Model selection - forward (single)

The LOGISTIC Procedure

Model Information

Data Set   WORK.TIMESINCEVAX
Response Variable   breakthrough   breakthrough
Number of Response Levels   2
Model   binary logit
Optimization Technique   Fisher's scoring

Number of Observations Read   3084648
Number of Observations Used   3084648

Response Profile

Ordered Value	breakthrough	Total Frequency
1	1	29677
2	0	3054971

Probability modeled is breakthrough=1.

Forward Selection Procedure

Class Level Information

Class	Value	Design Variables	
gender_code	F	1	0
	M	0	1
	U	0	0
vaccination_code	Janssen	1	0

```
                        Moderna        O        1
                        Pfizer         O        O


        The following effects will be included in each model:

 Intercept   gender_code   vaccination_code   followup_time   time_since_vax   age   age*age


            Step   O. The INCLUDE effects were entered.



                        Model Convergence Status

        Convergence criterion (GCONV=1E-8) satisfied.
```

Model selection - forward (single)

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Model Fit Statistics

		Intercept
	Intercept	and
Criterion	Only	Covariates
AIC	334698.88	9549.493
SC	334711.82	9665.971
-2 Log L	334696.88	9531.493

Testing Global Null Hypothesis: BETA=0

Test	Chi-Square	DF	Pr > ChiSq
Likelihood Ratio	325165.390	8	<.0001
Score	1679665.60	8	<.0001
Wald	3214.6038	8	<.0001

Residual Chi-Square Test

Chi-Square	DF	Pr > ChiSq
3970.7904	44	<.0001

Step 1. Effect followup_*time_since entered:

Model Convergence Status

Convergence criterion (GCONV=1E-8) satisfied.

Model Fit Statistics

```
                                  Intercept
                       Intercept        and
         Criterion          Only   Covariates

         AIC            334698.88    6614.048
         SC             334711.82    6743.468
         -2 Log L       334696.88    6594.048



         Testing Global Null Hypothesis: BETA=0

Test                 Chi-Square      DF     Pr > ChiSq

Likelihood Ratio      328102.835      9        <.0001
Score                1685598.38       9        <.0001
Wald                   2356.3173      9        <.0001
```

Model selection - forward (single)

The LOGISTIC Procedure

Residual Chi-Square Test

Chi-Square	DF	Pr > ChiSq
465.7389	43	<.0001

Step 2. Effect time_since_vax*age entered:

Model Convergence Status

Convergence criterion (GCONV=1E-8) satisfied.

Model Fit Statistics

Criterion	Intercept Only	Intercept and Covariates
AIC	334698.88	6571.327
SC	334711.82	6713.689
-2 Log L	334696.88	6549.327

Testing Global Null Hypothesis: BETA=0

Test	Chi-Square	DF	Pr > ChiSq
Likelihood Ratio	328147.556	10	<.0001
Score	1686062.27	10	<.0001
Wald	2416.5478	10	<.0001

Residual Chi-Square Test

```
        Chi-Square      DF      Pr > ChiSq

         398.2946        42         <.0001


Step  3. Effect time_sinc*vaccinatio entered:


                Model Convergence Status

Convergence criterion (GCONV=1E-8) satisfied.


                Model Fit Statistics

                                         Intercept
                          Intercept            and
         Criterion             Only      Covariates

         AIC             334698.88        6542.714
         SC              334711.82        6710.959
         -2 Log L        334696.88        6516.714
```

Model selection - forward (single)

The LOGISTIC Procedure

Testing Global Null Hypothesis: BETA=0

Test	Chi-Square	DF	Pr > ChiSq
Likelihood Ratio	328180.169	12	<.0001
Score	1686237.92	12	<.0001
Wald	2355.3548	12	<.0001

Residual Chi-Square Test

Chi-Square	DF	Pr > ChiSq
249.4421	40	<.0001

Step 4. Effect followup_*vaccinatio entered:

Model Convergence Status

Convergence criterion (GCONV=1E-8) satisfied.

Model Fit Statistics

Criterion	Intercept Only	Intercept and Covariates
AIC	334698.88	6497.973
SC	334711.82	6692.103
-2 Log L	334696.88	6467.973

Testing Global Null Hypothesis: BETA=0

```
Test               Chi-Square      DF      Pr > ChiSq

Likelihood Ratio    328228.910     14        <.0001
Score              1687463.19      14        <.0001
Wald                 2616.9296     14        <.0001


              Residual Chi-Square Test


        Chi-Square      DF      Pr > ChiSq


        193.1954        38        <.0001



  Step  5. Effect follow*time_s*vaccin entered:



              Model Convergence Status

  Convergence criterion (GCONV=1E-8) satisfied.
```

Model selection - forward (single)

The LOGISTIC Procedure

Model Fit Statistics

Criterion	Intercept Only	Intercept and Covariates
AIC	334698.88	6460.731
SC	334711.82	6680.744
-2 Log L	334696.88	6426.731

Testing Global Null Hypothesis: BETA=0

Test	Chi-Square	DF	Pr > ChiSq
Likelihood Ratio	328270.152	16	<.0001
Score	1688017.59	16	<.0001
Wald	2525.1544	16	<.0001

Residual Chi-Square Test

Chi-Square	DF	Pr > ChiSq
151.0892	36	<.0001

NOTE: No (additional) effects met the 0.0001 significance level for entry into the model.

Summary of Forward Selection

Step	Effect Entered	DF	Number In	Score Chi-Square	Pr > ChiSq	Variable Label
1	followup_*time_since	1	7	3467.8628	<.0001	
2	time_since_vax*age	1	8	52.3980	<.0001	

3	time_sinc*vaccinatio	2	9	38.1245	<.0001
4	followup_*vaccinatio	2	10	50.1770	<.0001
5	follow*time_s*vaccin	2	11	37.0781	<.0001

Joint Tests

Effect	DF	Wald Chi-Square	Pr > ChiSq
gender_code	2	5.8906	0.0526
vaccination_code	2	38.5012	<.0001
followup_time	1	1443.9560	<.0001
time_since_vax	1	1462.9245	<.0001
age	1	49.4451	<.0001
age*age	1	14.0620	0.0002
followup_*vaccinatio	2	9.0920	0.0106
time_sinc*vaccinatio	2	10.3344	0.0057
followup_*time_since	1	398.5053	<.0001
follow*time_s*vaccin	2	34.8436	<.0001
time_since_vax*age	1	48.5389	<.0001

NOTE: Under full-rank parameterizations, Type 3 effect tests are replaced by joint tests. The joint test for

Model selection - forward (single)

The LOGISTIC Procedure

an effect is a test that all the parameters associated with that effect are zero. Such joint tests
might not be equivalent to Type 3 effect tests under GLM parameterization.

Analysis of Maximum Likelihood Estimates

Parameter		DF	Estimate	Standard Error	Wald Chi-Square	Pr > ChiSq
Intercept		1	-22.3296	1.3870	259.1721	<.0001
gender_code	F	1	-0.5998	0.5710	1.1034	0.2935
gender_code	M	1	-0.8203	0.5742	2.0410	0.1531
vaccination_code	Janssen	1	3.3775	1.6418	4.2322	0.0397
vaccination_code	Moderna	1	-14.6169	2.8347	26.5879	<.0001
followup_time		1	-6.2478	0.1644	1443.9560	<.0001
time_since_vax		1	197.9	5.1730	1462.9245	<.0001
age		1	0.1288	0.0183	49.4451	<.0001
age*age		1	-0.00063	0.000168	14.0620	0.0002
followup_*vaccinatio	Janssen	1	-1.3935	0.5958	5.4706	0.0193
followup_*vaccinatio	Moderna	1	-0.7189	0.3259	4.8653	0.0274
time_sinc*vaccinatio	Janssen	1	40.9238	18.6750	4.8021	0.0284
time_sinc*vaccinatio	Moderna	1	27.8487	10.6208	6.8754	0.0087
followup_*time_since		1	-0.0291	0.00146	398.5053	<.0001
follow*time_s*vaccin	Janssen	1	0.00651	0.00302	4.6530	0.0310
follow*time_s*vaccin	Moderna	1	-0.0190	0.00379	25.0522	<.0001
time_since_vax*age		1	-0.0135	0.00193	48.5389	<.0001

Odds Ratio Estimates

Effect	Point Estimate	95% Wald Confidence Limits	
gender_code F vs U	0.549	0.179	1.681
gender_code M vs U	0.440	0.143	1.357

```
            Association of Predicted Probabilities and Observed Responses

    Percent Concordant            99.7      Somers' D     0.994
    Percent Discordant             0.3      Gamma         0.994
    Percent Tied                   0.0      Tau-a         0.019
    Pairs                   90662374367     c             0.997
```