S1 Table Characteristics of the subjects analyzed in this study at the start of oral care

Lifestyle independence

	Subjects with follow-up data one year before and after oral care (N=27)		Subjects who underwent oral care (N=72)		Subjects with more than one year of follow-up(N=57)						P-value
					Start of oral care		After 6 months		After 12 months		
	n	%	n	%	n	%	n	%	n	%	
Certification of the need for long-term care											
1	0	0	1	1.4							0.003
2	3	11.1	5	6.9	5	9.4	4	7.5	1	1.9	
3	9	33.3	20	27.8	16	30.2	17	32.1	12	22.6	
4	11	40.7	26	36.1	22	41.5	24	45.3	27	54.0	
5	4	14.8	20	27.8	10	18.9	8	15.1	10	20.0	
The degree of independence in everyday life											
A	5	18.5	9	12.5	9	17.0	10	18.9	10	18.9	0.513
B	19	70.4	53	73.6	37	69.8	36	67.9	36	71.7	
C	2	7.4	6	8.3	3	5.7	4	7.5	3	5.7	
J	1	3.7	4	5.6	4	7.5	3	5.7	2	3.8	
Dementia degree of autonomy											
Independent	0	0.0	4	5.6	3	5.7	2	4.7	0	0	0.097
I	1	3.7	3	4.2	3	5.7	3	7.0	2	5.3	
II a	0	0.0	4	5.6	3	5.7	2	4.7	2	5.3	
II b	6	22.2	13	18.3	11	20.8	9	20.9	8	21.1	
III a	9	33.3	23	32.4	18	34.0	10	23.3	12	31.6	
III b	3	11.1	6	8.5	5	9.4	8	18.6	8	21.1	
IV	7	25.9	16	22.5	9	17.0	9	20.9	6	15.8	
M	1	3.7	2	2.8	1	1.9	0	0	0	0	

Meal and food factors

	Subjects with follow-up data from one year before and after oral care (N=27)		Subjects who underwent oral care (N=72)		Subjects with more than one year of follow-up (N=57)						P-value
					Start of oral care		After 6 months		After 12 months		
	n	%	n	%	n	%	n	%	n	%	
Meal care											
Independent	18	66.7	45	62.5	37	69.8	35	66.0	22	41.5	0.022
Needs care	4	14.8	9	12.5	7	13.2	7	13.2	9	17.0	
Dependent	5	18.5	18	25.0	9	17.0	10	18.9	21	39.6	
Food prescription											
Ordinary food	12	44.4	29	40.3	22	41.5	19	35.8	19	35.8	0.761
Sliced food	3	11.1	9	12.5	9	17.0	9	17.0	7	13.2	
Pureed food	12	44.4	32	44.4	21	39.6	23	43.4	22	41.5	
Liquid food	0	0	0	0	1	1.9	2	3.8	3	5.7	
Arousal during the meal											
+	24	88.9	59	81.9	50	94.3	50	94.3	45	84.9	0.074
-	3	11.1	13	18.1	3	5.7	2	3.8	6	11.3	

Oral function, oral health status and independence

	Subjects with follow-up data from one year before and after oral care (N=27)		Subjects who underwent oral care (N=72)		Subjects with more than one year of follow-up(N=57)						P-value
					Start of oral care		After 6 months		After 12 months		
	n	%	n	%	n	%	n	%	n	%	
Swallowing difficulty											
Residue -	44	81.5	52	72.2	40	75.5	48	90.6	45	84.9	0.999<
Residue +	8	14.8	8	11.1	6	11.3	2	3.8	2	3.8	
Unable to swallow	2	3.7	1	1.4	1	1.9	3	5.7	6	11.3	
Dentures											
-	28	51.9	35	48.6	23	43.4	22	41.5	21	39.6	0.197
+	26	48.1	37	51.4	30	56.6	30	56.6	30	56.6	
Need care or attention for tooth brushing											
Independent	18	33.3	27	37.5	24	45.3	20	37.7	15	28.3	<0.001
Needs care	14	25.9	16	22.2	12	22.6	10	18.9	7	13.2	
Dependent	22	40.7	29	40.3	17	32.1	22	41.5	29	54.7	
Candida											
<750 cfu	36	66.7	40	55.6	15	28.3	21	39.6			0.162
>=750 cfu	18	33.3	22	30.6	33	62.3	16	30.2			

Fifty-seven subjects had more than one year of follow-up data. Changes in parameters were analyzed by Friedman test.

S2 Table Effects of oral care independence on fever according to participation in the oral care program and number of functional teeth

(A) With or without dentures, (B) Assistance with tooth brushing, (C) Food test (swallowing function)

		Model S2 (A)	95% CI		P-value	Model S2 (B)	95% CI		P-value	Model S2 (C)	95% CI		P-value	Model S2 (D)	95% CI		P-value
		Coefficient	Lower	Upper		Coefficient	Lower	Upper		Coefficient	Lower	Upper		Coefficient	Lower	Upper	
Intercept		0.285	-0.211	0.780	0.254	0.689	0.161	1.217	0.012	0.205	-0.133	0.543	0.229	0.066	-0.197	0.33	0.615
Oral care	-	Reference				Reference				Reference				Reference			
	+	0.724	0.176	1.273	0.011	0.636	0.106	1.166	0.020	0.675	0.069	1.280	0.030	0.935	0.324	1.547	0.003
Number of functional teeth		0.030	-0.005	0.064	0.087	0.018	-0.009	0.044	0.185	0.035	<0.001	0.070	0.052	0.045	0.011	0.079	0.010
Interaction with number of functional teeth																	
Oral care	-	Reference				Reference				Reference				Reference			
	+	-0.054	-0.099	-0.009	0.020	-0.04	-0.076	-0.004	0.028	-0.050	-0.096	-0.004	0.034	-0.064	-0.114	-0.015	0.012
Dentures																	
	-	Reference															
	+	-0.237	-0.706	0.232	0.315												
Needs assistance with tooth brushing																	
Independent						Reference											
Needs attention						-0.622	-1.16	-0.084	0.024								
Dependent						-0.647	-1.158	-0.136	0.014								
Swallowing ability																	
Possible										Reference							
Impossible										-0.435	-0.816	-0.054	0.026				
Meal support																	
Independent														Reference			
Needs support														-0.312	-0.622	-0.002	0.048

With or without dentures was not statistically significant. Needs attention and dependent for tooth brushing were statistically significant. Their coefficients were negative. Inability to swallow was statistically significant.

The results indicate that the oral care program was effective for subjects who were not fully independent during tooth brushing and for those with dysphagia. The effect of the oral care program was not associated with denture use. This may be because dedicated attention was paid to denture wearers and because detailed denture care instructions were provided for the nurses and caregivers.

S3 Table Effects of the interaction of dietary or meal factors with the oral care program and the number of functional teeth on the incidence of fever

Model S3 (A)

		Coefficient	95% CI Lower	95% CI Upper	P-value
Intercept		0.222	-0.002	0.446	0.052
Interaction with oral care and meal care					
Oral care (+)	**Independent**	Reference			
	Needs attention	2.028	0.5	3.556	0.010
	Needs assistance	-0.222	-0.446	0.002	0.052
Oral care (-)	**Independent**	0.167	-0.205	0.538	0.371
	Needs attention	1.778	0.335	3.220	0.017
	Needs assistance	0.178	-0.435	0.790	0.562

Model S3 (B)

		Coefficient	95% CI Lower	95% CI Upper	P-value
Intercept		0.417	0.042	0.791	0.030
Interaction with oral care and food prescription					
Oral care (+)	Ordinary	Reference			
	Sliced	1.250	-0.295	2.795	0.110
	Pureed	-0.167	-0.641	0.307	0.483
Oral care (-)	Ordinary	-0.083	-0.586	0.419	0.740
	Sliced	0.917	-0.475	2.308	0.192
	Pureed	0.333	-0.294	0.960	0.290

Model S3 (C)

		Coefficient	95% CI Lower	95% CI Upper	P-value
Intercept		0.500	0.210	0.790	0.001
Interaction with oral care and food prescription					
Oral care (+)	**Arousal(+)**	Reference			
	Arousal(-)	-0.167	-0.896	0.563	0.648
Oral care (-)	**Arousal(+)**	-0.167	-0.541	0.208	0.375
	Arousal(-)	2.500	0.471	4.529	0.017

Model S3 (D)

	Coefficient	95% CI		P-value
		Lower	Upper	
Intercept	1.193	-4392.762	4395.148	0.999<
Interaction with number of functional teeth and meal care				
Independent	-0.017	-411.164	411.13	0.999<
Needs attention	0.033	-507.696	507.763	0.999<
Needs assistance	-0.056	-587.035	586.923	0.999<

Model S3 (E)

	Coefficient	95% CI		P-value
		Lower	Upper	
Intercept	<0.001	<0.001	<0.001	0.999<
Interaction with number of functional teeth and food prescription				
Ordinary	0.033	0.011	0.055	0.004
Sliced	0.136	0.045	0.228	0.004
Pureed	<0.001	<0.001	<0.001	0.999<

Model S3 (F)

	Coefficient	95% CI		P-value
		Lower	Upper	
Intercept	-0.102	-0.373	0.169	0.451
Interaction with number of functional teeth and arousal at meal time				
Arousal(+)	0.024	-0.002	0.049	0.067
Arousal(-)	0.047	-0.017	0.111	0.148

The interactions between the need for attention at meal time and participation/nonparticipation in the oral care program and between nonarousal during the meal and no oral care program had statistically significant effects on the incidence of fever. The interactions between dietary prescription and oral care program were not statistically significant. In contrast, the interaction between the number of functional teeth and ordinary and sliced food prescriptions had significant effects on the risk of fever. The coefficient for the prescription of sliced food was higher for the prescription of ordinary food.

S4 Table Effect of the interactions of *Candida* and oral care and candida and number of functional teeth on fever

Model S4 (A)		Coefficient	95% CI		P-value
			Lower	Upper	
Intercept		0.389	0.094	0.684	0.011
Interaction with oral care and oral levels of *Candida*					
Oral care (－)	*Candida* <750 cfu	Reference			
	Candida >=750 cfu	0.278	-0.344	0.899	0.373
Oral care (＋)	*Candida* <750 cfu	-0.167	-0.537	0.203	0.370
	Candida >=750 cfu	1.056	0.198	1.913	0.017

Model S4 (B)		Coefficient	95% CI		P-value
			Lower	Upper	
Intercept		0.389	0.094	0.684	0.011
Interaction with number of functional teeth and oral levels of *Candida*					
Candida	<750 cfu	0.030	0.002	0.059	0.038
	>=750 cfu	0.071	0.028	0.114	0.002

Coefficient of interaction of oral *Candia*>=750 cfu and oral care (+) was statistically significant and its coefficient was positive. The results indicated that the risk of pyrexia may increase by the oral care for the subjects with higher levels of *Candida*. And interactions of *Candida* and number of functional teeth had statistically significant coefficient. Coefficient of Candida levels >=750 cfu was higher than that of <750 cfu.

S1 File Model Specification

Model 1

Multilevel random slope and random intercept model for the incidence of fever.

Below, fixed effects (random effects or error terms) are denoted by Greek letters (alphabet).

Model 1 Subjects and oral care are indexed by *ij*.

$$P_o(X_o) = \pi_{0i} + \pi_{1i}(\text{Number of functional teeth})_i + \varepsilon_{1ij} \sum_{m=1}^{2} \pi_{2i}^{(m)}(\text{Oral care})_i$$

$$+ \sum_{m=1}^{2} \pi_{2i}^{(m)}(\text{Oral care})_{ij} \times (\text{Number of functional teeth})_i + \varepsilon_{2ij}$$

$where\ e_i \sim N(0, \delta_e^2)\ and\ e_i \sim N(0, \delta_e^2)$

Data structure: Subjects, oral care

Random effects

  Oral care level: Intercept, random slope for oral care

  Random effect covariance: variance component

  Where *Xo*: Fever, *X₁*: Hospitalization, *X₂*: Hospitalization for pneumonia for Model 1(A),(B) and (C), respectively

SPSS Syntax

*Generalized Linear Mixed Models.

GENLINMIXED

  /DATA_STRUCTURE SUBJECTS=Subjects

  /FIELDS TARGET=X₀ TRIALS=NONE OFFSET=NONE

  /TARGET_OPTIONS DISTRIBUTION=POISSON LINK=IDENTITY

  /FIXED EFFECTS=Oralcare Numberoffunctionalteeth Oralcare *Numberoffunctionalteeth USE_INTERCEPT=TRUE

  /RANDOM EFFECTS=Oralcare USE_INTERCEPT=TRUE SUBJECTS=Subjects COVARIANCE_TYPE=VARIANCE_COMPONENTS

  /BUILD_OPTIONS TARGET_CATEGORY_ORDER=ASCENDING INPUTS_CATEGORY_ORDER=ASCENDING MAX_ITERATIONS=100

    CONFIDENCE_LEVEL=95 DF_METHOD=RESIDUAL COVB=MODEL PCONVERGE=0.000001(ABSOLUTE) SCORING=0

    SINGULAR=0.000000000001

  /EMMEANS_OPTIONS SCALE=ORIGINAL PADJUST=LSD.

Models 2, 3

Multilevel random slope and random intercept model for the incidence of fever according to dietary or meal factors and *Candida.*

Below, fixed effects (random effects or error terms) are denoted by Greek letters (alphabet).

Model 1 Subjects and oral care are indexed by *ij*.

$$P_o(\text{Fever}) = \pi_{0i} + \pi_{1i}(\text{Number of functional teeth})_i + \varepsilon_{1ij} \sum_{m=1}^{2} \pi_{2i}^{(m)}(\text{Oral care})_i$$

$$+ \sum_{m=1}^{2} \pi_{2i}^{(m)}(\text{Oral care})_{ij} \times (\text{Number of functional teeth})_i + \sum_{m=1}^{2} \pi_{2i}^{(m)}(X_o)_i + \varepsilon_{2ij}$$

where $e_i \sim N(0, \delta_e^2)$ *and* $e_i \sim N(0, \delta_e^2)$

Data structure: Subjects, Oral care

Random effects

  Oral care level: Intercept, random slope for oral care

  Random effect covariance: Variance component

  Where X_o: Meal care, X_1: Food prescription, X_2: Arousal during meals, and X_4: Oral levels of Candida for Model 2(A), (B), (C) and (D), respectively

SPSS Syntax

*Generalized Linear Mixed Models.

GENLINMIXED

  /DATA_STRUCTURE SUBJECTS=Subjects

  /FIELDS TARGET=Pyrexia TRIALS=NONE OFFSET=NONE

  /TARGET_OPTIONS DISTRIBUTION=POISSON LINK=IDENTITY

  /FIXED EFFECTS=Oralcare Numberoffunctionalteeth Oralcare *Numberoffunctionalteeth Xo USE_INTERCEPT=TRUE

  /RANDOM EFFECTS=Oralcare USE_INTERCEPT=TRUE SUBJECTS=Subjects COVARIANCE_TYPE=VARIANCE_COMPONENTS

  /BUILD_OPTIONS TARGET_CATEGORY_ORDER=ASCENDING INPUTS_CATEGORY_ORDER=ASCENDING MAX_ITERATIONS=100

    CONFIDENCE_LEVEL=95 DF_METHOD=RESIDUAL COVB=MODEL PCONVERGE=0.000001(ABSOLUTE) SCORING=0

    SINGULAR=0.000000000001

  /EMMEANS_OPTIONS SCALE=ORIGINAL PADJUST=LSD.

Model 3

Generalized linear model for the incidence of fever according to the number of functional teeth, dietary or meal factors and *Candida*.

Below, error terms are denoted by Greek letters (alphabet).

Subjects are indexed by *i*.

$$P_o(\text{Fever}) = \alpha_1(\text{Number of functional teeth})_i + \alpha_2 \sum_{m=1}^{n} (\text{Meal care})_i$$

$$+ \alpha_3 \sum_{m=1}^{n} (\text{Food prescripton})_i + \alpha_4 \sum_{m=1}^{n} (\text{Apousal})_i + \alpha_5 \sum_{m=1}^{n} (Candida)_i + \varepsilon_i$$

SPSS Syntax

GENLIN Pyrexia BY Mealcare Foodprescription Arousal Candida (ORDER=ASCENDING) WITH Functionalteeh

  /MODEL Mealcare Foodprescription Arousal Candida Functionalteeh INTERCEPT=YES

 DISTRIBUTION=POISSON LINK=LOG

  /CRITERIA METHOD=FISHER(1) SCALE=1 COVB=MODEL MAXITERATIONS=100 MAXSTEPHALVING=5

    PCONVERGE=1E-006(ABSOLUTE) SINGULAR=1E-012 ANALYSISTYPE=3(WALD) CILEVEL=95 CITYPE=WALD

    LIKELIHOOD=FULL

  /MISSING CLASSMISSING=EXCLUDE

  /PRINT CPS DESCRIPTIVES MODELINFO FIT SUMMARY SOLUTION.

Model 4

Cox's proportional hazard model for the time between the start of the oral care program and the incidence of fever according to the number of functional teeth, dietary and meal factors and *Candida*.

$$h(t|x) = h_0(t)\exp(a_1 x_1 + a_2 x_2 + a_3 x_3 + a_4 x_4 + a_5 x_5)$$

SPSS Syntax

```
BOOTSTRAP

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  /CRITERIA CILEVEL=95 CITYPE=PERCENTILE NSAMPLES=1000

  /MISSING USERMISSING=EXCLUDE.

COXREG OT1

  /STATUS=O1(1)

  /CONTRAST (v12)=Indicator

  /CONTRAST (v26)=Indicator

  /CONTRAST (v07)=Indicator

  /CONTRAST (v08)=Indicator

  /METHOD=ENTER vc06 v07 v08 v12 v26

  /PRINT=CI(95)

  /CRITERIA=PIN(.05) POUT(.10) ITERATE(20).
```

S2 File

Colony counts of *Candida* depend on the number of samples. With swab sampling, it is impossible to obtain a uniform number of samples. Therefore, we dichotomized the colony count of *Candida* using the following methodology.

(A) ROC curves were used to set the cutoff point of oral levels of *Candida* for fever.
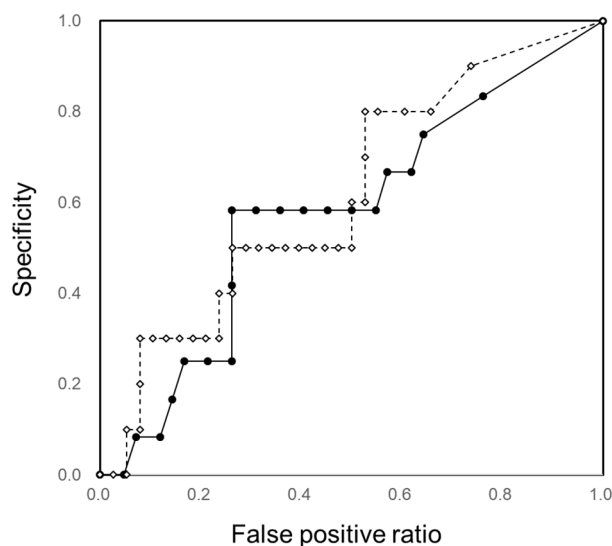
The solid line indicates the 27 subjects who did and did not receive the oral care intervention. The dotted line indicates the data for 53 subjects for one year after receiving oral care. The optimal cut off points were between 700 cfu and 785 cfu for the 27 subjects who did and did not receive oral care and between 735 cfu and 785 cfu for the 53 subjects with data for one year after receiving oral care. Therefore, in this study, the cut-off point was conventionally set as 750 cfu.

(B) Cross tabulations of oral levels of Candida and fever

Data			*Candida*	
			<750 cfu	750 cfu<=
With or without oral care	Fever	+	5	7
		-	31	11
Oral care	Fever	+	5	5
		-	10	28

(C) Precision of the cut-off point

| Data	Sensitivity	Specificity	Positive predictive vale	Negative predictive vale	AUR	Likelihood ratio
With or without oral care	0.58	0.74	0.39	0.86	0.58	1.77
Oral care	0.50	0.74	0.33	0.85	0.62	1.47

AUR: Area under the ROC curve
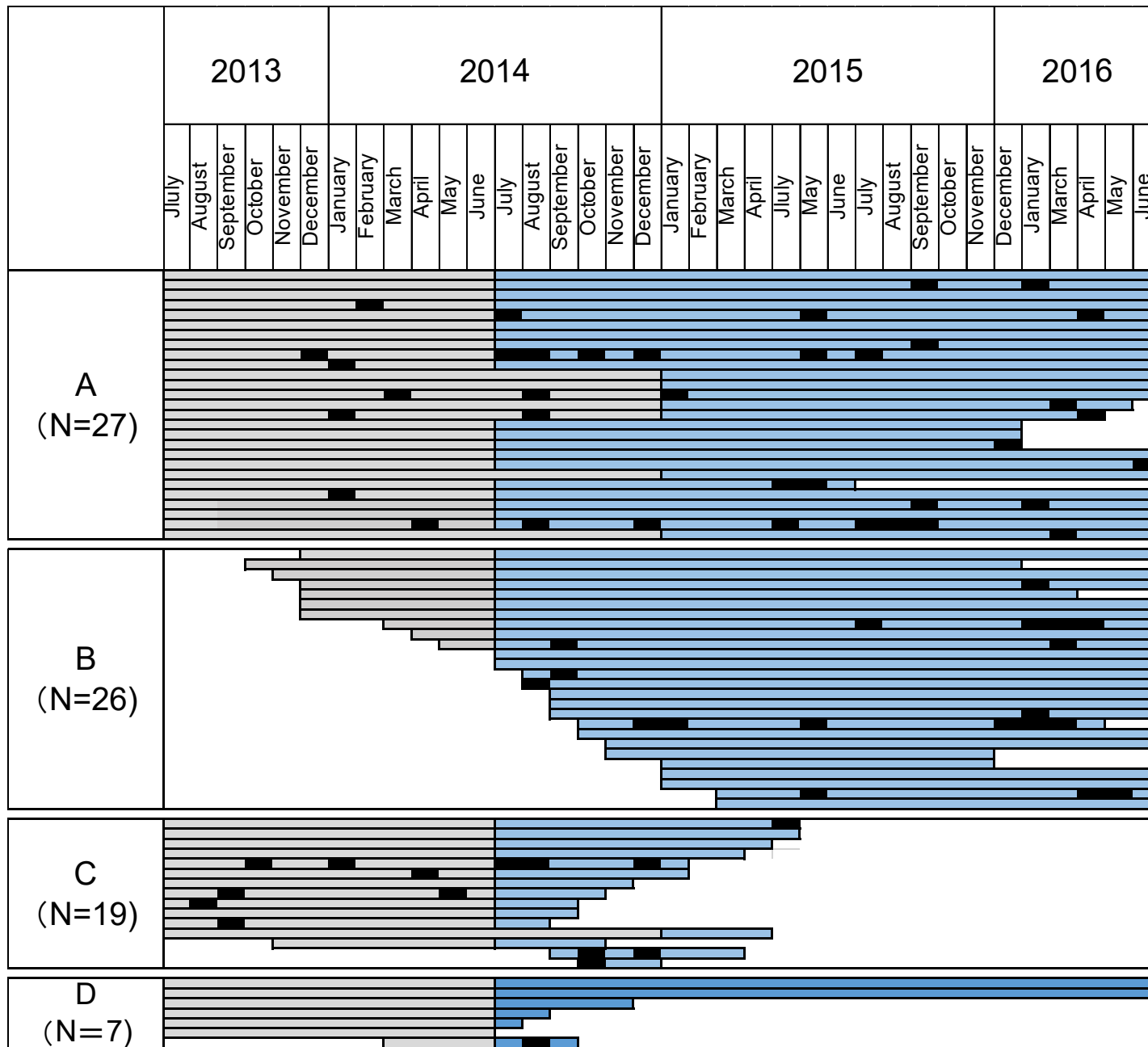
S1 Figure
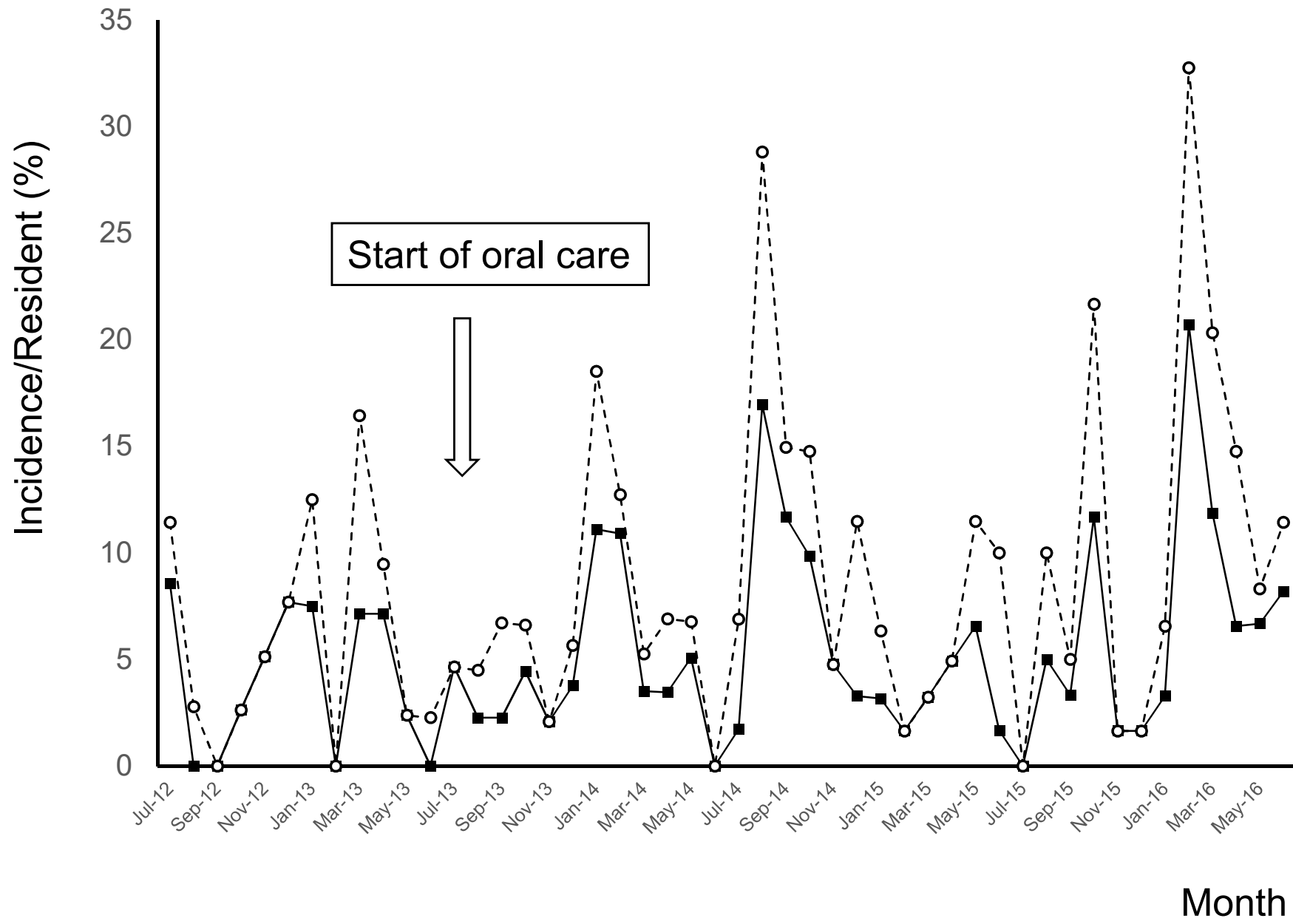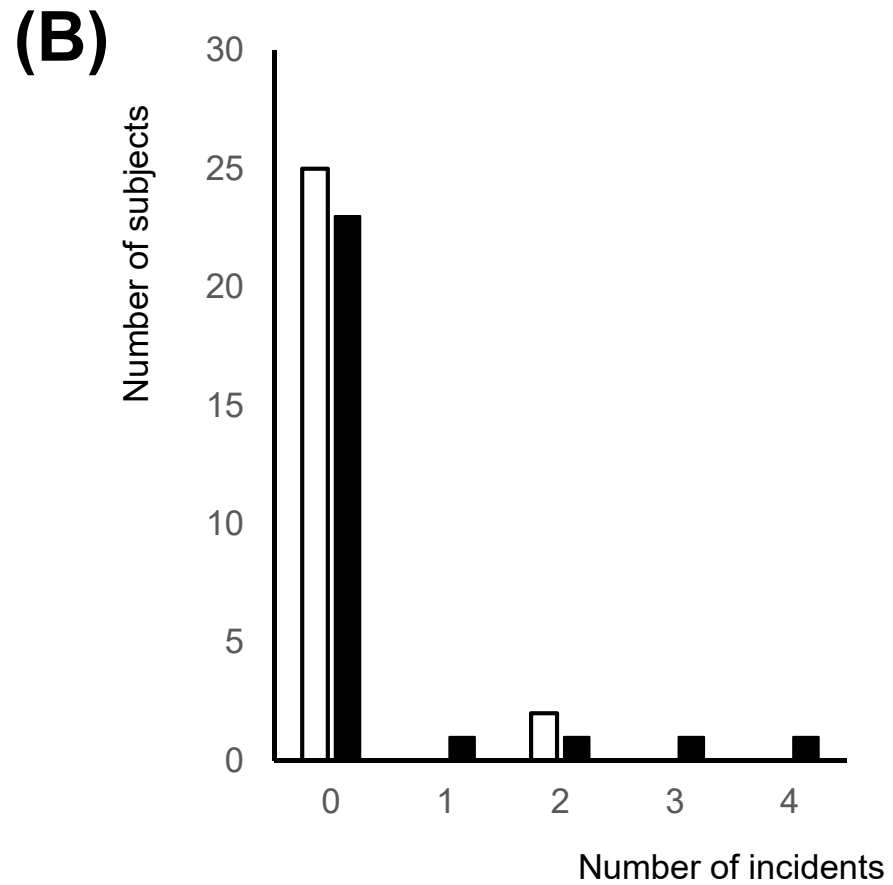
S2 Figure

Distribution of the incidence of fever, hospitalization and hospitalization
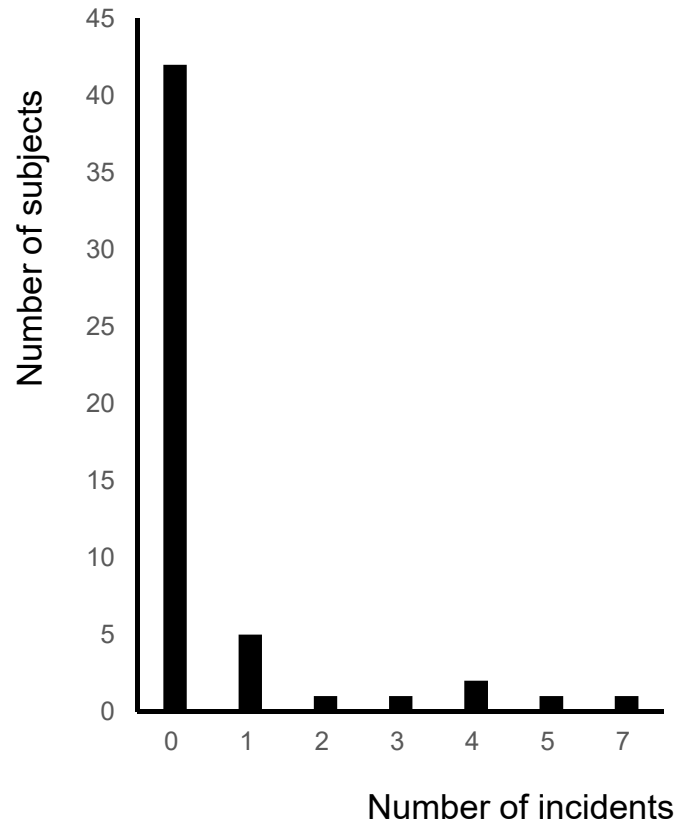for pneumonia with or without oral care intervention

(A)

Number of subjects

Number of incidents

Fever

(B)

Number of subjects

Number of incidents
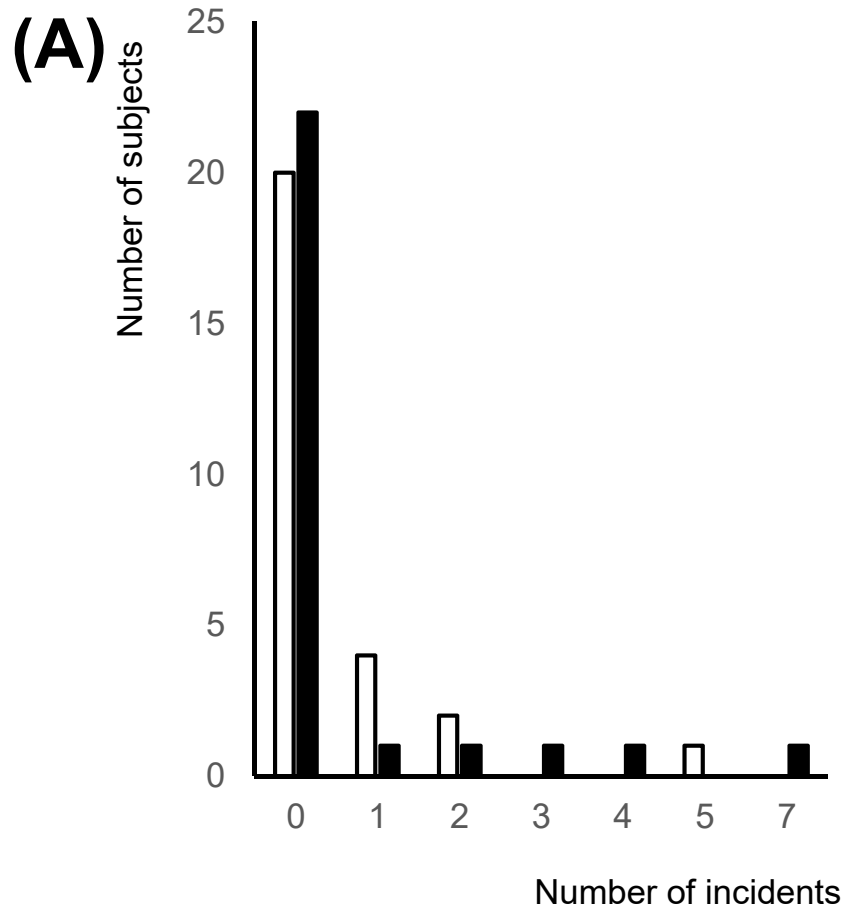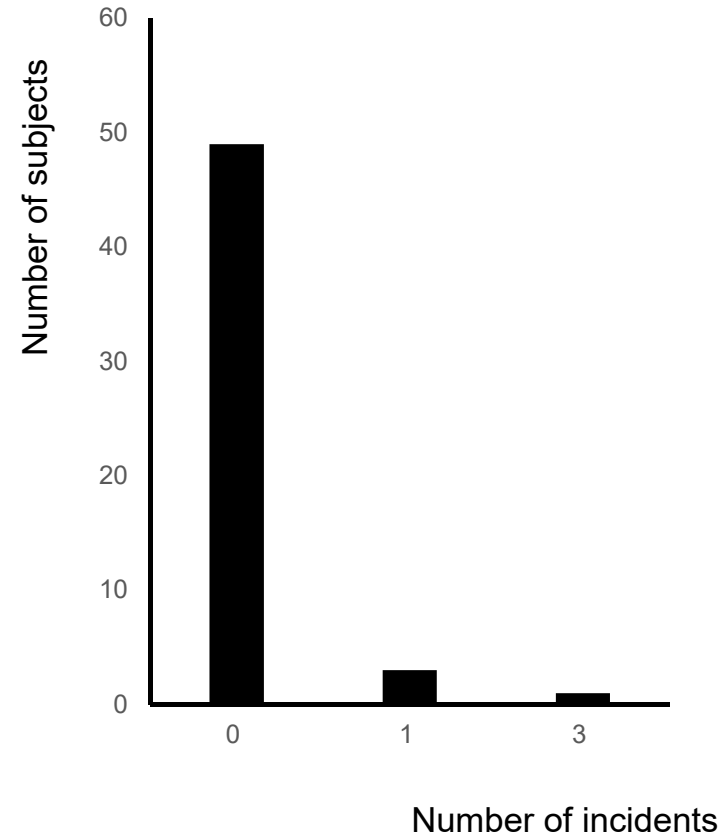
Hospitalization for pneumonia

S3   Figure

Distribution of incidence of fever, hospitalization and hospitalization for pneumonia during the 1-year follow-up period
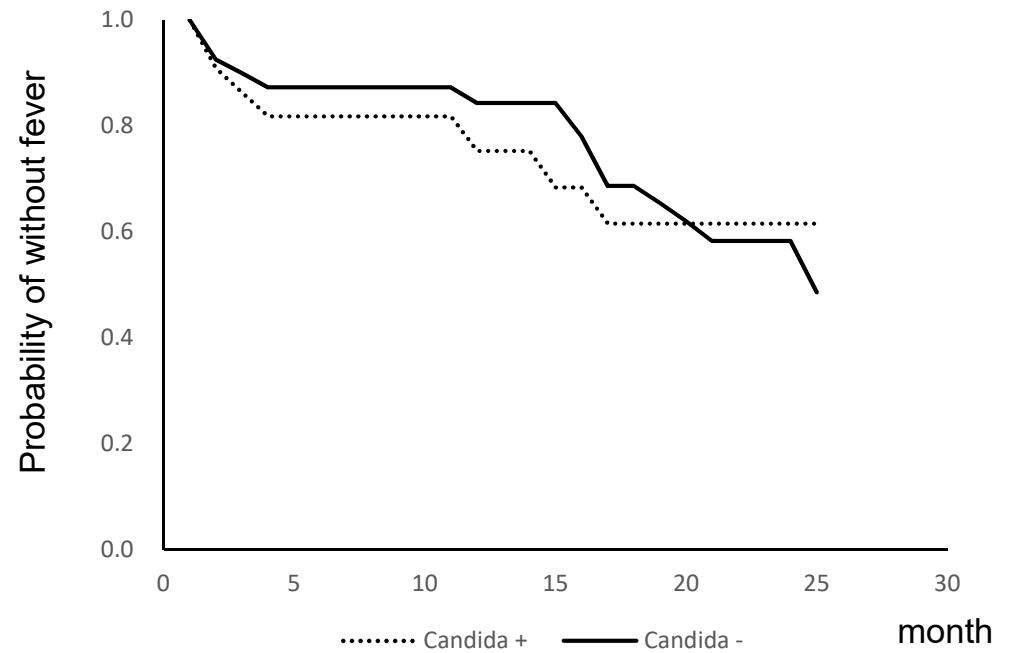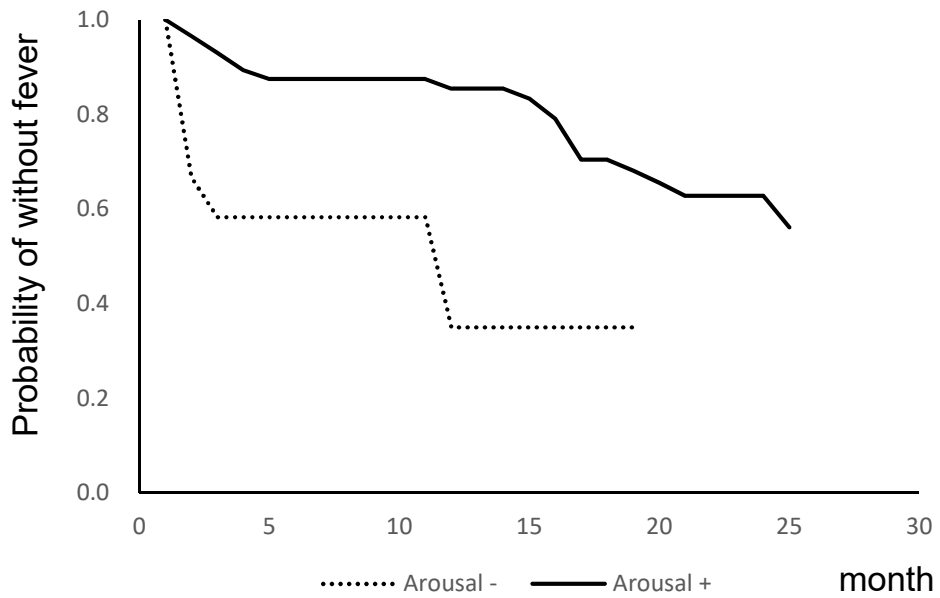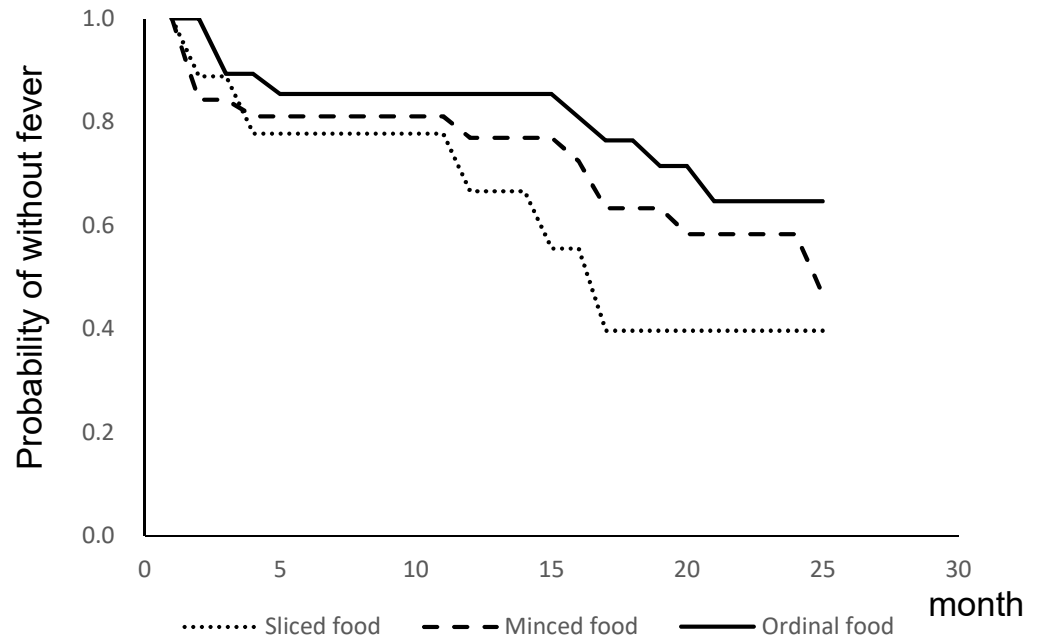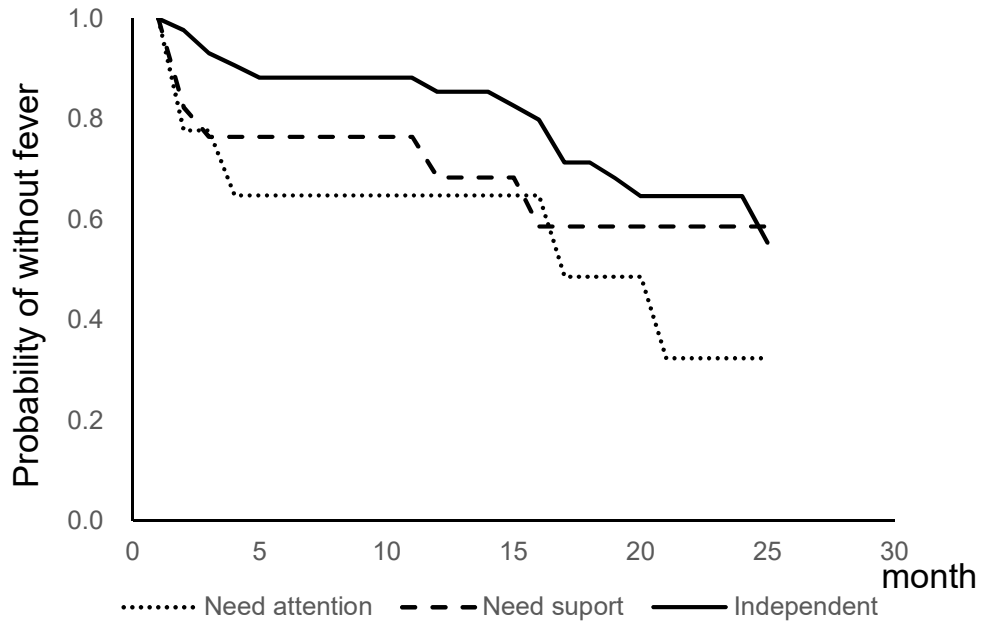
(A)

(B)

Fever

Hospitalization for pneumonia

S4 Figure

S5 Figure