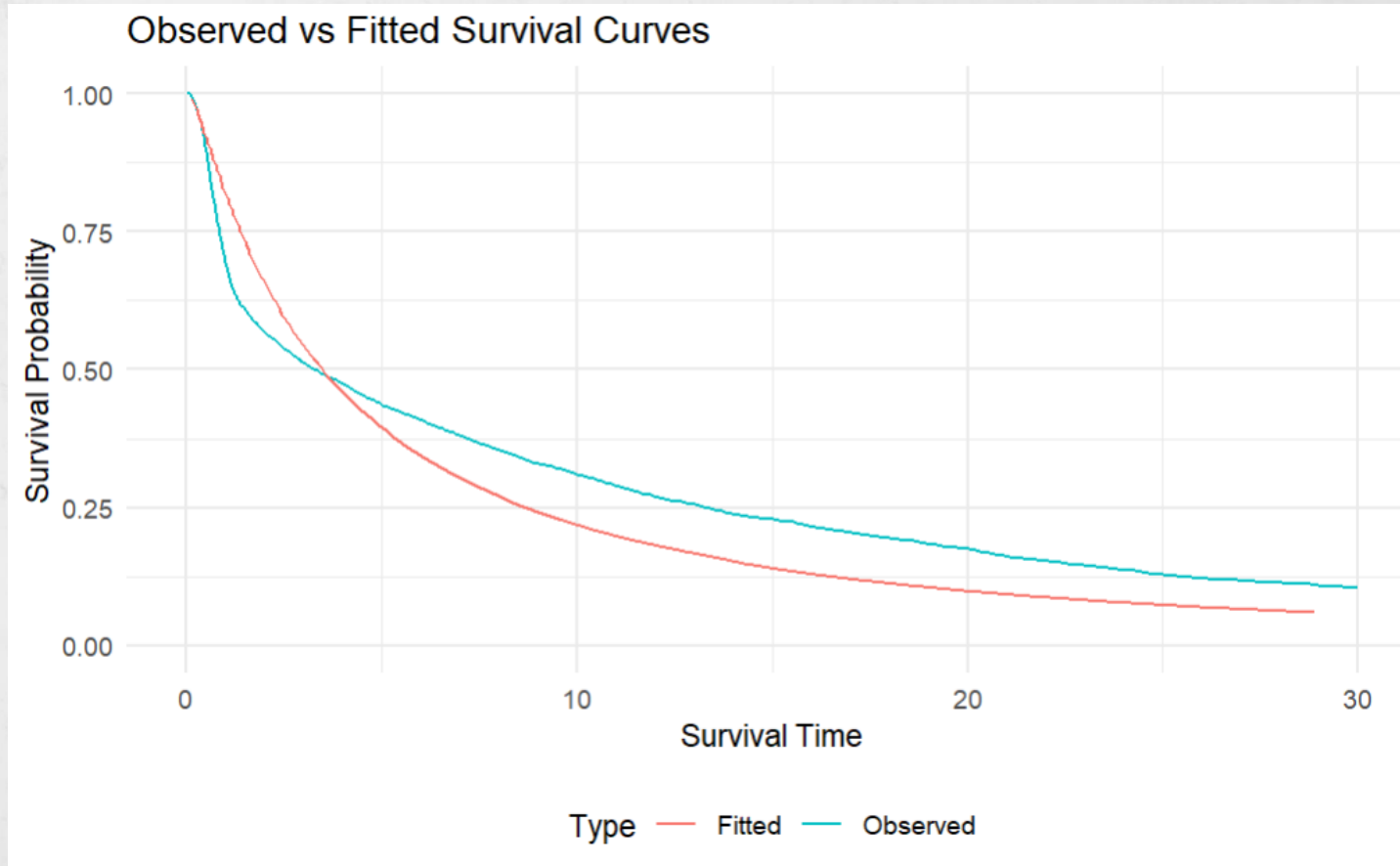
## Survival Analysis results:

Wayfinder	Exp( $\beta$ )	p	Environment	Exp( $\beta$ )	p	Map interaction	Exp( $\beta$ )	p
<i>age</i>	1.153955	0.0019	<i>Traffic_density</i>	1.1765054	0.0010	<i>if_follow</i>	0.673645	0.0253
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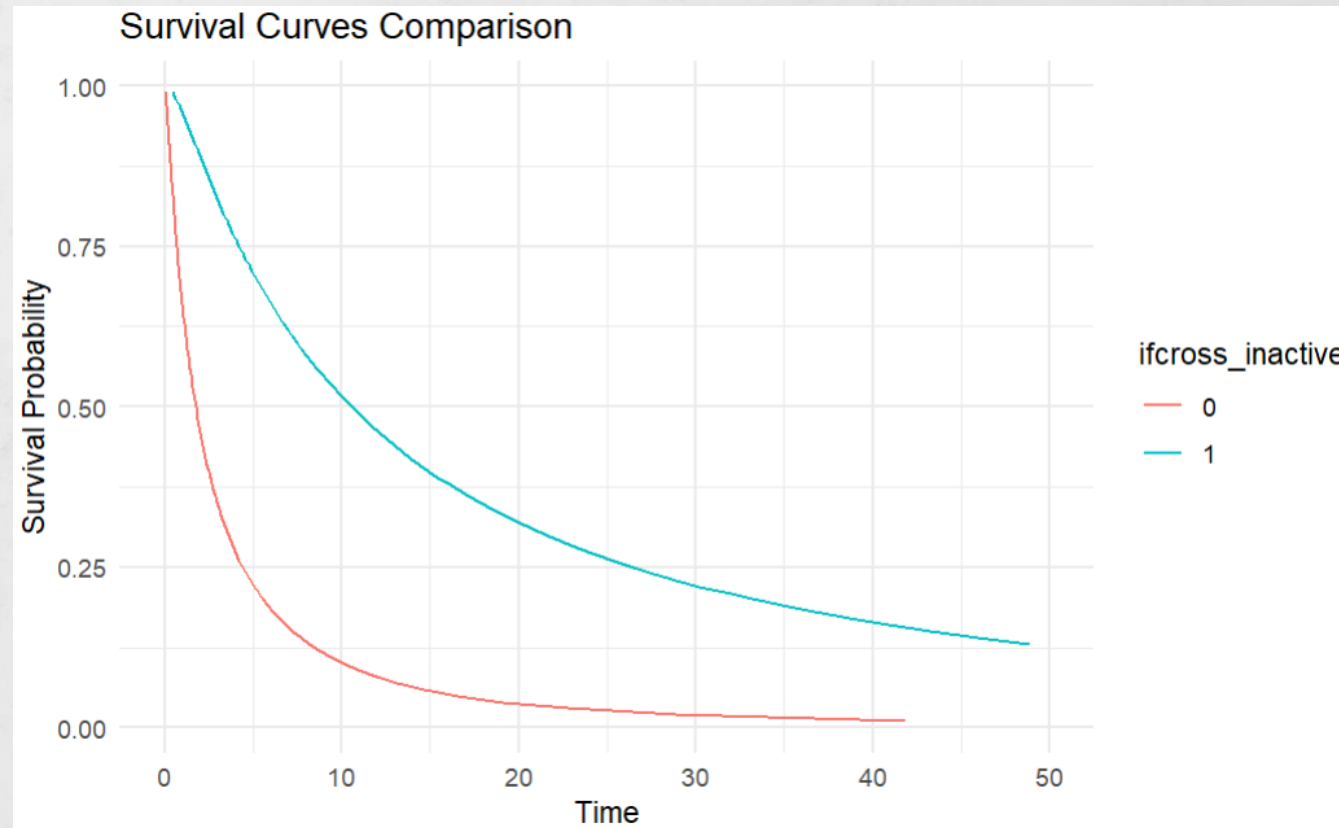
Vs linear

Wayfinder	$\beta$	p	Environment	$\beta$	p	Map interaction	$\beta$	p
<i>age</i>	1.80548	0.000125	<i>Traffic_density</i>	1.20512	0.016657	<i>if_follow</i>	-5.37718	0.002824
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			<i>num_poi</i>	tbd	tbd			
			<i>segment_length</i>	tbd	tbd			

## Survival Analysis results:

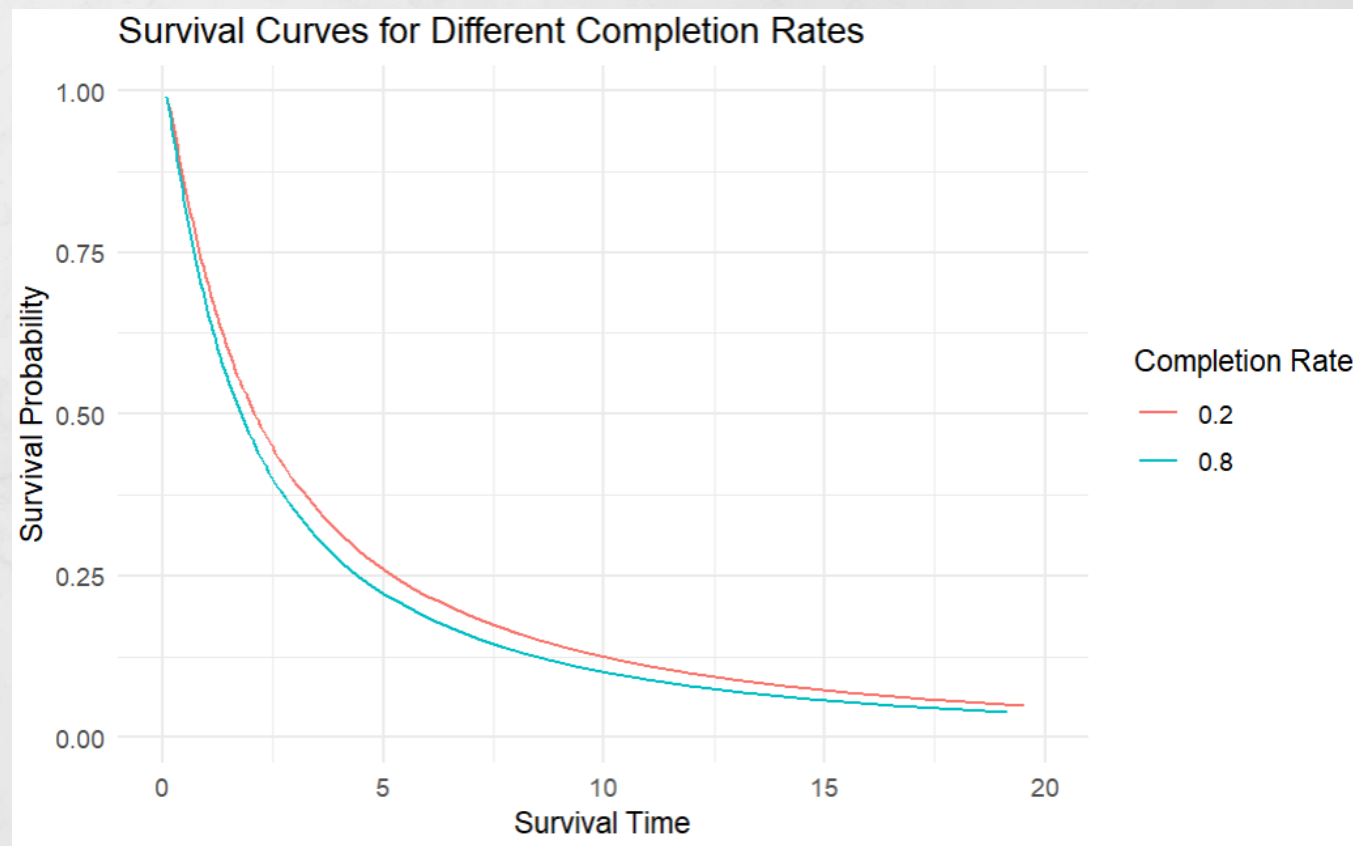


## Survival Analysis results:



Compare the survival curves for a female aged 18-24 with an SBSOD score of 3 and a map use frequency of at most once a week, under two conditions:  
**crossing road or not crossing road**

## Survival Analysis results:



Compare the survival curves for a female aged 18-24 with an SBSOD score of 3 and a map use frequency of at most once a week, under two conditions:

**20% completion rate vs 80% completion rate**