Análisis de supervivencia

Gómez Rodríguez Angel Giovanni

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Introducción.

El análisis de supervivencia corresponde a un conjunto de enfoques estadísticos utilizados para investigar el tiempo que tarda en ocurrir un evento de interés.

El análisis de supervivencia se utiliza en una variedad de campos, uno de ellos son estudios de cáncer para análisis de tiempo de supervivencia de pacientes.

En los estudios sobre el cáncer, las preguntas de investigación típicas son las siguientes:

- ¿Cuál es el impacto de ciertas características clínicas en la supervivencia del paciente?
- ¿Cuál es la probabilidad de que un individuo sobreviva ciertos años?
- ¿Existen diferencias en la supervivencia entre grupos de paciente?

Algunas de esas preguntas se verán a continuación.

1. Elija una base de datos para hacer un análisis de supervivencia.

Para efectos de este proyecto, se seleccionó el conjunto de datos *colon* del paquete *Survival*.

2. Características de la base de datos.

Análisis descriptivo del tiempo de supervivencia de los sujetos.

Lo siguiente es un extracto de la base de datos seleccionada.

id	study	rx	sex	age	obstruct	perfor	adhere
778	1	Lev+5FU	0	32	0	0	0
584	1	Lev+5FU	1	55	1	0	0
743	1	Lev	1	59	1	0	0
666	1	Obs	1	66	1	0	0
110	1	Lev+5FU	0	52	0	0	0
110	1	Lev+5FU	0	52	0	0	0
689	1	Lev	1	72	1	0	0
689	1	Lev	1	72	1	0	0
334	1	Lev	1	74	0	0	0
584	1	Lev+5FU	1	55	1	0	0
809	1	Lev	1	73	1	0	0
245	1	Obs	0	60	1	0	1
726	1	Lev	0	56	0	0	0
482	1	Lev+5FU	0	58	1	0	0
37	1	Obs	1	79	0	0	0

nodes	status	differ	extent	surg	node4	time	etype
14	1	3	2	0	1	8	1
5	1	3	3	0	1	9	1
2	1	2	3	1	0	19	1
4	1	2	3	0	0	20	1
3	1	3	3	1	0	23	2
3	0	3	3	1	0	23	1
4	1	3	3	1	0	24	2
4	0	3	3	1	0	24	1
4	1	2	3	0	0	28	1
5	1	3	3	0	1	34	2
7	1	2	3	1	1	35	1
4	1	3	3	0	0	36	1
8	1	1	3	0	1	38	1
5	1	3	3	0	1	40	1
19	1	2	3	0	1	43	1

Estos son datos de uno de los primeros ensayos exitosos de quimioterapia adyuvante (es decir, que se administra de manera complementaria después del tratamiento principal) para tratar el cáncer de colon.

Como ya se explicó anteriormente, el levamisol es un compuesto de baja toxicidad utilizado anteriormente para tratar infestaciones de gusanos en animales; Por otro lado, el 5-FU es un agente de quimioterapia moderadamente tóxico (como sucede con este tipo de terapias).

Número de observaciones.

```
## [1] 1858
```

En total son 1858 observaciones, es decir, hay 1858 pacientes registrados en la base *colon*.

Datos faltantes

```
## [1] 82
```

Se puede apreciar que si existen NA, por tanto la base *colon* si tiene algunos datos faltantes. Veremos si esto no afecta en los siguientes pasos.

Variables involucradas.

La base de datos *colon* tiene 16 columnas, cada una con una variable distinta:

- La variable *id*, la cual denota la identificación del paciente
- La variable *study*, que denota que el paciente está dentro del estudio. En todos los pacientes se cumple que $study = 1$
- La variable *rx* denota la prescripción o el tratamiento establecido para cada paciente. En donde:
  - *Obs* indica que el paciente está en observación. Después se denotará la variable por un 0.
  - *Lev* indica que al paciente se le administra levamisol. Posteriormente, se denotará esta variable por un 1.
  - $Lev + 5FU$ indica que al paciente se le administra levamisol + 5FU. Esta variable después se denotará por un 2.
- La variable *sex* indica el sexo del paciente.
  - El sexo femenino se denota por el 0.
  - El sexo masculino se denota por el 1.
- La variable *age* denota los años de cada paciente.
- La variable *obstruct* indica si existe una obstrucción del colon por tumor:
  - Si no hay obstrucción, se denota por un 0.
  - Si existe obstrucción, se denota por el 1.
- La variable $perfor$ indica si hay perforación de colon en el paciente:
  - Si no existe perforación, se denota por un 0.
  - Si hay perforación de colon, se denota por el 1.
- La variable *adhere* indica si el cáncer de colon pudo adherirse a órganos cercanos.
  - Si no existe adherencia, se denota por 0.
  - Si hay adherencia a órganos cercanos, se denota por 1.

- La variable *nodes* indica el número de ganglios linfáticos, que son parte del sistema inmunológico que tienen un cáncer detectable.
- La variable *time* indica los días hasta un fallo o censura.
- La variable *status* indica el estado del paciente. En este caso se denota por:
  - Si el paciente está vivo se denota por un 0.
  - Si el paciente muere, se denota por el 1.
- La variable $differ$ denota el grado del tumor:
  - El 1 denota un tumor benigno.
  - El 2 denota un tumor moderado.
  - El 3 denota un tumor maligno.
- La variable *extent* denota la extensión de la diseminación local, es decir se hacen metástasis, cuando las células cancerosas se desprenden del tumor original y viajan por el torrente sanguíneo o por el sistema linfático a otras partes del organismo:
  - El 1 indica que afecta a la submucosa.
  - El 2 indica que el músculo ha sido afectado.
  - El 3 indica que el tumor afectó la serosa, que es la capa más externa del tubo digestivo.
  - El 4 indica que el tumor afectó estructuras contiguas, es decir otros órganos.
- La variable *surg* indica el tiempo desde la cirugía de colon hasta el registro:
  - El número 0 es si ha transcurrido un tiempo corto.
  - El 1 se ocupa para denotar que ha transcurrido un tiempo largo.
- La variable *node*4 indica si existen más de 4 ganglios linfáticos positivos.
- La variable *etype* indica el tipo de evento que pasa:
  - Si hay recurrencia se denota por el 1.
  - Si el paciente muere, se denota por el 2.

Algunas características de las variables involucradas.

```
##    Min. 1st Qu.  Median    Mean 3rd Qu.    Max.
##   18.00   53.00   61.00   59.75   69.00   85.00
```

En este caso se puede apreciar que los pacientes incluidos en la BD tienen un rango de edad al momento del estudio de cáncer que va desde los 18 hasta los 85 años. Finalmente, en promedio de edad de pacientes con cáncer es de 59-60 años.

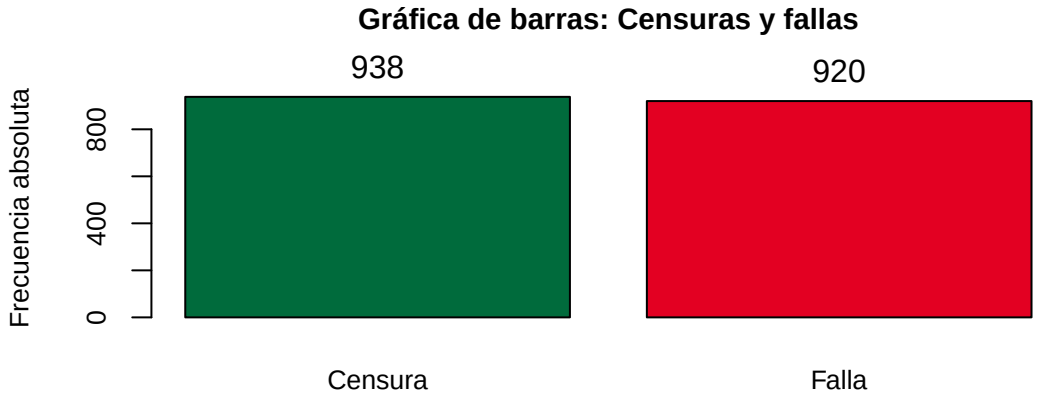
```
##    Min. 1st Qu.  Median    Mean 3rd Qu.    Max.    NA's
##    0.00    1.00    2.00    3.66    5.00   33.00      36
```

Se muestra que existen 36 pacientes que no tienen registro de datos de ganglios linfáticos afectados. Además se registra que el número máximo de nodos afectados es de 33. Para finalizar, el promedio de ganglios afectados es de entre 3 y 4.

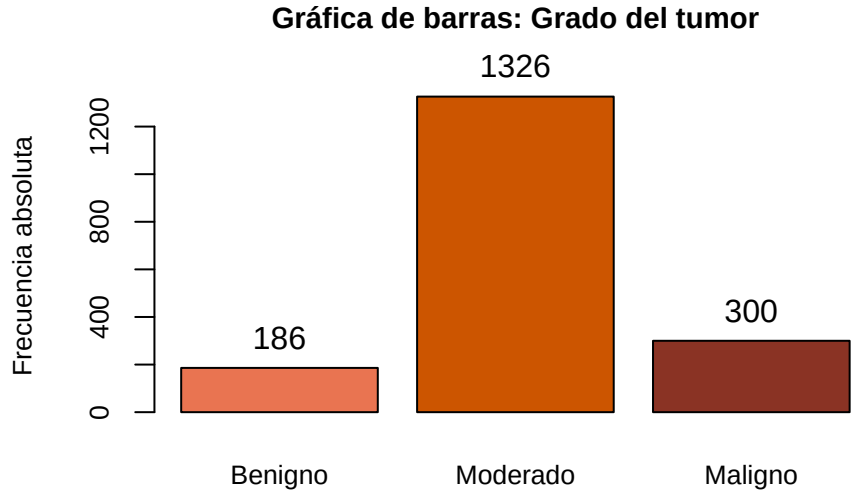
```
##    Min. 1st Qu.  Median    Mean 3rd Qu.    Max.
##       8     566    1855    1538    2331    3329
```

El mínimo de días que tienen los pacientes para fallo o censura tras el estudio es de 8 días, mientras que el máximo de días desde el estudio hasta una falla o censura es de 3339 días. En promedio se registran 1538 días desde el estudio hasta el fallo o censura en los pacientes.

Censuras y fallas.



Grado del tumor.



Obtenga la estimación de Kaplan-Meier y grafique.

A continuación, se muestra un breve resumen de las curvas de supervivencia y se imprime el número de observaciones, el número de eventos, la mediana de supervivencia y los intervalos de confianza para la mediana.

```
## Call: survfit(formula = survObject ~ 1, type = "kaplan-meier", conf.type = "plain",
##     conf.int = 0.95)
##
##         n events median 0.95LCL 0.95UCL
## [1,] 1858    920   2351    2012    2910
```

Para el cálculo de la función de supervivencia $S(t)$ la información se encuentra en el apartado *survival*, además se muestra un resumen de las curvas de supervivencia

```
## Call: survfit(formula = survObject ~ 1, type = "kaplan-meier", conf.type = "plain",
##     conf.int = 0.95)
##
##  time n.risk n.event survival  std.err lower 95% CI upper 95% CI
##     8   1858       1    0.999 0.000538        0.998        1.000
##     9   1857       1    0.999 0.000761        0.997        1.000
##    19   1856       1    0.998 0.000931        0.997        1.000
##    20   1855       1    0.998 0.001075        0.996        1.000
##    23   1854       1    0.997 0.001202        0.995        1.000
##    24   1852       1    0.997 0.001316        0.994        0.999
##    28   1850       1    0.996 0.001422        0.993        0.999
##    34   1849       1    0.996 0.001520        0.993        0.999
##    35   1848       1    0.995 0.001611        0.992        0.998
##    36   1847       1    0.995 0.001698        0.991        0.998
##    38   1846       1    0.994 0.001781        0.991        0.998
##    40   1845       1    0.994 0.001859        0.990        0.997
##    43   1844       1    0.993 0.001935        0.989        0.997
##    45   1843       2    0.992 0.002077        0.988        0.996
##    49   1840       1    0.991 0.002145        0.987        0.996
##    52   1839       1    0.991 0.002211        0.987        0.995
##    56   1838       1    0.990 0.002274        0.986        0.995
##    59   1836       1    0.990 0.002336        0.985        0.994
##    62   1835       2    0.989 0.002455        0.984        0.993
##    63   1833       1    0.988 0.002512        0.983        0.993
##    68   1832       1    0.988 0.002568        0.983        0.993
##    72   1831       2    0.987 0.002676        0.981        0.992
##    77   1829       2    0.985 0.002780        0.980        0.991
##    78   1827       1    0.985 0.002830        0.979        0.990
##    79   1826       2    0.984 0.002928        0.978        0.990
##    80   1824       3    0.982 0.003069        0.976        0.988
##    85   1821       2    0.981 0.003159        0.975        0.987
##    86   1819       2    0.980 0.003246        0.974        0.986
##    88   1817       1    0.980 0.003289        0.973        0.986
##    91   1816       2    0.978 0.003372        0.972        0.985
##    93   1814       1    0.978 0.003413        0.971        0.985
##    94   1813       1    0.977 0.003454        0.971        0.984
##    98   1812       3    0.976 0.003572        0.969        0.983
##    99   1809       2    0.975 0.003649        0.968        0.982
```

```
##   100   1807       1    0.974 0.003686        0.967        0.981
##   101   1806       2    0.973 0.003760        0.966        0.980
##   102   1804       1    0.973 0.003797        0.965        0.980
##   103   1803       1    0.972 0.003833        0.964        0.979
##   105   1802       1    0.971 0.003869        0.964        0.979
##   106   1801       1    0.971 0.003904        0.963        0.979
##   108   1800       1    0.970 0.003939        0.963        0.978
##   109   1799       1    0.970 0.003973        0.962        0.978
##   111   1798       1    0.969 0.004008        0.961        0.977
##   113   1797       4    0.967 0.004141        0.959        0.975
##   116   1793       3    0.965 0.004238        0.957        0.974
##   118   1790       1    0.965 0.004270        0.957        0.973
##   119   1789       1    0.964 0.004302        0.956        0.973
##   121   1788       2    0.963 0.004364        0.955        0.972
##   122   1786       2    0.962 0.004425        0.954        0.971
##   125   1784       1    0.962 0.004456        0.953        0.970
##   127   1783       2    0.961 0.004515        0.952        0.969
##   129   1781       1    0.960 0.004545        0.951        0.969
##   131   1780       1    0.960 0.004574        0.951        0.969
##   132   1779       1    0.959 0.004603        0.950        0.968
##   133   1778       1    0.958 0.004632        0.949        0.968
##   134   1777       1    0.958 0.004661        0.949        0.967
##   136   1776       1    0.957 0.004690        0.948        0.967
##   138   1775       1    0.957 0.004718        0.948        0.966
##   139   1774       1    0.956 0.004746        0.947        0.966
##   141   1773       2    0.955 0.004801        0.946        0.965
##   143   1771       1    0.955 0.004829        0.945        0.964
##   144   1770       1    0.954 0.004856        0.945        0.964
##   145   1769       2    0.953 0.004910        0.943        0.963
##   146   1767       2    0.952 0.004964        0.942        0.962
##   147   1765       1    0.951 0.004990        0.942        0.961
##   150   1764       1    0.951 0.005016        0.941        0.961
##   154   1763       2    0.950 0.005068        0.940        0.960
##   157   1761       3    0.948 0.005145        0.938        0.958
##   160   1758       1    0.948 0.005170        0.938        0.958
##   161   1757       2    0.947 0.005220        0.936        0.957
##   164   1755       1    0.946 0.005245        0.936        0.956
##   165   1754       4    0.944 0.005343        0.933        0.954
##   166   1750       2    0.943 0.005391        0.932        0.953
##   167   1748       1    0.942 0.005415        0.932        0.953
##   168   1747       1    0.942 0.005439        0.931        0.952
##   169   1746       1    0.941 0.005462        0.931        0.952
##   171   1745       2    0.940 0.005509        0.929        0.951
##   173   1743       3    0.939 0.005578        0.928        0.949
##   174   1740       3    0.937 0.005646        0.926        0.948
##   175   1737       1    0.936 0.005669        0.925        0.947
##   176   1736       2    0.935 0.005713        0.924        0.946
##   179   1734       1    0.935 0.005735        0.924        0.946
##   181   1733       1    0.934 0.005757        0.923        0.945
##   183   1732       2    0.933 0.005801        0.922        0.944
##   185   1730       5    0.930 0.005908        0.919        0.942
##   186   1725       2    0.929 0.005950        0.918        0.941
##   187   1723       1    0.929 0.005971        0.917        0.941
##   188   1722       1    0.928 0.005992        0.917        0.940
```

```
##   189   1721       2    0.927 0.006034        0.915        0.939
##   191   1719       3    0.926 0.006095        0.914        0.938
##   196   1716       1    0.925 0.006115        0.913        0.937
##   198   1715       1    0.924 0.006135        0.912        0.937
##   199   1714       1    0.924 0.006155        0.912        0.936
##   201   1713       2    0.923 0.006195        0.911        0.935
##   203   1711       1    0.922 0.006215        0.910        0.935
##   204   1710       1    0.922 0.006235        0.910        0.934
##   205   1709       1    0.921 0.006255        0.909        0.934
##   206   1708       1    0.921 0.006274        0.908        0.933
##   208   1707       3    0.919 0.006332        0.907        0.932
##   215   1704       3    0.917 0.006390        0.905        0.930
##   216   1701       1    0.917 0.006409        0.904        0.930
##   218   1700       4    0.915 0.006484        0.902        0.927
##   219   1696       3    0.913 0.006539        0.900        0.926
##   221   1692       1    0.913 0.006558        0.900        0.925
##   222   1691       1    0.912 0.006576        0.899        0.925
##   223   1690       1    0.912 0.006594        0.899        0.924
##   224   1689       1    0.911 0.006612        0.898        0.924
##   226   1688       1    0.910 0.006630        0.897        0.923
##   227   1687       1    0.910 0.006648        0.897        0.923
##   228   1686       1    0.909 0.006666        0.896        0.922
##   229   1685       2    0.908 0.006702        0.895        0.921
##   230   1683       5    0.906 0.006790        0.892        0.919
##   232   1678       1    0.905 0.006807        0.892        0.918
##   235   1677       1    0.905 0.006824        0.891        0.918
##   237   1676       2    0.903 0.006859        0.890        0.917
##   238   1674       3    0.902 0.006910        0.888        0.915
##   241   1671       1    0.901 0.006927        0.888        0.915
##   242   1670       2    0.900 0.006960        0.887        0.914
##   243   1668       1    0.900 0.006977        0.886        0.913
##   245   1667       2    0.899 0.007010        0.885        0.912
##   246   1665       1    0.898 0.007027        0.884        0.912
##   248   1664       1    0.898 0.007043        0.884        0.911
##   250   1663       1    0.897 0.007060        0.883        0.911
##   251   1662       1    0.896 0.007076        0.883        0.910
##   252   1661       1    0.896 0.007092        0.882        0.910
##   253   1660       2    0.895 0.007125        0.881        0.909
##   255   1658       1    0.894 0.007141        0.880        0.908
##   256   1657       2    0.893 0.007173        0.879        0.907
##   257   1655       2    0.892 0.007205        0.878        0.906
##   258   1653       1    0.892 0.007221        0.877        0.906
##   259   1652       2    0.891 0.007252        0.876        0.905
##   260   1650       2    0.889 0.007283        0.875        0.904
##   261   1648       1    0.889 0.007299        0.875        0.903
##   262   1647       1    0.888 0.007314        0.874        0.903
##   263   1646       2    0.887 0.007345        0.873        0.902
##   264   1644       2    0.886 0.007376        0.872        0.901
##   269   1642       1    0.886 0.007391        0.871        0.900
##   271   1641       3    0.884 0.007437        0.869        0.899
##   273   1638       1    0.883 0.007452        0.869        0.898
##   274   1637       2    0.882 0.007481        0.868        0.897
##   275   1635       1    0.882 0.007496        0.867        0.897
##   276   1634       3    0.880 0.007541        0.865        0.895
```

```
##   279   1631       4    0.878 0.007599        0.863        0.893
##   280   1627       1    0.878 0.007613        0.863        0.892
##   283   1626       2    0.876 0.007642        0.861        0.891
##   285   1624       1    0.876 0.007657        0.861        0.891
##   286   1623       3    0.874 0.007699        0.859        0.889
##   289   1620       1    0.874 0.007713        0.859        0.889
##   290   1619       2    0.873 0.007742        0.858        0.888
##   291   1617       1    0.872 0.007756        0.857        0.887
##   293   1616       1    0.872 0.007769        0.856        0.887
##   294   1615       2    0.871 0.007797        0.855        0.886
##   296   1613       2    0.869 0.007825        0.854        0.885
##   300   1611       1    0.869 0.007839        0.854        0.884
##   302   1610       1    0.868 0.007852        0.853        0.884
##   303   1609       1    0.868 0.007866        0.852        0.883
##   304   1608       2    0.867 0.007893        0.851        0.882
##   308   1606       1    0.866 0.007907        0.851        0.882
##   311   1605       1    0.866 0.007920        0.850        0.881
##   313   1604       2    0.865 0.007947        0.849        0.880
##   314   1602       2    0.864 0.007974        0.848        0.879
##   315   1600       2    0.862 0.008000        0.847        0.878
##   316   1598       1    0.862 0.008013        0.846        0.878
##   322   1597       3    0.860 0.008052        0.844        0.876
##   323   1594       1    0.860 0.008066        0.844        0.876
##   324   1593       1    0.859 0.008078        0.843        0.875
##   325   1592       1    0.859 0.008091        0.843        0.875
##   326   1591       1    0.858 0.008104        0.842        0.874
##   328   1589       1    0.858 0.008117        0.842        0.873
##   329   1588       1    0.857 0.008130        0.841        0.873
##   330   1587       2    0.856 0.008156        0.840        0.872
##   331   1585       1    0.855 0.008168        0.839        0.871
##   333   1584       1    0.855 0.008181        0.839        0.871
##   334   1583       1    0.854 0.008194        0.838        0.870
##   335   1582       1    0.854 0.008206        0.838        0.870
##   336   1581       2    0.853 0.008231        0.837        0.869
##   337   1579       3    0.851 0.008269        0.835        0.867
##   340   1576       1    0.851 0.008281        0.834        0.867
##   341   1574       1    0.850 0.008293        0.834        0.866
##   342   1573       1    0.849 0.008306        0.833        0.866
##   343   1572       1    0.849 0.008318        0.833        0.865
##   344   1571       1    0.848 0.008330        0.832        0.865
##   348   1570       2    0.847 0.008355        0.831        0.864
##   349   1568       2    0.846 0.008379        0.830        0.863
##   352   1566       2    0.845 0.008403        0.829        0.862
##   354   1564       1    0.845 0.008415        0.828        0.861
##   355   1563       2    0.844 0.008439        0.827        0.860
##   356   1560       3    0.842 0.008474        0.825        0.859
##   360   1557       2    0.841 0.008498        0.824        0.857
##   362   1555       2    0.840 0.008521        0.823        0.856
##   363   1553       1    0.839 0.008533        0.822        0.856
##   365   1552       2    0.838 0.008556        0.821        0.855
##   366   1550       2    0.837 0.008579        0.820        0.854
##   369   1548       1    0.837 0.008591        0.820        0.853
##   370   1547       1    0.836 0.008602        0.819        0.853
##   372   1546       2    0.835 0.008625        0.818        0.852
```

```
##   374   1544       1    0.834 0.008636        0.817        0.851
##   376   1543       1    0.834 0.008648        0.817        0.851
##   378   1542       1    0.833 0.008659        0.816        0.850
##   379   1541       1    0.833 0.008670        0.816        0.850
##   380   1540       2    0.832 0.008692        0.815        0.849
##   381   1538       1    0.831 0.008704        0.814        0.848
##   382   1537       2    0.830 0.008726        0.813        0.847
##   384   1535       3    0.828 0.008759        0.811        0.846
##   386   1532       2    0.827 0.008781        0.810        0.845
##   389   1530       2    0.826 0.008803        0.809        0.843
##   390   1528       1    0.826 0.008813        0.808        0.843
##   392   1527       1    0.825 0.008824        0.808        0.842
##   393   1526       1    0.825 0.008835        0.807        0.842
##   398   1525       1    0.824 0.008846        0.807        0.841
##   400   1524       1    0.824 0.008856        0.806        0.841
##   401   1523       1    0.823 0.008867        0.806        0.840
##   402   1522       2    0.822 0.008888        0.804        0.839
##   405   1520       1    0.821 0.008899        0.804        0.839
##   406   1519       2    0.820 0.008920        0.803        0.838
##   408   1517       1    0.820 0.008930        0.802        0.837
##   409   1516       1    0.819 0.008941        0.802        0.837
##   411   1515       2    0.818 0.008962        0.801        0.836
##   413   1513       3    0.817 0.008993        0.799        0.834
##   415   1510       2    0.815 0.009013        0.798        0.833
##   417   1508       1    0.815 0.009024        0.797        0.833
##   420   1507       1    0.814 0.009034        0.797        0.832
##   421   1506       1    0.814 0.009044        0.796        0.832
##   422   1504       2    0.813 0.009064        0.795        0.830
##   428   1502       1    0.812 0.009074        0.794        0.830
##   429   1501       1    0.812 0.009084        0.794        0.829
##   430   1500       2    0.811 0.009104        0.793        0.828
##   431   1498       1    0.810 0.009114        0.792        0.828
##   433   1497       2    0.809 0.009134        0.791        0.827
##   434   1495       1    0.808 0.009144        0.790        0.826
##   435   1494       1    0.808 0.009154        0.790        0.826
##   437   1493       2    0.807 0.009174        0.789        0.825
##   438   1491       3    0.805 0.009203        0.787        0.823
##   439   1488       2    0.804 0.009222        0.786        0.822
##   440   1486       1    0.804 0.009232        0.785        0.822
##   441   1485       1    0.803 0.009242        0.785        0.821
##   443   1484       2    0.802 0.009261        0.784        0.820
##   444   1482       1    0.801 0.009270        0.783        0.820
##   448   1481       2    0.800 0.009289        0.782        0.818
##   449   1479       1    0.800 0.009299        0.782        0.818
##   454   1476       3    0.798 0.009327        0.780        0.816
##   458   1473       2    0.797 0.009346        0.779        0.815
##   459   1471       1    0.796 0.009355        0.778        0.815
##   460   1470       1    0.796 0.009365        0.778        0.814
##   461   1469       1    0.795 0.009374        0.777        0.814
##   462   1468       1    0.795 0.009383        0.776        0.813
##   464   1467       1    0.794 0.009392        0.776        0.813
##   465   1466       3    0.793 0.009420        0.774        0.811
##   466   1463       2    0.792 0.009438        0.773        0.810
##   469   1461       1    0.791 0.009447        0.773        0.810
```

```
##   472   1460       1    0.791 0.009456        0.772        0.809
##   474   1459       2    0.789 0.009474        0.771        0.808
##   475   1457       1    0.789 0.009483        0.770        0.807
##   476   1456       1    0.788 0.009492        0.770        0.807
##   480   1455       1    0.788 0.009501        0.769        0.806
##   482   1454       1    0.787 0.009510        0.769        0.806
##   484   1453       1    0.787 0.009519        0.768        0.805
##   485   1452       2    0.786 0.009537        0.767        0.804
##   486   1449       1    0.785 0.009546        0.766        0.804
##   489   1447       1    0.785 0.009554        0.766        0.803
##   490   1446       2    0.783 0.009572        0.765        0.802
##   491   1444       2    0.782 0.009589        0.764        0.801
##   493   1442       1    0.782 0.009598        0.763        0.801
##   495   1441       1    0.781 0.009607        0.762        0.800
##   496   1440       1    0.781 0.009615        0.762        0.800
##   497   1439       1    0.780 0.009624        0.761        0.799
##   498   1438       2    0.779 0.009641        0.760        0.798
##   499   1436       4    0.777 0.009675        0.758        0.796
##   503   1432       1    0.776 0.009684        0.757        0.795
##   504   1431       1    0.776 0.009692        0.757        0.795
##   505   1430       1    0.775 0.009700        0.756        0.794
##   506   1429       1    0.775 0.009709        0.756        0.794
##   510   1428       2    0.774 0.009725        0.755        0.793
##   511   1426       1    0.773 0.009734        0.754        0.792
##   512   1425       1    0.773 0.009742        0.754        0.792
##   513   1424       1    0.772 0.009750        0.753        0.791
##   522   1423       1    0.772 0.009759        0.752        0.791
##   523   1422       1    0.771 0.009767        0.752        0.790
##   525   1421       1    0.770 0.009775        0.751        0.790
##   526   1420       1    0.770 0.009783        0.751        0.789
##   527   1419       1    0.769 0.009791        0.750        0.789
##   528   1418       1    0.769 0.009799        0.750        0.788
##   529   1417       1    0.768 0.009807        0.749        0.788
##   532   1416       2    0.767 0.009824        0.748        0.786
##   534   1414       1    0.767 0.009832        0.747        0.786
##   536   1413       1    0.766 0.009840        0.747        0.785
##   537   1412       1    0.766 0.009848        0.746        0.785
##   540   1411       1    0.765 0.009855        0.746        0.784
##   542   1410       1    0.764 0.009863        0.745        0.784
##   543   1409       2    0.763 0.009879        0.744        0.783
##   546   1407       1    0.763 0.009887        0.743        0.782
##   547   1406       1    0.762 0.009895        0.743        0.782
##   548   1405       1    0.762 0.009903        0.742        0.781
##   550   1404       1    0.761 0.009911        0.742        0.781
##   553   1403       1    0.761 0.009918        0.741        0.780
##   554   1402       2    0.760 0.009934        0.740        0.779
##   555   1400       1    0.759 0.009942        0.740        0.779
##   559   1399       1    0.759 0.009949        0.739        0.778
##   560   1398       1    0.758 0.009957        0.738        0.777
##   561   1397       1    0.757 0.009965        0.738        0.777
##   563   1396       2    0.756 0.009980        0.737        0.776
##   565   1394       1    0.756 0.009987        0.736        0.775
##   569   1393       1    0.755 0.009995        0.736        0.775
##   570   1392       1    0.755 0.010002        0.735        0.774
```

```
##   573   1391       3    0.753 0.010025        0.733        0.773
##   576   1388       2    0.752 0.010040        0.732        0.772
##   577   1386       1    0.751 0.010047        0.732        0.771
##   578   1385       3    0.750 0.010069        0.730        0.770
##   580   1382       2    0.749 0.010084        0.729        0.769
##   581   1380       1    0.748 0.010091        0.728        0.768
##   582   1379       1    0.748 0.010098        0.728        0.767
##   583   1378       2    0.747 0.010113        0.727        0.766
##   587   1376       1    0.746 0.010120        0.726        0.766
##   589   1375       1    0.745 0.010127        0.726        0.765
##   591   1374       2    0.744 0.010142        0.725        0.764
##   592   1372       1    0.744 0.010149        0.724        0.764
##   593   1371       3    0.742 0.010170        0.722        0.762
##   594   1368       2    0.741 0.010184        0.721        0.761
##   595   1366       1    0.741 0.010191        0.721        0.761
##   599   1365       2    0.740 0.010205        0.720        0.760
##   601   1362       1    0.739 0.010212        0.719        0.759
##   602   1361       3    0.737 0.010232        0.717        0.757
##   603   1358       1    0.737 0.010239        0.717        0.757
##   604   1357       1    0.736 0.010246        0.716        0.756
##   608   1356       2    0.735 0.010260        0.715        0.755
##   609   1354       1    0.735 0.010267        0.715        0.755
##   612   1353       1    0.734 0.010273        0.714        0.754
##   613   1352       1    0.734 0.010280        0.713        0.754
##   614   1351       1    0.733 0.010287        0.713        0.753
##   615   1350       1    0.732 0.010293        0.712        0.753
##   616   1349       2    0.731 0.010307        0.711        0.752
##   617   1347       1    0.731 0.010313        0.711        0.751
##   622   1346       2    0.730 0.010327        0.710        0.750
##   625   1344       1    0.729 0.010333        0.709        0.749
##   628   1343       1    0.729 0.010340        0.708        0.749
##   629   1341       1    0.728 0.010346        0.708        0.748
##   632   1340       1    0.728 0.010353        0.707        0.748
##   636   1339       1    0.727 0.010359        0.707        0.747
##   638   1338       1    0.726 0.010366        0.706        0.747
##   641   1337       1    0.726 0.010372        0.706        0.746
##   642   1336       2    0.725 0.010385        0.705        0.745
##   643   1334       2    0.724 0.010398        0.703        0.744
##   647   1332       1    0.723 0.010405        0.703        0.744
##   649   1331       1    0.723 0.010411        0.702        0.743
##   653   1330       1    0.722 0.010417        0.702        0.743
##   654   1329       1    0.722 0.010424        0.701        0.742
##   657   1328       1    0.721 0.010430        0.701        0.741
##   659   1327       2    0.720 0.010442        0.700        0.740
##   663   1325       3    0.718 0.010461        0.698        0.739
##   664   1322       1    0.718 0.010467        0.697        0.738
##   665   1321       1    0.717 0.010473        0.697        0.738
##   666   1319       1    0.717 0.010480        0.696        0.737
##   668   1318       1    0.716 0.010486        0.696        0.737
##   669   1317       1    0.716 0.010492        0.695        0.736
##   670   1316       1    0.715 0.010498        0.695        0.736
##   672   1315       1    0.715 0.010504        0.694        0.735
##   673   1314       1    0.714 0.010510        0.693        0.735
##   674   1313       1    0.713 0.010516        0.693        0.734
```

```
##   675   1312       2    0.712 0.010528        0.692        0.733
##   678   1310       1    0.712 0.010534        0.691        0.732
##   680   1309       1    0.711 0.010540        0.691        0.732
##   683   1308       1    0.711 0.010546        0.690        0.731
##   684   1307       1    0.710 0.010552        0.690        0.731
##   685   1306       1    0.710 0.010558        0.689        0.730
##   686   1305       1    0.709 0.010564        0.688        0.730
##   687   1304       1    0.709 0.010570        0.688        0.729
##   692   1303       3    0.707 0.010587        0.686        0.728
##   693   1300       1    0.706 0.010593        0.686        0.727
##   696   1299       1    0.706 0.010599        0.685        0.727
##   697   1298       1    0.705 0.010605        0.685        0.726
##   700   1297       2    0.704 0.010616        0.683        0.725
##   701   1295       1    0.704 0.010622        0.683        0.724
##   702   1294       2    0.703 0.010633        0.682        0.723
##   706   1292       1    0.702 0.010639        0.681        0.723
##   708   1291       1    0.701 0.010645        0.681        0.722
##   709   1290       2    0.700 0.010656        0.680        0.721
##   711   1288       1    0.700 0.010662        0.679        0.721
##   712   1287       2    0.699 0.010673        0.678        0.720
##   716   1285       1    0.698 0.010678        0.677        0.719
##   717   1284       2    0.697 0.010689        0.676        0.718
##   718   1282       1    0.697 0.010695        0.676        0.718
##   720   1281       1    0.696 0.010700        0.675        0.717
##   721   1280       1    0.696 0.010706        0.675        0.716
##   723   1279       1    0.695 0.010711        0.674        0.716
##   726   1278       1    0.694 0.010716        0.673        0.715
##   729   1277       1    0.694 0.010722        0.673        0.715
##   730   1276       2    0.693 0.010733        0.672        0.714
##   731   1274       1    0.692 0.010738        0.671        0.713
##   735   1273       1    0.692 0.010743        0.671        0.713
##   736   1272       1    0.691 0.010749        0.670        0.712
##   739   1271       2    0.690 0.010759        0.669        0.711
##   742   1269       1    0.690 0.010764        0.668        0.711
##   743   1268       2    0.688 0.010775        0.667        0.710
##   748   1266       1    0.688 0.010780        0.667        0.709
##   751   1265       1    0.687 0.010785        0.666        0.708
##   752   1264       1    0.687 0.010790        0.666        0.708
##   753   1263       1    0.686 0.010796        0.665        0.707
##   755   1262       1    0.686 0.010801        0.665        0.707
##   758   1261       1    0.685 0.010806        0.664        0.706
##   759   1260       2    0.684 0.010816        0.663        0.705
##   760   1258       1    0.684 0.010821        0.662        0.705
##   761   1257       1    0.683 0.010826        0.662        0.704
##   764   1256       1    0.682 0.010831        0.661        0.704
##   765   1255       1    0.682 0.010836        0.661        0.703
##   766   1254       1    0.681 0.010841        0.660        0.703
##   770   1253       1    0.681 0.010846        0.660        0.702
##   772   1252       1    0.680 0.010851        0.659        0.702
##   774   1251       2    0.679 0.010861        0.658        0.700
##   775   1249       1    0.679 0.010866        0.657        0.700
##   795   1248       1    0.678 0.010871        0.657        0.699
##   797   1247       2    0.677 0.010880        0.656        0.698
##   802   1245       2    0.676 0.010890        0.655        0.697
```

```
##   803   1243       1    0.675 0.010895        0.654        0.697
##   805   1242       1    0.675 0.010900        0.653        0.696
##   806   1241       2    0.674 0.010909        0.652        0.695
##   811   1239       1    0.673 0.010914        0.652        0.695
##   827   1238       1    0.673 0.010919        0.651        0.694
##   828   1237       1    0.672 0.010923        0.651        0.694
##   832   1236       1    0.672 0.010928        0.650        0.693
##   833   1235       2    0.670 0.010937        0.649        0.692
##   835   1233       1    0.670 0.010942        0.648        0.691
##   840   1232       1    0.669 0.010947        0.648        0.691
##   844   1231       1    0.669 0.010951        0.647        0.690
##   845   1229       1    0.668 0.010956        0.647        0.690
##   846   1227       1    0.668 0.010961        0.646        0.689
##   849   1226       1    0.667 0.010965        0.646        0.689
##   851   1225       1    0.667 0.010970        0.645        0.688
##   853   1224       1    0.666 0.010974        0.645        0.688
##   854   1223       1    0.666 0.010979        0.644        0.687
##   855   1222       1    0.665 0.010983        0.644        0.687
##   858   1221       1    0.664 0.010988        0.643        0.686
##   862   1220       1    0.664 0.010992        0.642        0.685
##   863   1219       1    0.663 0.010997        0.642        0.685
##   871   1218       1    0.663 0.011001        0.641        0.684
##   874   1217       1    0.662 0.011006        0.641        0.684
##   875   1216       1    0.662 0.011010        0.640        0.683
##   883   1215       2    0.661 0.011019        0.639        0.682
##   884   1213       1    0.660 0.011023        0.639        0.682
##   885   1211       1    0.660 0.011028        0.638        0.681
##   887   1210       3    0.658 0.011041        0.636        0.680
##   890   1206       1    0.657 0.011045        0.636        0.679
##   891   1205       1    0.657 0.011049        0.635        0.679
##   900   1204       1    0.656 0.011053        0.635        0.678
##   901   1203       1    0.656 0.011058        0.634        0.677
##   902   1202       1    0.655 0.011062        0.634        0.677
##   904   1201       1    0.655 0.011066        0.633        0.676
##   905   1200       2    0.654 0.011075        0.632        0.675
##   909   1198       1    0.653 0.011079        0.631        0.675
##   911   1197       1    0.653 0.011083        0.631        0.674
##   912   1196       1    0.652 0.011087        0.630        0.674
##   916   1195       1    0.651 0.011091        0.630        0.673
##   918   1194       1    0.651 0.011095        0.629        0.673
##   922   1193       1    0.650 0.011100        0.629        0.672
##   924   1192       1    0.650 0.011104        0.628        0.672
##   928   1191       1    0.649 0.011108        0.627        0.671
##   929   1190       1    0.649 0.011112        0.627        0.670
##   930   1189       1    0.648 0.011116        0.626        0.670
##   931   1188       1    0.648 0.011120        0.626        0.669
##   934   1187       1    0.647 0.011124        0.625        0.669
##   936   1186       2    0.646 0.011132        0.624        0.668
##   938   1184       1    0.645 0.011136        0.624        0.667
##   939   1182       1    0.645 0.011140        0.623        0.667
##   940   1181       1    0.644 0.011144        0.622        0.666
##   942   1180       1    0.644 0.011148        0.622        0.666
##   944   1179       1    0.643 0.011151        0.621        0.665
##   949   1178       1    0.643 0.011155        0.621        0.665
```

```
##   952   1177       1    0.642 0.011159        0.620        0.664
##   957   1176       1    0.642 0.011163        0.620        0.663
##   959   1175       1    0.641 0.011167        0.619        0.663
##   960   1174       1    0.640 0.011171        0.619        0.662
##   961   1173       4    0.638 0.011186        0.616        0.660
##   963   1169       1    0.638 0.011190        0.616        0.660
##   966   1168       1    0.637 0.011193        0.615        0.659
##   968   1167       2    0.636 0.011201        0.614        0.658
##   969   1165       1    0.636 0.011205        0.614        0.658
##   975   1164       1    0.635 0.011208        0.613        0.657
##   976   1163       1    0.634 0.011212        0.613        0.656
##   977   1162       1    0.634 0.011215        0.612        0.656
##   986   1161       1    0.633 0.011219        0.611        0.655
##   993   1160       1    0.633 0.011223        0.611        0.655
##   997   1159       2    0.632 0.011230        0.610        0.654
##  1013   1157       1    0.631 0.011233        0.609        0.653
##  1018   1156       1    0.631 0.011237        0.609        0.653
##  1020   1155       1    0.630 0.011241        0.608        0.652
##  1021   1154       1    0.630 0.011244        0.608        0.652
##  1022   1153       1    0.629 0.011248        0.607        0.651
##  1024   1152       1    0.628 0.011251        0.606        0.651
##  1025   1151       1    0.628 0.011254        0.606        0.650
##  1026   1150       1    0.627 0.011258        0.605        0.649
##  1029   1149       1    0.627 0.011261        0.605        0.649
##  1031   1148       1    0.626 0.011265        0.604        0.648
##  1032   1147       1    0.626 0.011268        0.604        0.648
##  1034   1146       1    0.625 0.011272        0.603        0.647
##  1037   1145       2    0.624 0.011278        0.602        0.646
##  1041   1143       1    0.624 0.011282        0.601        0.646
##  1042   1142       1    0.623 0.011285        0.601        0.645
##  1046   1141       1    0.622 0.011288        0.600        0.645
##  1048   1140       1    0.622 0.011292        0.600        0.644
##  1052   1139       1    0.621 0.011295        0.599        0.644
##  1055   1138       1    0.621 0.011298        0.599        0.643
##  1057   1137       2    0.620 0.011305        0.598        0.642
##  1061   1135       1    0.619 0.011308        0.597        0.641
##  1070   1134       1    0.619 0.011311        0.596        0.641
##  1079   1133       1    0.618 0.011314        0.596        0.640
##  1081   1132       1    0.618 0.011317        0.595        0.640
##  1083   1131       1    0.617 0.011321        0.595        0.639
##  1089   1130       1    0.616 0.011324        0.594        0.639
##  1092   1129       1    0.616 0.011327        0.594        0.638
##  1101   1128       1    0.615 0.011330        0.593        0.638
##  1103   1127       1    0.615 0.011333        0.593        0.637
##  1105   1125       1    0.614 0.011336        0.592        0.637
##  1106   1124       1    0.614 0.011339        0.592        0.636
##  1108   1123       1    0.613 0.011342        0.591        0.635
##  1112   1122       1    0.613 0.011345        0.590        0.635
##  1114   1121       1    0.612 0.011348        0.590        0.634
##  1117   1120       1    0.612 0.011351        0.589        0.634
##  1122   1119       2    0.610 0.011357        0.588        0.633
##  1130   1117       1    0.610 0.011360        0.588        0.632
##  1133   1116       1    0.609 0.011363        0.587        0.632
##  1134   1115       1    0.609 0.011366        0.587        0.631
```

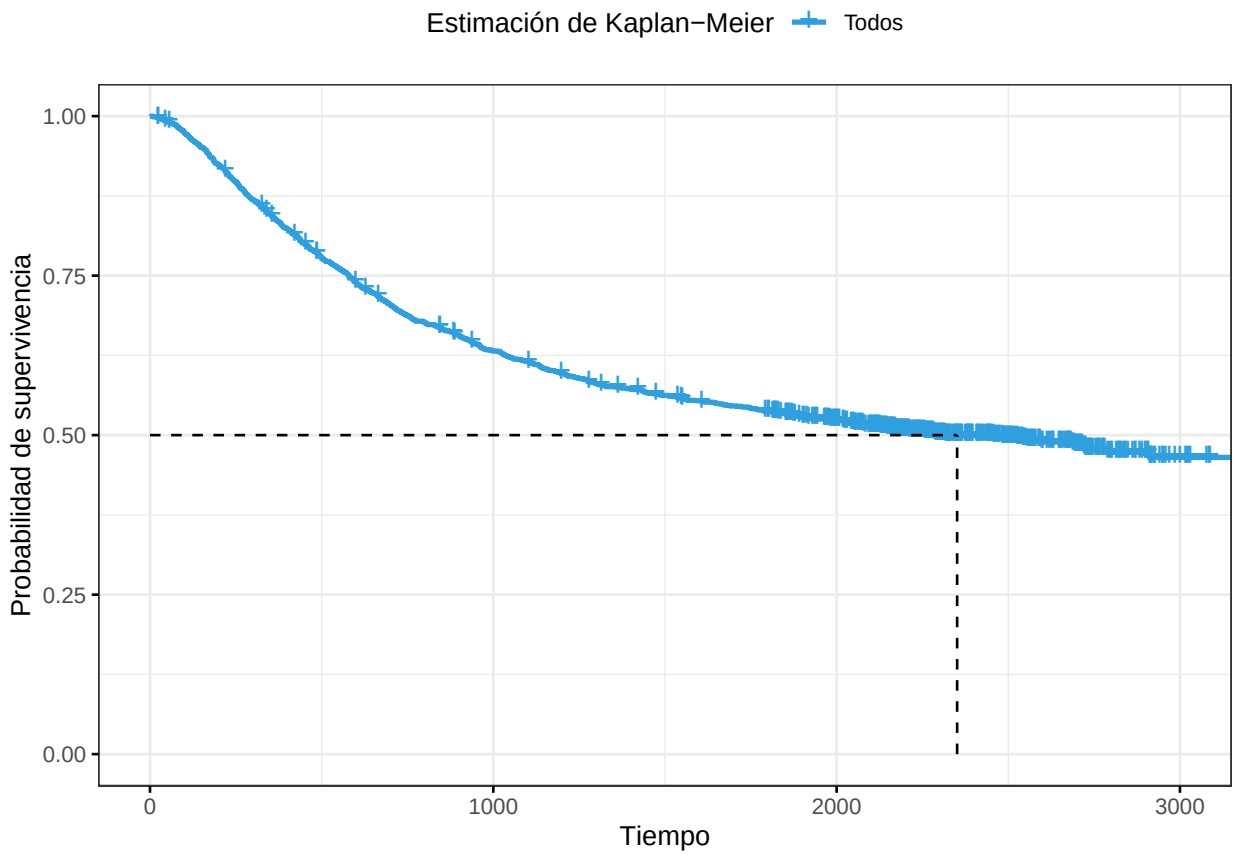
```
##  1135   1114       1    0.608 0.011369        0.586        0.631
##  1136   1113       1    0.608 0.011372        0.585        0.630
##  1138   1112       1    0.607 0.011375        0.585        0.629
##  1139   1111       2    0.606 0.011381        0.584        0.628
##  1142   1109       1    0.606 0.011384        0.583        0.628
##  1145   1108       2    0.604 0.011389        0.582        0.627
##  1151   1106       1    0.604 0.011392        0.582        0.626
##  1154   1105       1    0.603 0.011395        0.581        0.626
##  1159   1104       2    0.602 0.011400        0.580        0.625
##  1161   1102       1    0.602 0.011403        0.579        0.624
##  1166   1101       1    0.601 0.011406        0.579        0.624
##  1178   1100       2    0.600 0.011411        0.578        0.622
##  1183   1098       1    0.600 0.011414        0.577        0.622
##  1186   1097       1    0.599 0.011417        0.577        0.621
##  1191   1096       1    0.598 0.011419        0.576        0.621
##  1193   1095       1    0.598 0.011422        0.576        0.620
##  1195   1094       1    0.597 0.011425        0.575        0.620
##  1198   1093       1    0.597 0.011427        0.574        0.619
##  1201   1091       1    0.596 0.011430        0.574        0.619
##  1207   1090       1    0.596 0.011432        0.573        0.618
##  1209   1089       1    0.595 0.011435        0.573        0.618
##  1211   1088       1    0.595 0.011438        0.572        0.617
##  1212   1087       1    0.594 0.011440        0.572        0.616
##  1215   1086       1    0.594 0.011443        0.571        0.616
##  1216   1085       1    0.593 0.011445        0.571        0.615
##  1219   1084       1    0.592 0.011448        0.570        0.615
##  1230   1083       1    0.592 0.011450        0.569        0.614
##  1233   1082       1    0.591 0.011453        0.569        0.614
##  1236   1081       1    0.591 0.011455        0.568        0.613
##  1237   1080       1    0.590 0.011458        0.568        0.613
##  1246   1079       2    0.589 0.011462        0.567        0.612
##  1252   1077       1    0.589 0.011465        0.566        0.611
##  1262   1076       2    0.588 0.011470        0.565        0.610
##  1272   1074       1    0.587 0.011472        0.564        0.609
##  1273   1073       1    0.586 0.011474        0.564        0.609
##  1274   1072       1    0.586 0.011477        0.563        0.608
##  1275   1071       1    0.585 0.011479        0.563        0.608
##  1276   1070       2    0.584 0.011483        0.562        0.607
##  1277   1068       1    0.584 0.011486        0.561        0.606
##  1279   1067       1    0.583 0.011488        0.561        0.606
##  1290   1064       1    0.583 0.011490        0.560        0.605
##  1295   1063       2    0.581 0.011495        0.559        0.604
##  1298   1061       1    0.581 0.011497        0.558        0.603
##  1302   1060       1    0.580 0.011499        0.558        0.603
##  1304   1059       1    0.580 0.011501        0.557        0.602
##  1306   1058       1    0.579 0.011504        0.557        0.602
##  1313   1057       1    0.579 0.011506        0.556        0.601
##  1314   1056       1    0.578 0.011508        0.556        0.601
##  1323   1054       1    0.578 0.011510        0.555        0.600
##  1325   1053       1    0.577 0.011512        0.555        0.600
##  1327   1052       1    0.577 0.011514        0.554        0.599
##  1329   1051       1    0.576 0.011516        0.553        0.599
##  1353   1050       1    0.575 0.011518        0.553        0.598
##  1363   1049       1    0.575 0.011521        0.552        0.597
```

```
##  1365   1047       1    0.574 0.011523        0.552        0.597
##  1375   1046       1    0.574 0.011525        0.551        0.596
##  1387   1045       1    0.573 0.011527        0.551        0.596
##  1388   1044       1    0.573 0.011529        0.550        0.595
##  1399   1043       1    0.572 0.011531        0.550        0.595
##  1405   1042       1    0.572 0.011533        0.549        0.594
##  1424   1039       1    0.571 0.011535        0.548        0.594
##  1432   1038       1    0.571 0.011537        0.548        0.593
##  1434   1037       2    0.569 0.011541        0.547        0.592
##  1436   1035       1    0.569 0.011543        0.546        0.591
##  1437   1034       1    0.568 0.011545        0.546        0.591
##  1439   1033       1    0.568 0.011547        0.545        0.590
##  1446   1032       2    0.567 0.011550        0.544        0.589
##  1447   1030       1    0.566 0.011552        0.543        0.589
##  1455   1029       1    0.566 0.011554        0.543        0.588
##  1466   1028       1    0.565 0.011556        0.542        0.588
##  1471   1027       1    0.564 0.011558        0.542        0.587
##  1475   1024       1    0.564 0.011560        0.541        0.587
##  1482   1023       1    0.563 0.011562        0.541        0.586
##  1488   1022       1    0.563 0.011563        0.540        0.585
##  1495   1021       1    0.562 0.011565        0.540        0.585
##  1509   1020       1    0.562 0.011567        0.539        0.584
##  1511   1019       1    0.561 0.011569        0.538        0.584
##  1521   1018       1    0.561 0.011570        0.538        0.583
##  1530   1017       1    0.560 0.011572        0.537        0.583
##  1535   1016       1    0.559 0.011574        0.537        0.582
##  1539   1013       1    0.559 0.011576        0.536        0.582
##  1540   1012       1    0.558 0.011577        0.536        0.581
##  1548   1011       2    0.557 0.011581        0.535        0.580
##  1550   1008       1    0.557 0.011583        0.534        0.579
##  1551   1006       1    0.556 0.011584        0.533        0.579
##  1561   1005       1    0.556 0.011586        0.533        0.578
##  1564   1004       1    0.555 0.011588        0.532        0.578
##  1568   1003       1    0.555 0.011589        0.532        0.577
##  1589   1002       1    0.554 0.011591        0.531        0.577
##  1606   1001       2    0.553 0.011594        0.530        0.576
##  1607    999       1    0.552 0.011596        0.530        0.575
##  1620    997       1    0.552 0.011597        0.529        0.574
##  1637    996       1    0.551 0.011599        0.528        0.574
##  1644    995       1    0.551 0.011600        0.528        0.573
##  1647    994       1    0.550 0.011602        0.527        0.573
##  1652    993       1    0.550 0.011604        0.527        0.572
##  1656    992       1    0.549 0.011605        0.526        0.572
##  1668    991       2    0.548 0.011608        0.525        0.571
##  1671    989       1    0.547 0.011610        0.525        0.570
##  1679    988       1    0.547 0.011611        0.524        0.570
##  1687    987       1    0.546 0.011612        0.523        0.569
##  1692    986       1    0.546 0.011614        0.523        0.568
##  1709    985       1    0.545 0.011615        0.522        0.568
##  1723    984       2    0.544 0.011618        0.521        0.567
##  1743    982       1    0.543 0.011619        0.521        0.566
##  1745    981       1    0.543 0.011621        0.520        0.566
##  1749    980       1    0.542 0.011622        0.520        0.565
##  1752    979       1    0.542 0.011623        0.519        0.565
```

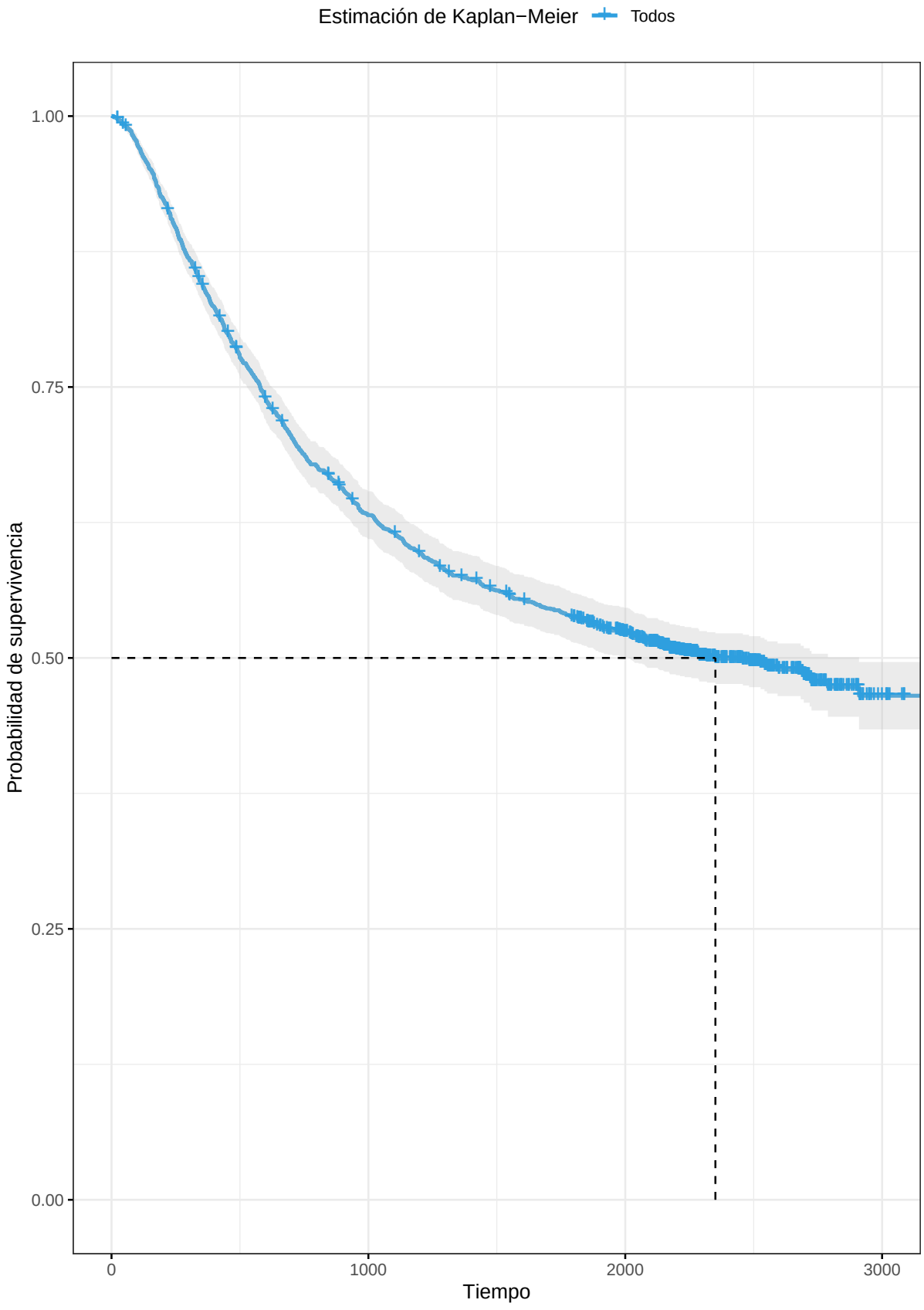
```
##  1759    978       1    0.541 0.011625        0.518        0.564
##  1767    977       1    0.541 0.011626        0.518        0.563
##  1768    976       1    0.540 0.011627        0.517        0.563
##  1772    975       1    0.540 0.011629        0.517        0.562
##  1783    974       1    0.539 0.011630        0.516        0.562
##  1786    973       1    0.538 0.011631        0.516        0.561
##  1788    972       1    0.538 0.011632        0.515        0.561
##  1790    971       1    0.537 0.011633        0.515        0.560
##  1798    968       1    0.537 0.011635        0.514        0.560
##  1812    963       1    0.536 0.011636        0.513        0.559
##  1818    958       1    0.536 0.011637        0.513        0.558
##  1829    942       1    0.535 0.011639        0.512        0.558
##  1831    941       1    0.535 0.011640        0.512        0.557
##  1839    937       1    0.534 0.011642        0.511        0.557
##  1850    936       1    0.533 0.011643        0.511        0.556
##  1851    935       1    0.533 0.011645        0.510        0.556
##  1856    928       1    0.532 0.011647        0.509        0.555
##  1875    918       1    0.532 0.011648        0.509        0.555
##  1876    915       1    0.531 0.011650        0.508        0.554
##  1879    914       1    0.531 0.011652        0.508        0.553
##  1884    911       1    0.530 0.011653        0.507        0.553
##  1885    910       1    0.529 0.011655        0.507        0.552
##  1895    907       1    0.529 0.011657        0.506        0.552
##  1896    906       1    0.528 0.011659        0.505        0.551
##  1907    898       1    0.528 0.011661        0.505        0.550
##  1915    895       1    0.527 0.011662        0.504        0.550
##  1918    894       1    0.526 0.011664        0.504        0.549
##  1932    886       1    0.526 0.011666        0.503        0.549
##  1950    880       1    0.525 0.011668        0.502        0.548
##  1976    871       1    0.525 0.011670        0.502        0.547
##  1981    864       1    0.524 0.011673        0.501        0.547
##  1995    855       1    0.523 0.011675        0.501        0.546
##  2012    840       1    0.523 0.011678        0.500        0.546
##  2018    839       1    0.522 0.011681        0.499        0.545
##  2021    834       1    0.522 0.011683        0.499        0.544
##  2023    833       1    0.521 0.011686        0.498        0.544
##  2028    828       1    0.520 0.011689        0.497        0.543
##  2031    823       1    0.520 0.011692        0.497        0.543
##  2035    822       1    0.519 0.011695        0.496        0.542
##  2036    821       1    0.518 0.011697        0.495        0.541
##  2052    814       1    0.518 0.011700        0.495        0.541
##  2067    800       1    0.517 0.011704        0.494        0.540
##  2074    795       1    0.516 0.011707        0.493        0.539
##  2077    786       1    0.516 0.011710        0.493        0.539
##  2079    785       1    0.515 0.011714        0.492        0.538
##  2083    783       1    0.514 0.011717        0.491        0.537
##  2085    780       1    0.514 0.011721        0.491        0.537
##  2127    737       1    0.513 0.011726        0.490        0.536
##  2128    736       1    0.512 0.011731        0.489        0.535
##  2133    728       1    0.512 0.011736        0.489        0.535
##  2148    711       1    0.511 0.011741        0.488        0.534
##  2152    707       1    0.510 0.011747        0.487        0.533
##  2171    671       2    0.509 0.011761        0.486        0.532
##  2174    668       1    0.508 0.011768        0.485        0.531
```

```
##   2197     618       1    0.507 0.011778        0.484        0.530
##   2213     591       1    0.506 0.011789        0.483        0.529
##   2231     571       1    0.505 0.011801        0.482        0.529
##   2257     543       1    0.504 0.011816        0.481        0.528
##   2284     513       1    0.504 0.011834        0.480        0.527
##   2287     510       1    0.503 0.011852        0.479        0.526
##   2288     509       1    0.502 0.011870        0.478        0.525
##   2318     480       1    0.500 0.011891        0.477        0.524
##   2351     446       1    0.499 0.011917        0.476        0.523
##   2458     365       1    0.498 0.011963        0.475        0.521
##   2482     346       1    0.497 0.012015        0.473        0.520
##   2527     294       1    0.495 0.012092        0.471        0.519
##   2542     276       1    0.493 0.012180        0.469        0.517
##   2552     265       1    0.491 0.012276        0.467        0.515
##   2593     235       1    0.489 0.012400        0.465        0.513
##   2683     187       1    0.487 0.012606        0.462        0.511
##   2695     181       1    0.484 0.012820        0.459        0.509
##   2718     162       1    0.481 0.013084        0.455        0.506
##   2725     154       1    0.478 0.013367        0.452        0.504
##   2789     105       1    0.473 0.013992        0.446        0.501
##   2910      59       1    0.465 0.015888        0.434        0.496
```

Para visualizar todas las observaciones, se tiene:

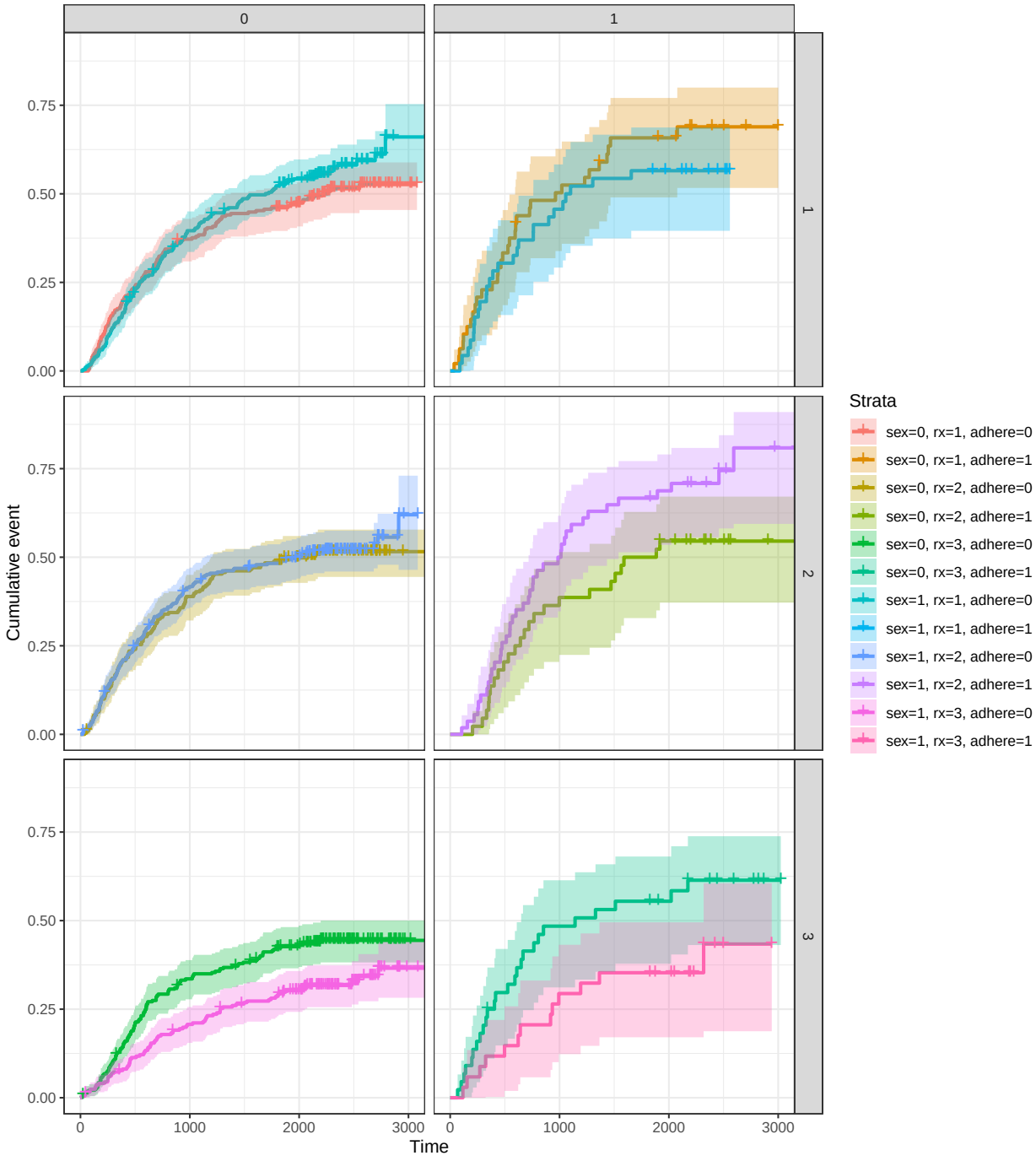


Para visualizar todas las observaciones, pero con un intervalo de confianza, se tiene:


Estimación de Kaplan−Meier
Todos
1.00
0.75
0.50
0.25
0.00
Probabilidad de supervivencia
0
1000
2000
3000
Tiempo

```
## [1] "NULL"
```

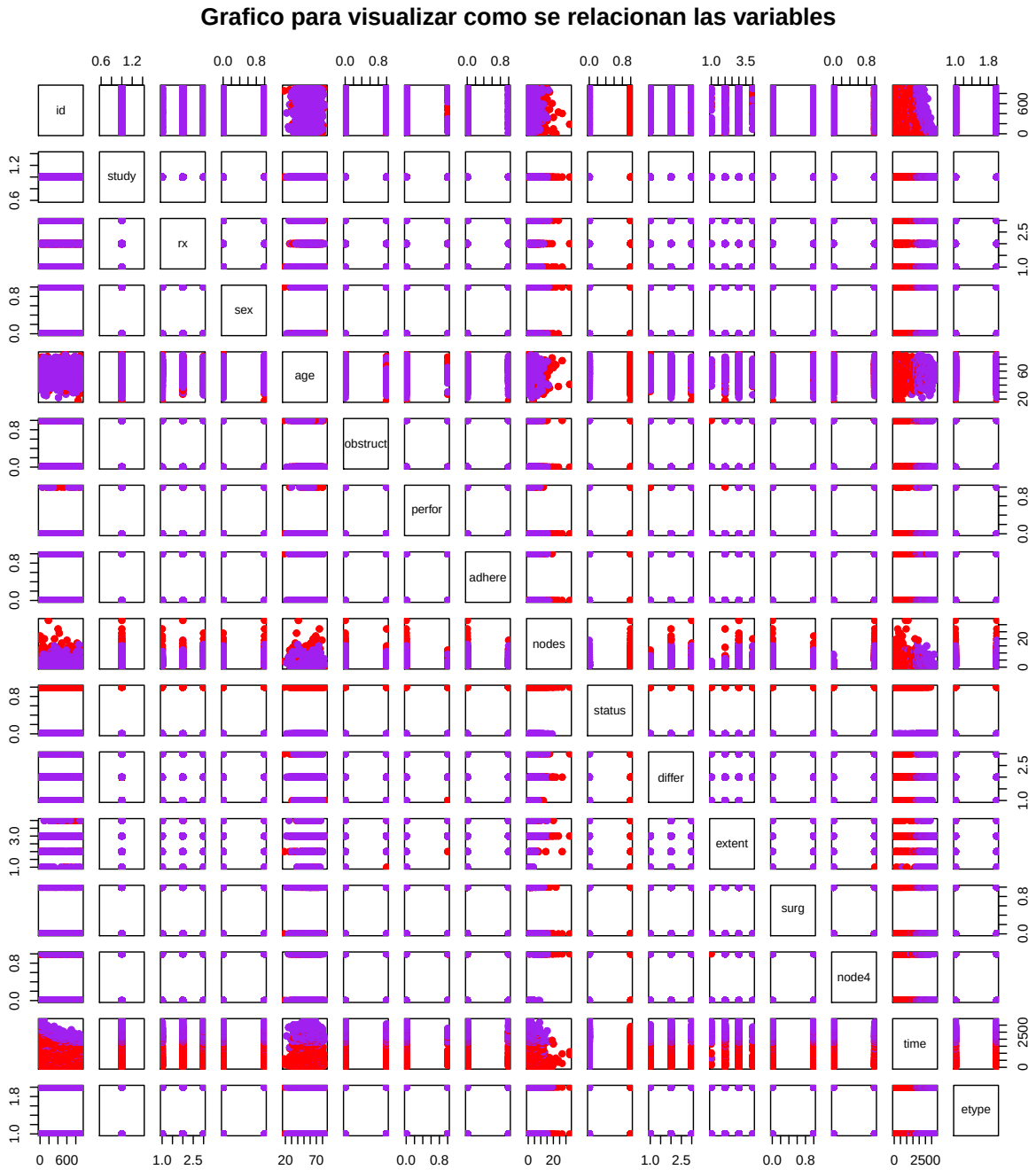
Ahora, también se puede ajustar curvas de supervivencia complejas usando la combinación de múltiples factores. A continuación se da una prueba de ello:



Identifique las variables que afectan el tiempo de supervivencia.

Manera exploratoria.

Gráfica de pares. En la siguiente gráfica de pares, se puede observa cómo se relacionan todas las variables de la base de datos.



De este grafico se pueden seleccionar las gráficas con la menor superposicion entre los estados.

Respecto a la gráfica de pares, se tiene:

- La variable *id*, no se considera ya que solo es una identificación para cada paciente y no afecta al tiempo de supervivencia.
- La variable *study* no se considera pues en todos es 1.
- Las demás variables si están relacionadas unas con otras.

Gráficamente se puede decir que son variables que afectan al tiempo de supervivencia.

Correlación. También se puede emplear la estadistica descriptiva para ver cómo se comporta la correlación de las variables con el tiempo de supervivencia:

```
##                   id study           rx           sex          age    obstruct
## id         1.000000000    NA -0.003668652  0.0215090310 -0.020638766  0.01275521
## study             NA     1           NA            NA           NA          NA
## rx        -0.003668652    NA  1.000000000 -0.0508706306  0.008646940 -0.02291945
## sex        0.021509031    NA -0.050870631  1.0000000000  0.021612700 -0.03150160
## age       -0.020638766    NA  0.008646940  0.0216126998  1.000000000 -0.09916130
## obstruct   0.012755211    NA -0.022919445 -0.0315016034 -0.099161301  1.00000000
## perfor     0.025256025    NA -0.005341023 -0.0008560593 -0.020053272  0.07731102
## adhere     0.024088425    NA -0.023955946 -0.0203826846  0.045814549  0.01424129
## nodes             NA    NA           NA            NA           NA          NA
## status    -0.012178545    NA -0.121479638 -0.0071349069 -0.024266121  0.05105063
## differ            NA    NA           NA            NA           NA          NA
## extent     0.002221288    NA -0.022283009  0.0163586680 -0.008825196  0.06332690
## surg      -0.021786310    NA -0.036046847  0.0064154608  0.009919297  0.02553390
## node4      0.019086245    NA -0.014719463 -0.0427445133 -0.100467737 -0.02079858
## time      -0.168002831    NA  0.116315805  0.0073533207  0.004850039 -0.07654974
## etype      0.000000000    NA  0.000000000  0.0000000000  0.000000000  0.00000000
##                 perfor       adhere nodes       status differ       extent
## id         0.0252560249  0.024088425    NA -0.012178545     NA  0.002221288
## study            NA           NA     NA           NA     NA           NA
## rx        -0.0053410229 -0.023955946    NA -0.121479638     NA -0.022283009
## sex       -0.0008560593 -0.020382685    NA -0.007134907     NA  0.016358668
## age       -0.0200532725  0.045814549    NA -0.024266121     NA -0.008825196
## obstruct   0.0773110219  0.014241294    NA  0.051050630     NA  0.063326895
## perfor     1.0000000000  0.146849564    NA  0.033717139     NA  0.066348538
## adhere     0.1468495636  1.000000000    NA  0.083412451     NA  0.145607347
## nodes            NA           NA     1           NA     NA           NA
## status     0.0337171388  0.083412451    NA  1.000000000     NA  0.163236383
## differ           NA           NA     NA           NA      1           NA
## extent     0.0663485378  0.145607347    NA  0.163236383     NA  1.000000000
## surg       0.0264164555  0.014563744    NA  0.078927707     NA -0.005407833
## node4     -0.0202636419 -0.007227562    NA  0.261656530     NA  0.078221143
## time      -0.0285661270 -0.074339079    NA -0.838574626     NA -0.181554460
## etype      0.0000000000  0.000000000    NA -0.017223629     NA  0.000000000
##                surg        node4         time       etype
## id        -0.021786310  0.019086245 -0.168002831  0.00000000
## study            NA           NA           NA          NA
## rx        -0.036046847 -0.014719463  0.116315805  0.00000000
## sex        0.006415461 -0.042744513  0.007353321  0.00000000
```

```
## age       0.009919297 -0.100467737  0.004850039  0.00000000
## obstruct  0.025533905 -0.020798581 -0.076549743  0.00000000
## perfor    0.026416455 -0.020263642 -0.028566127  0.00000000
## adhere    0.014563744 -0.007227562 -0.074339079  0.00000000
## nodes              NA           NA           NA          NA
## status    0.078927707  0.261656530 -0.838574626 -0.01722363
## differ             NA           NA           NA          NA
## extent   -0.005407833  0.078221143 -0.181554460  0.00000000
## surg      1.000000000 -0.020740105 -0.057359141  0.00000000
## node4    -0.020740105  1.000000000 -0.297699293  0.00000000
## time     -0.057359141 -0.297699293  1.000000000  0.13990201
## etype     0.000000000  0.000000000  0.139902009  1.00000000
```

Se puede observar que

- Las variables *study*, *nodes* y $differ$ no presentan correlación con otras.

Manera formal.

Ahora, se realizarán las respectivas pruebas que contrastan las hipótesis:

$$H_0 : S_j(t) = S_k(t) \text{ Para toda } t > 0 \text{ y para toda j, k}$$

$$vs$$

$$H_a : S_j(t) \neq S_k(t) \text{ para alguna } t > 0 \text{ y para alguna } j \neq t$$

Ahora se aplicará a cada variable:

Por sexo.

Prueba log-rank (Mantel-Haenszel):

```
## Call:
## survdiff(formula = Surv(time, status) ~ factor(colon$sex), data = colon,
##     rho = 0)
##
##                         N Observed Expected (O-E)^2/E (O-E)^2/V
## factor(colon$sex)=0 890      444      436     0.136     0.259
## factor(colon$sex)=1 968      476      484     0.123     0.259
##
##  Chisq= 0.3  on 1 degrees of freedom, p= 0.6
```

Se obtiene un $p - value = 0.6 > 0.05 = \alpha$ por lo que se acepta H_0, es decir, no existe evidencia estadística de que las supervivencias sean distintas por sexo.

Prueba log-rank (Peto-Peto, Gehan-Wilxocon):

```
## Call:
## survdiff(formula = Surv(time, status) ~ factor(colon$sex), data = colon,
##     rho = 1)
##
##                         N Observed Expected (O-E)^2/E (O-E)^2/V
## factor(colon$sex)=0 890      338      328     0.303      0.74
## factor(colon$sex)=1 968      353      363     0.273      0.74
##
##  Chisq= 0.7  on 1 degrees of freedom, p= 0.4
```

Se obtiene un $p - value = 0.4 > 0.05 = \alpha$, por tanto no se cuenta con evidencia suficiente para rechazar H_0.

Por lo tanto, se concluye que la supervivencia no es distinta en ambos sexos.

Así, el sexo no es una variable que influye en la supervivencia.

Por prescripción.

Prueba log-rank (Mantel-Haenszel):

```
## Call:
## survdiff(formula = Surv(time, status) ~ factor(colon$rx), data = colon,
##     rho = 0)
##
##                         N Observed Expected (O-E)^2/E (O-E)^2/V
## factor(colon$rx)=1 630      345      299      7.01     10.40
## factor(colon$rx)=2 620      333      295      4.93      7.26
## factor(colon$rx)=3 608      242      326     21.61     33.54
##
##  Chisq= 33.6  on 2 degrees of freedom, p= 5e-08
```

Se obtiene un $p - value = 5e^{-8} < 0.05 = \alpha$ por lo que no se acepta H_0, es decir, que si existe evidencia estadística de que las supervivencias sean distintas según su prescripción.

Prueba log-rank (Peto-Peto, Gehan-Wilxocon):

```
## Call:
## survdiff(formula = Surv(time, status) ~ factor(colon$rx), data = colon,
##     rho = 1)
##
##                         N Observed Expected (O-E)^2/E (O-E)^2/V
## factor(colon$rx)=1 630      259      226      4.69      8.93
## factor(colon$rx)=2 620      252      223      3.94      7.45
## factor(colon$rx)=3 608      180      242     15.96     31.73
##
##  Chisq= 31.7  on 2 degrees of freedom, p= 1e-07
```

Se obtiene un $p - value = e^{-7} < 0.05 = \alpha$, por tanto si hay evidencia suficiente para rechazar H_0.

Por lo tanto, se concluye que la supervivencia es distinta para diferentes prescripciones.

De esta manera, la prescripción es una variable que influye en la supervivencia.

Por edad.

Prueba log-rank (Mantel-Haenszel):

```
## Call:
## survdiff(formula = Surv(time, status) ~ factor(colon$age), data = colon,
##     rho = 0)
##
##                         N Observed Expected (O-E)^2/E (O-E)^2/V
## factor(colon$age)=18  2        2    0.401   6.36444   6.37358
## factor(colon$age)=22  2        0    1.364   1.36395   1.36664
## factor(colon$age)=25  2        1    0.775   0.06527   0.06537
## factor(colon$age)=26  2        0    1.496   1.49552   1.49953
## factor(colon$age)=27  6        4    2.391   1.08305   1.08690
## factor(colon$age)=28  2        2    0.360   7.48100   7.49243
## factor(colon$age)=29  2        0    1.294   1.29409   1.29658
## factor(colon$age)=30 10        6    4.266   0.70521   0.70898
## factor(colon$age)=31  4        4    0.904  10.60753  10.62922
## factor(colon$age)=32 10        8    4.268   3.26403   3.28153
## factor(colon$age)=33 14        4    8.463   2.35395   2.37905
## factor(colon$age)=34  8        8    2.169  15.68126  15.75230
## factor(colon$age)=35  4        2    2.303   0.03978   0.03990
## factor(colon$age)=36 20       10    9.196   0.07025   0.07100
## factor(colon$age)=37  4        2    2.178   0.01448   0.01452
## factor(colon$age)=38 20       17    7.477  12.13030  12.24807
## factor(colon$age)=39 28        9   13.872   1.71098   1.73805
## factor(colon$age)=40 16       11    8.478   0.75055   0.75791
## factor(colon$age)=41 14       11    5.404   5.79390   5.83266
## factor(colon$age)=42 14        4    7.240   1.44967   1.46210
## factor(colon$age)=43 22       10   11.913   0.30732   0.31151
## factor(colon$age)=44 16       12    6.516   4.61562   4.65180
## factor(colon$age)=45 26       12   12.611   0.02962   0.03005
## factor(colon$age)=46 38       17   20.410   0.56974   0.58297
## factor(colon$age)=47 24       16   12.020   1.31794   1.33614
## factor(colon$age)=48 30       11   15.728   1.42146   1.44717
## factor(colon$age)=49 26       11   15.127   1.12612   1.14571
## factor(colon$age)=50 28       15   12.611   0.45271   0.45959
## factor(colon$age)=51 20       12    8.187   1.77609   1.79346
## factor(colon$age)=52 40       17   21.386   0.89966   0.92156
## factor(colon$age)=53 44       20   23.006   0.39268   0.40296
## factor(colon$age)=54 32       18   16.730   0.09635   0.09820
## factor(colon$age)=55 54       22   29.657   1.97711   2.04428
## factor(colon$age)=56 62       30   31.203   0.04636   0.04801
## factor(colon$age)=57 62       28   29.926   0.12395   0.12820
## factor(colon$age)=58 58       21   32.481   4.05808   4.21070
## factor(colon$age)=59 62       27   34.409   1.59522   1.65837
## factor(colon$age)=60 62       31   29.116   0.12196   0.12602
## factor(colon$age)=61 72       32   34.861   0.23476   0.24414
## factor(colon$age)=62 42       25   18.363   2.39924   2.45025
## factor(colon$age)=63 58       22   31.354   2.79040   2.89146
## factor(colon$age)=64 72       38   36.384   0.07180   0.07480
## factor(colon$age)=65 56       25   27.951   0.31155   0.32150
## factor(colon$age)=66 70       37   31.820   0.84316   0.87387
## factor(colon$age)=67 48       20   25.000   1.00011   1.02875
```

```
## factor(colon$age)=68 76       52   35.317   7.88104   8.20861
## factor(colon$age)=69 40       25   17.460   3.25640   3.32286
## factor(colon$age)=70 72       41   34.372   1.27798   1.32840
## factor(colon$age)=71 48       30   20.734   4.14113   4.23984
## factor(colon$age)=72 50       19   26.872   2.30591   2.37658
## factor(colon$age)=73 40       19   17.975   0.05845   0.05965
## factor(colon$age)=74 68       27   36.230   2.35135   2.44941
## factor(colon$age)=75 34       11   19.588   3.76556   3.85013
## factor(colon$age)=76 42       22   21.689   0.00446   0.00457
## factor(colon$age)=77 22       10   11.820   0.28023   0.28403
## factor(colon$age)=78 10        0    6.724   6.72418   6.77831
## factor(colon$age)=79 14        8    4.947   1.88392   1.89550
## factor(colon$age)=80 16       10    6.071   2.54231   2.56061
## factor(colon$age)=81 10        8    3.395   6.24547   6.27498
## factor(colon$age)=82  4        2    2.229   0.02351   0.02358
## factor(colon$age)=83  2        0    1.306   1.30606   1.30859
## factor(colon$age)=85  2        2    0.205  15.68017  15.70645
##
##  Chisq= 164  on 61 degrees of freedom, p= 3e-11
```

Se obtiene un $p-value = 3e^{-11} < 0.05 = \alpha$ por lo que no se acepta H_0, es decir, existe evidencia estadística que indica que la supervivencia es distinta según la edad.

Prueba log-rank (Peto-Peto, Gehan-Wilxocon):

```
## Call:
## survdiff(formula = Surv(time, status) ~ factor(colon$age), data = colon,
##     rho = 1)
##
##                       N Observed Expected (O-E)^2/E (O-E)^2/V
## factor(colon$age)=18  2    1.647    0.354   4.71349   5.30556
## factor(colon$age)=22  2    0.000    0.989   0.98917   1.31587
## factor(colon$age)=25  2    0.974    0.554   0.31902   0.42638
## factor(colon$age)=26  2    0.000    1.054   1.05368   1.43274
## factor(colon$age)=27  6    2.947    1.912   0.55946   0.68587
## factor(colon$age)=28  2    1.678    0.325   5.63097   6.21107
## factor(colon$age)=29  2    0.000    0.953   0.95321   1.25305
## factor(colon$age)=30 10    4.696    3.303   0.58803   0.73785
## factor(colon$age)=31  4    3.233    0.770   7.88217   9.14808
## factor(colon$age)=32 10    5.660    3.280   1.72665   2.19171
## factor(colon$age)=33 14    3.020    6.152   1.59430   2.12283
## factor(colon$age)=34  8    6.139    1.868   9.76069  11.27515
## factor(colon$age)=35  4    1.222    1.742   0.15485   0.19926
## factor(colon$age)=36 20    8.010    6.956   0.15968   0.20586
## factor(colon$age)=37  4    1.395    1.629   0.03354   0.04333
## factor(colon$age)=38 20   12.544    5.977   7.21566   8.88259
## factor(colon$age)=39 28    7.444   10.352   0.81665   1.06973
## factor(colon$age)=40 16    7.121    6.380   0.08626   0.11179
## factor(colon$age)=41 14    8.369    4.194   4.15598   5.22220
## factor(colon$age)=42 14    3.556    5.358   0.60614   0.79504
## factor(colon$age)=43 22    7.032    8.940   0.40727   0.53145
## factor(colon$age)=44 16    8.957    5.022   3.08184   3.90211
## factor(colon$age)=45 26    9.540    9.420   0.00152   0.00199
## factor(colon$age)=46 38   12.168   15.264   0.62801   0.82850
```

```
## factor(colon$age)=47 24   10.925    9.151   0.34398   0.44269
## factor(colon$age)=48 30    8.816   11.709   0.71510   0.94071
## factor(colon$age)=49 26    7.475   11.168   1.22127   1.61907
## factor(colon$age)=50 28   12.311    9.393   0.90653   1.18446
## factor(colon$age)=51 20    9.628    6.316   1.73624   2.19500
## factor(colon$age)=52 40   12.117   15.886   0.89422   1.18850
## factor(colon$age)=53 44   14.753   17.157   0.33684   0.44645
## factor(colon$age)=54 32   12.453   12.595   0.00159   0.00208
## factor(colon$age)=55 54   15.625   21.979   1.83701   2.46729
## factor(colon$age)=56 62   22.535   23.412   0.03290   0.04378
## factor(colon$age)=57 62   22.702   22.302   0.00716   0.00957
## factor(colon$age)=58 58   15.573   24.019   2.97036   4.00565
## factor(colon$age)=59 62   19.164   25.466   1.55941   2.10650
## factor(colon$age)=60 62   24.536   21.901   0.31719   0.41976
## factor(colon$age)=61 72   25.580   26.165   0.01309   0.01749
## factor(colon$age)=62 42   19.359   14.124   1.94018   2.48935
## factor(colon$age)=63 58   16.947   23.201   1.68595   2.26822
## factor(colon$age)=64 72   27.585   27.281   0.00339   0.00455
## factor(colon$age)=65 56   19.728   20.909   0.06667   0.08849
## factor(colon$age)=66 70   29.015   24.061   1.02025   1.34844
## factor(colon$age)=67 48   15.574   18.524   0.46965   0.62650
## factor(colon$age)=68 76   36.560   27.118   3.28714   4.32628
## factor(colon$age)=69 40   18.867   13.479   2.15404   2.76066
## factor(colon$age)=70 72   30.362   26.019   0.72493   0.96137
## factor(colon$age)=71 48   23.078   15.824   3.32511   4.31440
## factor(colon$age)=72 50   13.429   19.997   2.15696   2.87820
## factor(colon$age)=73 40   14.977   13.550   0.15018   0.19626
## factor(colon$age)=74 68   19.383   27.144   2.21918   2.97644
## factor(colon$age)=75 34    7.659   14.466   3.20301   4.26690
## factor(colon$age)=76 42   15.902   16.177   0.00469   0.00621
## factor(colon$age)=77 22    7.109    8.885   0.35505   0.46214
## factor(colon$age)=78 10    0.000    4.893   4.89288   6.52693
## factor(colon$age)=79 14    6.260    3.817   1.56289   1.97127
## factor(colon$age)=80 16    8.369    4.620   3.04257   3.88490
## factor(colon$age)=81 10    6.223    2.729   4.47383   5.45274
## factor(colon$age)=82  4    1.296    1.692   0.09263   0.11866
## factor(colon$age)=83  2    0.000    0.959   0.95946   1.26387
## factor(colon$age)=85  2    1.806    0.195  13.29497  13.99683
##
##  Chisq= 143  on 61 degrees of freedom, p= 1e-08
```

Se obtiene un $p - value = e^{-8} < 0.05 = \alpha$, por tanto si se cuenta con evidencia suficiente para rechazar H_0.

Por lo tanto, se concluye que la supervivencia es distinta según la edad.

Así, la edad si es una variable que afecta la supervivencia.

Por obstrucción.

Prueba log-rank (Mantel-Haenszel):

```
## Call:
## survdiff(formula = Surv(time, status) ~ factor(colon$obstruct),
##     data = colon, rho = 0)
```

```
##
##                              N Observed Expected (O-E)^2/E (O-E)^2/V
## factor(colon$obstruct)=0 1498      723      758       1.6      9.11
## factor(colon$obstruct)=1  360      197      162       7.5      9.11
##
##  Chisq= 9.1  on 1 degrees of freedom, p= 0.003
```

Se obtiene un $p - value = 0.003 < 0.05 = \alpha$ por lo que no se acepta H_0, es decir, hay evidencia estadística de que las supervivencias son distintas entre las personas que presentan obstrucción y las que no.

Prueba log-rank (Peto-Peto, Gehan-Wilxocon):

```
## Call:
## survdiff(formula = Surv(time, status) ~ factor(colon$obstruct),
##     data = colon, rho = 1)
##
##                              N Observed Expected (O-E)^2/E (O-E)^2/V
## factor(colon$obstruct)=0 1498      537      569      1.72      12.4
## factor(colon$obstruct)=1  360      154      122      8.00      12.4
##
##  Chisq= 12.4  on 1 degrees of freedom, p= 4e-04
```

Se obtiene un $p - value = 4e^{-4} < 0.05 = \alpha$, por tanto si se cuenta con evidencia estadística suficiente para rechazar H_0.

Por lo tanto, se concluye que la supervivencia es distinta entre personas que tienen obstrucción de colon y las que no.

Por lo tanto, la obstrucción si es una variable que influye en la supervivencia.

Por perforación.

Prueba log-rank (Mantel-Haenszel):

```
## Call:
## survdiff(formula = Surv(time, status) ~ factor(colon$perfor),
##     data = colon, rho = 0)
##
##                             N Observed Expected (O-E)^2/E (O-E)^2/V
## factor(colon$perfor)=0 1804      888    895.2    0.0584      2.17
## factor(colon$perfor)=1   54       32     24.8    2.1118      2.17
##
##  Chisq= 2.2  on 1 degrees of freedom, p= 0.1
```

Se obtiene un $p - value = 0.1 > 0.05 = \alpha$ por lo que se acepta H_0, es decir, no existe evidencia estadística de que las supervivencias sean distintas si hay perforación.

Prueba log-rank (Peto-Peto, Gehan-Wilxocon):

```
## Call:
## survdiff(formula = Surv(time, status) ~ factor(colon$perfor),
##     data = colon, rho = 1)
##
##                             N Observed Expected (O-E)^2/E (O-E)^2/V
```

```
## factor(colon$perfor)=0 1804    666.9    672.2    0.0406      1.88
## factor(colon$perfor)=1   54     24.1     18.9    1.4452      1.88
##
##  Chisq= 1.9  on 1 degrees of freedom, p= 0.2
```

Se obtiene un $p - value = 0.2 > 0.05 = \alpha$, por tanto no se cuenta con evidencia suficiente para rechazar H_0.

Por lo tanto, se concluye que la supervivencia no es distinta en entre personas que tienen perforación y las que no.

Por lo tanto, la perforación no es una variable que influye en la supervivencia.

Por adherencia.

Prueba log-rank (Mantel-Haenszel):

```
## Call:
## survdiff(formula = Surv(time, status) ~ factor(colon$adhere),
##     data = colon, rho = 0)
##
##                            N Observed Expected (O-E)^2/E (O-E)^2/V
## factor(colon$adhere)=0 1588      759      797      1.78      13.3
## factor(colon$adhere)=1  270      161      123     11.49      13.3
##
##  Chisq= 13.3  on 1 degrees of freedom, p= 3e-04
```

Se obtiene un $p - value = 3e^{-4} < 0.05 = \alpha$ por lo que se acepta H_0, es decir, hay evidencia estadística de que las supervivencias son distintas entre las personas que presentan adherencia y las que no.

Prueba log-rank (Peto-Peto, Gehan-Wilxocon):

```
## Call:
## survdiff(formula = Surv(time, status) ~ factor(colon$adhere),
##     data = colon, rho = 1)
##
##                            N Observed Expected (O-E)^2/E (O-E)^2/V
## factor(colon$adhere)=0 1588      570    597.1      1.21      11.3
## factor(colon$adhere)=1  270      121     93.9      7.70      11.3
##
##  Chisq= 11.3  on 1 degrees of freedom, p= 8e-04
```

Se obtiene un $p - value = 8e^{-4} < 0.05 = \alpha$, por tanto si se cuenta con evidencia suficiente para rechazar H_0.

Por lo tanto, se concluye que la supervivencia es distinta entre las personas que tienen adherencia del cáncer en otros órganos y las que no.

Por lo tanto, la adherencia si es una variable que influye en la supervivencia.

Por número de ganglios con cáncer.

Prueba log-rank (Mantel-Haenszel):

```
## Call:
## survdiff(formula = Surv(time, status) ~ factor(colon$nodes),
##     data = colon, rho = 0)
##
## n=1822, 36 observations deleted due to missingness.
##
##                           N Observed Expected (O-E)^2/E (O-E)^2/V
## factor(colon$nodes)=0     4        4    1.266     5.901     5.915
## factor(colon$nodes)=1   548      196  309.843    41.828    64.133
## factor(colon$nodes)=2   388      155  208.223    13.604    17.742
## factor(colon$nodes)=3   250      122  127.885     0.271     0.316
## factor(colon$nodes)=4   168       88   77.731     1.357     1.486
## factor(colon$nodes)=5    92       66   34.841    27.866    29.046
## factor(colon$nodes)=6    86       53   34.250    10.265    10.685
## factor(colon$nodes)=7    76       53   31.215    15.203    15.772
## factor(colon$nodes)=8    46       35   14.688    28.090    28.598
## factor(colon$nodes)=9    40       28   16.292     8.414     8.578
## factor(colon$nodes)=10   26       18    8.583    10.330    10.441
## factor(colon$nodes)=11   20       14    7.792     4.947     4.995
## factor(colon$nodes)=12   22       16    8.013     7.961     8.045
## factor(colon$nodes)=13   14       12    3.839    17.345    17.438
## factor(colon$nodes)=14    8        8    1.685    23.665    23.748
## factor(colon$nodes)=15   12       10    3.081    15.537    15.610
## factor(colon$nodes)=16    2        0    1.248     1.248     1.250
## factor(colon$nodes)=17    4        4    1.017     8.749     8.771
## factor(colon$nodes)=19    4        3    1.555     1.343     1.346
## factor(colon$nodes)=20    4        4    1.484     4.266     4.276
## factor(colon$nodes)=22    2        2    0.580     3.473     3.479
## factor(colon$nodes)=24    2        2    0.422     5.905     5.915
## factor(colon$nodes)=27    2        2    0.567     3.624     3.629
## factor(colon$nodes)=33    2        2    0.900     1.346     1.349
##
##  Chisq= 266  on 23 degrees of freedom, p= <2e-16
```

Se obtiene un $p - value \leq 2e^{-16} < 0.05 = \alpha$ por lo que no se acepta H_0, es decir, si existe evidencia estadística de que las supervivencias son distintas según el número de ganglios con cáncer.

Prueba log-rank (Peto-Peto, Gehan-Wilxocon):

```
## Call:
## survdiff(formula = Surv(time, status) ~ factor(colon$nodes),
##     data = colon, rho = 1)
##
## n=1822, 36 observations deleted due to missingness.
##
##                           N Observed Expected (O-E)^2/E (O-E)^2/V
## factor(colon$nodes)=0     4     2.97    1.038     3.581     4.310
## factor(colon$nodes)=1   548   139.39  229.844    35.601    69.866
## factor(colon$nodes)=2   388   114.50  155.013    10.588    17.762
## factor(colon$nodes)=3   250    87.66   96.443     0.799     1.196
## factor(colon$nodes)=4   168    68.29   58.686     1.570     2.198
## factor(colon$nodes)=5    92    51.55   27.096    22.069    28.720
## factor(colon$nodes)=6    86    42.94   26.324    10.486    13.725
## factor(colon$nodes)=7    76    40.22   24.127    10.730    13.970
```

```
## factor(colon$nodes)=8   46    28.41   11.542    24.647    30.950
## factor(colon$nodes)=9   40    21.67   12.482     6.757     8.685
## factor(colon$nodes)=10  26    15.15    6.706    10.645    13.329
## factor(colon$nodes)=11  20    10.74    6.049     3.638     4.591
## factor(colon$nodes)=12  22    12.32    6.391     5.493     6.778
## factor(colon$nodes)=13  14     9.93    3.076    15.273    18.608
## factor(colon$nodes)=14   8     6.57    1.437    18.340    21.187
## factor(colon$nodes)=15  12     8.53    2.501    14.517    17.441
## factor(colon$nodes)=16   2     0.00    0.929     0.929     1.211
## factor(colon$nodes)=17   4     3.13    0.874     5.818     6.726
## factor(colon$nodes)=19   4     2.28    1.190     1.001     1.270
## factor(colon$nodes)=20   4     2.84    1.166     2.402     2.978
## factor(colon$nodes)=22   2     1.50    0.503     1.969     2.258
## factor(colon$nodes)=24   2     1.62    0.379     4.084     4.529
## factor(colon$nodes)=27   2     1.53    0.474     2.346     2.761
## factor(colon$nodes)=33   2     1.28    0.724     0.422     0.517
##
##  Chisq= 266  on 23 degrees of freedom, p= <2e-16
```

Se obtiene un $p - value \leq 2e^{-16} > 0.05 = \alpha$, por tanto, se cuenta con evidencia suficiente para rechazar H_0.

Por lo tanto, se concluye que la supervivencia es distinta en cada persona según el número de ganglios afectados.

Por lo tanto, el número de ganglios si es una variable que influye en la supervivencia.

Por el estado del paciente.

Prueba log-rank (Mantel-Haenszel):

```
## Call:
## survdiff(formula = Surv(time, status) ~ factor(colon$status),
##     data = colon, rho = 0)
##
##                           N Observed Expected (O-E)^2/E (O-E)^2/V
## factor(colon$status)=0 938        0      638       638      2283
## factor(colon$status)=1 920      920      282      1443      2283
##
##  Chisq= 2283  on 1 degrees of freedom, p= <2e-16
```

Se obtiene un $p - value \leq 2e^{-16} < 0.05 = \alpha$ por lo que no se acepta H_0,
es decir, existe evidencia estadística de que las supervivencias son distintas según el estado en el que se encuentra el paciente.

Prueba log-rank (Peto-Peto, Gehan-Wilxocon):

```
## Call:
## survdiff(formula = Surv(time, status) ~ factor(colon$status),
##     data = colon, rho = 1)
##
##                           N Observed Expected (O-E)^2/E (O-E)^2/V
## factor(colon$status)=0 938        0      461       461      1842
## factor(colon$status)=1 920      691      230       926      1842
##
##  Chisq= 1842  on 1 degrees of freedom, p= <2e-16
```

Se obtiene un $p - value \leq 2e^{-16} < 0.05 = \alpha$, por tanto se cuenta con evidencia suficiente para rechazar H_0.

Por lo tanto, se concluye que la supervivencia cambia en los pacientes según su estad

Por tanto, el estado de los pacientes es una variable que influye en la supervivencia.

Por la gravedad del tumor.

Prueba log-rank (Mantel-Haenszel):

```
## Call:
## survdiff(formula = Surv(time, status) ~ factor(colon$differ),
##     data = colon, rho = 0)
##
## n=1812, 46 observations deleted due to missingness.
##
##                            N Observed Expected (O-E)^2/E (O-E)^2/V
## factor(colon$differ)=1   186       86       97      1.26      1.41
## factor(colon$differ)=2  1326      637      681      2.90     12.01
## factor(colon$differ)=3   300      176      120     25.59     29.59
##
##  Chisq= 29.8  on 2 degrees of freedom, p= 3e-07
```

Se obtiene un $p-value = 3e^{-7} < 0.05 = \alpha$ por lo que no se acepta H_0, es decir, si existe evidencia estadística de que las supervivencias son distintas según la gravedad del tumor.

Prueba log-rank (Peto-Peto, Gehan-Wilxocon):

```
## Call:
## survdiff(formula = Surv(time, status) ~ factor(colon$differ),
##     data = colon, rho = 1)
##
## n=1812, 46 observations deleted due to missingness.
##
##                            N Observed Expected (O-E)^2/E (O-E)^2/V
## factor(colon$differ)=1   186     63.8     72.5      1.07      1.54
## factor(colon$differ)=2  1326    467.0    510.4      3.70     19.44
## factor(colon$differ)=3   300    144.1     91.8     29.73     43.71
##
##  Chisq= 43.8  on 2 degrees of freedom, p= 3e-10
```

Se obtiene un $p - value = 3e^{-10} < 0.05 = \alpha$, por tanto si se cuenta con evidencia suficiente para rechazar H_0.

Por lo tanto, se concluye que la supervivencia es distinta según la gravedad del tumor.

Por lo tanto, la gravedad del tumor es una variable que influye en la supervivencia.

Por la extensión de la diseminación local.

Prueba log-rank (Mantel-Haenszel):

```
## Call:
## survdiff(formula = Surv(time, status) ~ factor(colon$extent),
##     data = colon, rho = 0)
##
##                             N Observed Expected (O-E)^2/E (O-E)^2/V
## factor(colon$extent)=1   42        9     25.6      10.8      11.1
## factor(colon$extent)=2  212       70    123.7      23.3      27.0
## factor(colon$extent)=3 1518      783    738.4       2.7      13.7
## factor(colon$extent)=4   86       58     32.3      20.5      21.2
##
##  Chisq= 57.5  on 3 degrees of freedom, p= 2e-12
```

Se obtiene un $p - value = 2e^{-12} < 0.05 = \alpha$ por lo que no se acepta H_0,
es decir, si existe evidencia estadística de que las supervivencias son distintas según la extensión del tumor.

Prueba log-rank (Peto-Peto, Gehan-Wilxocon):

```
## Call:
## survdiff(formula = Surv(time, status) ~ factor(colon$extent),
##     data = colon, rho = 1)
##
##                             N Observed Expected (O-E)^2/E (O-E)^2/V
## factor(colon$extent)=1   42     6.79     18.7      7.57      10.2
## factor(colon$extent)=2  212    49.47     91.1     19.05      28.7
## factor(colon$extent)=3 1518   588.77    556.2      1.91      12.7
## factor(colon$extent)=4   86    45.99     25.0     17.56      22.8
##
##  Chisq= 59.4  on 3 degrees of freedom, p= 8e-13
```

Se obtiene un $p - value = 8e^{-13} < 0.05 = \alpha$, por tanto se cuenta con evidencia suficiente para rechazar H_0.

Por lo tanto, se concluye que la supervivencia es distinta entre las personas a las que se les extendió el cáncer y las que no.

Por lo tanto, la extensión del cáncer es una variable que influye en la supervivencia.

Por el tiempo transcurrido desde la cirugía.

Prueba log-rank (Mantel-Haenszel):

```
## Call:
## survdiff(formula = Surv(time, status) ~ factor(colon$surg), data = colon,
##     rho = 0)
##
##                           N Observed Expected (O-E)^2/E (O-E)^2/V
## factor(colon$surg)=0 1364      643      688      2.97      11.8
## factor(colon$surg)=1  494      277      232      8.82      11.8
##
##  Chisq= 11.8  on 1 degrees of freedom, p= 6e-04
```

Se obtiene un $p - value = 6e^{-4} < 0.05 = \alpha$ por lo que no se acepta H_0,
es decir, si hay evidencia estadística de que las supervivencias según el tiempo transcurrido de la cirugía y el estudio, influyen en la supervivencia.

Prueba log-rank (Peto-Peto, Gehan-Wilxocon):

```
## Call:
## survdiff(formula = Surv(time, status) ~ factor(colon$surg), data = colon,
##     rho = 1)
##
##                          N Observed Expected (O-E)^2/E (O-E)^2/V
## factor(colon$surg)=0 1364      483      516      2.11      10.6
## factor(colon$surg)=1  494      208      175      6.21      10.6
##
##  Chisq= 10.6  on 1 degrees of freedom, p= 0.001
```

Se obtiene un $p - value = 0.001 < 0.05 = \alpha$, por tanto se cuenta con evidencia suficiente para rechazar H_0.

Por lo tanto, se concluye que la supervivencia cambia según el tiempo transcurrido entre la cirugía y el estudio del paciente.

Por lotanto, el tiempo desde la cirugía si es una variable que influye en la supervivencia.

Si el número de ganglios con cáncer es mayor a 4.

Prueba log-rank (Mantel-Haenszel):

```
## Call:
## survdiff(formula = Surv(time, status) ~ factor(colon$node4),
##     data = colon, rho = 0)
##
##                            N Observed Expected (O-E)^2/E (O-E)^2/V
## factor(colon$node4)=0 1348      559      728      39.3       190
## factor(colon$node4)=1  510      361      192     149.2       190
##
##  Chisq= 190  on 1 degrees of freedom, p= <2e-16
```

Se obtiene un $p - value \leq 2e^{-16} < 0.05 = \alpha$ por lo que no se acepta H_0,
es decir, hay evidencia estadística de que las supervivencias son distintas si el número de ganglios con cáncer es mayor a 4.

Prueba log-rank (Peto-Peto, Gehan-Wilxocon):

```
## Call:
## survdiff(formula = Surv(time, status) ~ factor(colon$node4),
##     data = colon, rho = 1)
##
##                            N Observed Expected (O-E)^2/E (O-E)^2/V
## factor(colon$node4)=0 1348      406      542      34.3       201
## factor(colon$node4)=1  510      285      149     124.8       201
##
##  Chisq= 201  on 1 degrees of freedom, p= <2e-16
```

Se obtiene un $p - value \leq 2e^{-16} < 0.05 = \alpha$, por tanto se cuenta con evidencia suficiente para rechazar H_0.

Por lo tanto, se concluye que la supervivencia es distinta entre personas que tienen más de 4 ganglios con cáncer y las que no.

Por lo tanto, el tener más de 4 nodos es una variable que influye en la supervivencia.

Por el tipo de evento.

Prueba log-rank (Mantel-Haenszel):

```
## Call:
## survdiff(formula = Surv(time, status) ~ factor(colon$etype),
##     data = colon, rho = 0)
##
##                           N Observed Expected (O-E)^2/E (O-E)^2/V
## factor(colon$etype)=1 929      468      419      5.79      10.6
## factor(colon$etype)=2 929      452      501      4.83      10.6
##
##  Chisq= 10.6  on 1 degrees of freedom, p= 0.001
```

Se obtiene un $p - value = 0.001 < 0.05 = \alpha$ por lo que no se acepta H_0,
es decir, hay evidencia estadística de que las supervivencias son distintas según si tienen reinfección.

Prueba log-rank (Peto-Peto, Gehan-Wilxocon):

```
## Call:
## survdiff(formula = Surv(time, status) ~ factor(colon$etype),
##     data = colon, rho = 1)
##
##                           N Observed Expected (O-E)^2/E (O-E)^2/V
## factor(colon$etype)=1 929      376      316     11.49      27.2
## factor(colon$etype)=2 929      315      375      9.67      27.2
##
##  Chisq= 27.2  on 1 degrees of freedom, p= 2e-07
```

Asú, se obtiene un $p - value = 2e^{-7} < 0.05 = \alpha$, por tanto se cuenta con evidencia suficiente para rechazar H_0.

Por lo tanto, se concluye que la supervivencia es distinta si hay reinfección.

De esta manerra, el evento es una variable que influye en la supervivencia.

Prueba para contrastar la supervivencia.

En este caso hay que partir una población seleccionada. Hay que probar si el tiempo de supervivencia es el mismo mediante alguna prueba de hipotesis.

Se establece un nivel de confianza del 95 %.

La variable que se usará para particionar la poblacion será la adherencia. (Hay que recordar que 0 implica que no hay adherencia del cáncer a otros órganos, y 1 implica que si hay adherencia.)

En caso de que no haya adherencia:

Para el cálculo de la función de supervivencia, se tiene el apartado *survival*

```
## Call: survfit(formula = Surv(data_ad1$time, data_ad1$status) ~ 1, data = data_ad1,
##     type = "kaplan-meier", conf.type = "plain", conf.int = 0.95)
##
##  time n.risk n.event survival std.err lower 95% CI upper 95% CI
##     8   1588       1    0.999 0.00063        0.998        1.000
```

```
##     9   1587       1    0.999 0.00089        0.997        1.000
##    19   1586       1    0.998 0.00109        0.996        1.000
##    20   1585       1    0.997 0.00126        0.995        1.000
##    23   1584       1    0.997 0.00141        0.994        1.000
##    24   1582       1    0.996 0.00154        0.993        0.999
##    28   1580       1    0.996 0.00166        0.992        0.999
##    34   1579       1    0.995 0.00178        0.991        0.998
##    35   1578       1    0.994 0.00188        0.991        0.998
##    38   1577       1    0.994 0.00199        0.990        0.998
##    40   1576       1    0.993 0.00208        0.989        0.997
##    43   1575       1    0.992 0.00217        0.988        0.997
##    45   1574       2    0.991 0.00235        0.987        0.996
##    49   1571       1    0.991 0.00243        0.986        0.995
##    52   1570       1    0.990 0.00251        0.985        0.995
##    56   1569       1    0.989 0.00258        0.984        0.994
##    59   1567       1    0.989 0.00266        0.983        0.994
##    62   1566       2    0.987 0.00280        0.982        0.993
##    63   1564       1    0.987 0.00287        0.981        0.992
##    72   1563       2    0.985 0.00300        0.980        0.991
##    77   1561       2    0.984 0.00313        0.978        0.990
##    78   1559       1    0.984 0.00319        0.977        0.990
##    79   1558       2    0.982 0.00331        0.976        0.989
##    80   1556       2    0.981 0.00342        0.974        0.988
##    85   1554       2    0.980 0.00353        0.973        0.987
##    86   1552       1    0.979 0.00359        0.972        0.986
##    91   1551       2    0.978 0.00369        0.971        0.985
##    93   1549       1    0.977 0.00374        0.970        0.985
##    94   1548       1    0.977 0.00379        0.969        0.984
##    98   1547       3    0.975 0.00394        0.967        0.982
##    99   1544       2    0.974 0.00403        0.966        0.981
##   100   1542       1    0.973 0.00408        0.965        0.981
##   101   1541       1    0.972 0.00413        0.964        0.980
##   102   1540       1    0.972 0.00417        0.963        0.980
##   103   1539       1    0.971 0.00422        0.963        0.979
##   106   1538       1    0.970 0.00426        0.962        0.979
##   108   1537       1    0.970 0.00430        0.961        0.978
##   111   1536       1    0.969 0.00435        0.961        0.978
##   113   1535       4    0.967 0.00452        0.958        0.975
##   116   1531       2    0.965 0.00460        0.956        0.974
##   119   1529       1    0.965 0.00464        0.956        0.974
##   121   1528       1    0.964 0.00468        0.955        0.973
##   122   1527       2    0.963 0.00476        0.953        0.972
##   125   1525       1    0.962 0.00479        0.953        0.972
##   127   1524       1    0.962 0.00483        0.952        0.971
##   129   1523       1    0.961 0.00487        0.951        0.970
##   131   1522       1    0.960 0.00491        0.951        0.970
##   132   1521       1    0.960 0.00495        0.950        0.969
##   133   1520       1    0.959 0.00498        0.949        0.969
##   134   1519       1    0.958 0.00502        0.949        0.968
##   136   1518       1    0.958 0.00506        0.948        0.968
##   138   1517       1    0.957 0.00509        0.947        0.967
##   139   1516       1    0.956 0.00513        0.946        0.967
##   141   1515       1    0.956 0.00516        0.946        0.966
##   143   1514       1    0.955 0.00520        0.945        0.965
```

```
##   144   1513       1    0.955 0.00523        0.944        0.965
##   145   1512       2    0.953 0.00530        0.943        0.964
##   146   1510       2    0.952 0.00537        0.942        0.963
##   147   1508       1    0.951 0.00540        0.941        0.962
##   150   1507       1    0.951 0.00543        0.940        0.961
##   157   1506       2    0.950 0.00550        0.939        0.960
##   160   1504       1    0.949 0.00553        0.938        0.960
##   161   1503       2    0.948 0.00560        0.937        0.959
##   165   1501       4    0.945 0.00572        0.934        0.956
##   166   1497       2    0.944 0.00578        0.932        0.955
##   167   1495       1    0.943 0.00581        0.932        0.955
##   168   1494       1    0.943 0.00585        0.931        0.954
##   169   1493       1    0.942 0.00588        0.930        0.953
##   171   1492       2    0.941 0.00593        0.929        0.952
##   173   1490       3    0.939 0.00602        0.927        0.951
##   174   1487       3    0.937 0.00611        0.925        0.949
##   175   1484       1    0.936 0.00614        0.924        0.948
##   176   1483       2    0.935 0.00619        0.923        0.947
##   179   1481       1    0.934 0.00622        0.922        0.947
##   181   1480       1    0.934 0.00625        0.921        0.946
##   183   1479       2    0.932 0.00630        0.920        0.945
##   185   1477       4    0.930 0.00641        0.917        0.943
##   186   1473       2    0.929 0.00647        0.916        0.941
##   187   1471       1    0.928 0.00649        0.915        0.941
##   188   1470       1    0.927 0.00652        0.915        0.940
##   189   1469       1    0.927 0.00654        0.914        0.940
##   191   1468       3    0.925 0.00662        0.912        0.938
##   196   1465       1    0.924 0.00665        0.911        0.937
##   199   1464       1    0.924 0.00667        0.911        0.937
##   201   1463       2    0.922 0.00672        0.909        0.936
##   203   1461       1    0.922 0.00675        0.909        0.935
##   205   1460       1    0.921 0.00677        0.908        0.934
##   206   1459       1    0.920 0.00680        0.907        0.934
##   208   1458       1    0.920 0.00682        0.906        0.933
##   215   1457       2    0.919 0.00687        0.905        0.932
##   216   1455       1    0.918 0.00690        0.904        0.931
##   218   1454       3    0.916 0.00697        0.902        0.930
##   219   1451       2    0.915 0.00701        0.901        0.929
##   221   1448       1    0.914 0.00704        0.900        0.928
##   222   1447       1    0.914 0.00706        0.900        0.927
##   224   1446       1    0.913 0.00708        0.899        0.927
##   226   1445       1    0.912 0.00711        0.898        0.926
##   227   1444       1    0.912 0.00713        0.898        0.926
##   228   1443       1    0.911 0.00715        0.897        0.925
##   229   1442       1    0.910 0.00718        0.896        0.924
##   230   1441       5    0.907 0.00729        0.893        0.921
##   232   1436       1    0.907 0.00731        0.892        0.921
##   235   1435       1    0.906 0.00733        0.892        0.920
##   237   1434       2    0.905 0.00738        0.890        0.919
##   238   1432       3    0.903 0.00744        0.888        0.917
##   241   1429       1    0.902 0.00746        0.888        0.917
##   242   1428       1    0.902 0.00749        0.887        0.916
##   245   1427       2    0.900 0.00753        0.886        0.915
##   246   1425       1    0.900 0.00755        0.885        0.914
```

```
##   248   1424       1    0.899 0.00757        0.884        0.914
##   250   1423       1    0.898 0.00759        0.883        0.913
##   251   1422       1    0.898 0.00761        0.883        0.913
##   252   1421       1    0.897 0.00763        0.882        0.912
##   253   1420       1    0.896 0.00765        0.881        0.911
##   255   1419       1    0.896 0.00768        0.881        0.911
##   256   1418       2    0.895 0.00772        0.879        0.910
##   257   1416       1    0.894 0.00774        0.879        0.909
##   259   1415       2    0.893 0.00778        0.877        0.908
##   260   1413       2    0.891 0.00782        0.876        0.907
##   261   1411       1    0.891 0.00784        0.875        0.906
##   262   1410       1    0.890 0.00786        0.875        0.906
##   263   1409       2    0.889 0.00790        0.873        0.904
##   264   1407       2    0.888 0.00794        0.872        0.903
##   269   1405       1    0.887 0.00796        0.871        0.903
##   271   1404       1    0.886 0.00797        0.871        0.902
##   273   1403       1    0.886 0.00799        0.870        0.901
##   274   1402       1    0.885 0.00801        0.869        0.901
##   275   1401       1    0.884 0.00803        0.869        0.900
##   276   1400       3    0.883 0.00809        0.867        0.898
##   279   1397       3    0.881 0.00815        0.865        0.897
##   280   1394       1    0.880 0.00816        0.864        0.896
##   283   1393       2    0.879 0.00820        0.863        0.895
##   285   1391       1    0.878 0.00822        0.862        0.894
##   286   1390       3    0.876 0.00827        0.860        0.892
##   290   1387       2    0.875 0.00831        0.859        0.891
##   291   1385       1    0.874 0.00833        0.858        0.891
##   293   1384       1    0.874 0.00835        0.857        0.890
##   294   1383       1    0.873 0.00836        0.857        0.889
##   296   1382       2    0.872 0.00840        0.855        0.888
##   300   1380       1    0.871 0.00842        0.855        0.888
##   303   1379       1    0.871 0.00843        0.854        0.887
##   304   1378       2    0.869 0.00847        0.853        0.886
##   308   1376       1    0.869 0.00849        0.852        0.885
##   311   1375       1    0.868 0.00850        0.851        0.885
##   313   1374       2    0.867 0.00854        0.850        0.884
##   314   1372       2    0.866 0.00857        0.849        0.882
##   315   1370       2    0.864 0.00861        0.847        0.881
##   316   1368       1    0.864 0.00862        0.847        0.881
##   322   1367       3    0.862 0.00867        0.845        0.879
##   323   1364       1    0.861 0.00869        0.844        0.878
##   325   1363       1    0.860 0.00871        0.843        0.878
##   326   1362       1    0.860 0.00872        0.843        0.877
##   329   1360       1    0.859 0.00874        0.842        0.876
##   330   1359       2    0.858 0.00877        0.841        0.875
##   335   1357       1    0.857 0.00879        0.840        0.875
##   336   1356       2    0.856 0.00882        0.839        0.873
##   337   1354       2    0.855 0.00885        0.837        0.872
##   341   1352       1    0.854 0.00887        0.837        0.872
##   342   1351       1    0.854 0.00889        0.836        0.871
##   343   1350       1    0.853 0.00890        0.835        0.870
##   344   1349       1    0.852 0.00892        0.835        0.870
##   348   1348       2    0.851 0.00895        0.833        0.869
##   349   1346       1    0.850 0.00896        0.833        0.868
```

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##   352   1345       1    0.850 0.00898        0.832        0.867
##   354   1344       1    0.849 0.00900        0.831        0.867
##   355   1343       2    0.848 0.00903        0.830        0.866
##   356   1340       2    0.847 0.00906        0.829        0.864
##   360   1338       1    0.846 0.00907        0.828        0.864
##   362   1337       2    0.845 0.00910        0.827        0.862
##   363   1335       1    0.844 0.00912        0.826        0.862
##   365   1334       2    0.843 0.00915        0.825        0.861
##   366   1332       1    0.842 0.00916        0.824        0.860
##   370   1331       1    0.841 0.00918        0.823        0.859
##   372   1330       2    0.840 0.00921        0.822        0.858
##   374   1328       1    0.840 0.00922        0.822        0.858
##   376   1327       1    0.839 0.00924        0.821        0.857
##   378   1326       1    0.838 0.00925        0.820        0.856
##   379   1325       1    0.838 0.00927        0.820        0.856
##   380   1324       1    0.837 0.00928        0.819        0.855
##   381   1323       1    0.836 0.00930        0.818        0.855
##   382   1322       2    0.835 0.00932        0.817        0.853
##   384   1320       2    0.834 0.00935        0.816        0.852
##   386   1318       2    0.833 0.00938        0.814        0.851
##   389   1316       2    0.831 0.00941        0.813        0.850
##   392   1314       1    0.831 0.00942        0.812        0.849
##   393   1313       1    0.830 0.00944        0.812        0.849
##   398   1312       1    0.829 0.00945        0.811        0.848
##   400   1311       1    0.829 0.00947        0.810        0.847
##   401   1310       1    0.828 0.00948        0.810        0.847
##   402   1309       1    0.828 0.00949        0.809        0.846
##   406   1308       1    0.827 0.00951        0.808        0.846
##   408   1307       1    0.826 0.00952        0.808        0.845
##   409   1306       1    0.826 0.00954        0.807        0.844
##   411   1305       2    0.824 0.00956        0.806        0.843
##   413   1303       3    0.823 0.00960        0.804        0.841
##   415   1300       1    0.822 0.00962        0.803        0.841
##   417   1299       1    0.821 0.00963        0.802        0.840
##   420   1298       1    0.821 0.00964        0.802        0.840
##   421   1297       1    0.820 0.00966        0.801        0.839
##   422   1295       2    0.819 0.00968        0.800        0.838
##   428   1293       1    0.818 0.00970        0.799        0.837
##   429   1292       1    0.817 0.00971        0.798        0.836
##   430   1291       2    0.816 0.00974        0.797        0.835
##   431   1289       1    0.816 0.00975        0.796        0.835
##   433   1288       1    0.815 0.00976        0.796        0.834
##   434   1287       1    0.814 0.00977        0.795        0.833
##   435   1286       1    0.814 0.00979        0.794        0.833
##   438   1285       3    0.812 0.00983        0.792        0.831
##   439   1282       1    0.811 0.00984        0.792        0.830
##   440   1281       1    0.810 0.00985        0.791        0.830
##   441   1280       1    0.810 0.00986        0.791        0.829
##   443   1279       2    0.809 0.00989        0.789        0.828
##   444   1277       1    0.808 0.00990        0.789        0.827
##   448   1276       2    0.807 0.00993        0.787        0.826
##   449   1274       1    0.806 0.00994        0.787        0.826
##   454   1271       3    0.804 0.00998        0.785        0.824
##   458   1268       1    0.804 0.00999        0.784        0.823
```

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##   459   1267       1    0.803 0.01000        0.783        0.822
##   460   1266       1    0.802 0.01001        0.783        0.822
##   461   1265       1    0.802 0.01002        0.782        0.821
##   462   1264       1    0.801 0.01004        0.781        0.821
##   465   1263       2    0.800 0.01006        0.780        0.819
##   466   1261       2    0.798 0.01008        0.779        0.818
##   469   1259       1    0.798 0.01010        0.778        0.818
##   472   1258       1    0.797 0.01011        0.777        0.817
##   474   1257       1    0.797 0.01012        0.777        0.816
##   475   1256       1    0.796 0.01013        0.776        0.816
##   476   1255       1    0.795 0.01014        0.775        0.815
##   482   1254       1    0.795 0.01016        0.775        0.815
##   484   1253       1    0.794 0.01017        0.774        0.814
##   485   1252       2    0.793 0.01019        0.773        0.813
##   486   1249       1    0.792 0.01020        0.772        0.812
##   489   1247       1    0.791 0.01021        0.771        0.811
##   490   1246       1    0.791 0.01023        0.771        0.811
##   491   1245       2    0.790 0.01025        0.769        0.810
##   493   1243       1    0.789 0.01026        0.769        0.809
##   495   1242       1    0.788 0.01027        0.768        0.808
##   496   1241       1    0.788 0.01028        0.767        0.808
##   498   1240       2    0.786 0.01031        0.766        0.807
##   499   1238       4    0.784 0.01035        0.764        0.804
##   503   1234       1    0.783 0.01036        0.763        0.804
##   504   1233       1    0.783 0.01037        0.762        0.803
##   505   1232       1    0.782 0.01038        0.762        0.802
##   506   1231       1    0.781 0.01039        0.761        0.802
##   510   1230       2    0.780 0.01042        0.760        0.800
##   511   1228       1    0.779 0.01043        0.759        0.800
##   512   1227       1    0.779 0.01044        0.758        0.799
##   522   1226       1    0.778 0.01045        0.758        0.799
##   523   1225       1    0.777 0.01046        0.757        0.798
##   525   1224       1    0.777 0.01047        0.756        0.797
##   527   1223       1    0.776 0.01048        0.756        0.797
##   529   1222       1    0.776 0.01049        0.755        0.796
##   532   1221       1    0.775 0.01050        0.754        0.796
##   534   1220       1    0.774 0.01051        0.754        0.795
##   536   1219       1    0.774 0.01052        0.753        0.794
##   537   1218       1    0.773 0.01053        0.752        0.794
##   540   1217       1    0.772 0.01054        0.752        0.793
##   543   1216       2    0.771 0.01056        0.750        0.792
##   547   1214       1    0.770 0.01058        0.750        0.791
##   550   1213       1    0.770 0.01059        0.749        0.791
##   553   1212       1    0.769 0.01060        0.748        0.790
##   554   1211       2    0.768 0.01062        0.747        0.789
##   555   1209       1    0.767 0.01063        0.746        0.788
##   559   1208       1    0.767 0.01064        0.746        0.788
##   560   1207       1    0.766 0.01065        0.745        0.787
##   561   1206       1    0.765 0.01066        0.745        0.786
##   563   1205       2    0.764 0.01068        0.743        0.785
##   565   1203       1    0.764 0.01069        0.743        0.784
##   570   1202       1    0.763 0.01070        0.742        0.784
##   573   1201       3    0.761 0.01073        0.740        0.782
##   576   1198       2    0.760 0.01075        0.739        0.781
```

```
##   578   1196       3    0.758 0.01078        0.737        0.779
##   580   1193       2    0.757 0.01079        0.735        0.778
##   581   1191       1    0.756 0.01080        0.735        0.777
##   582   1190       1    0.755 0.01081        0.734        0.776
##   583   1189       2    0.754 0.01083        0.733        0.775
##   587   1187       1    0.753 0.01084        0.732        0.775
##   589   1186       1    0.753 0.01085        0.731        0.774
##   591   1185       2    0.751 0.01087        0.730        0.773
##   593   1183       2    0.750 0.01089        0.729        0.772
##   594   1181       1    0.750 0.01090        0.728        0.771
##   595   1180       1    0.749 0.01091        0.728        0.770
##   599   1179       1    0.748 0.01092        0.727        0.770
##   601   1178       1    0.748 0.01093        0.726        0.769
##   602   1177       2    0.746 0.01094        0.725        0.768
##   603   1175       1    0.746 0.01095        0.724        0.767
##   604   1174       1    0.745 0.01096        0.724        0.767
##   608   1173       1    0.744 0.01097        0.723        0.766
##   613   1172       1    0.744 0.01098        0.722        0.765
##   614   1171       1    0.743 0.01099        0.722        0.765
##   615   1170       1    0.743 0.01100        0.721        0.764
##   616   1169       2    0.741 0.01102        0.720        0.763
##   617   1167       1    0.741 0.01103        0.719        0.762
##   622   1166       1    0.740 0.01103        0.718        0.762
##   628   1165       1    0.739 0.01104        0.718        0.761
##   629   1163       1    0.739 0.01105        0.717        0.760
##   632   1162       1    0.738 0.01106        0.716        0.760
##   636   1161       1    0.737 0.01107        0.716        0.759
##   638   1160       1    0.737 0.01108        0.715        0.759
##   642   1159       1    0.736 0.01109        0.714        0.758
##   643   1158       2    0.735 0.01110        0.713        0.757
##   647   1156       1    0.734 0.01111        0.713        0.756
##   653   1155       1    0.734 0.01112        0.712        0.755
##   654   1154       1    0.733 0.01113        0.711        0.755
##   657   1153       1    0.732 0.01114        0.711        0.754
##   659   1152       2    0.731 0.01116        0.709        0.753
##   663   1150       3    0.729 0.01118        0.707        0.751
##   664   1147       1    0.729 0.01119        0.707        0.750
##   665   1146       1    0.728 0.01120        0.706        0.750
##   669   1144       1    0.727 0.01121        0.705        0.749
##   670   1143       1    0.727 0.01121        0.705        0.749
##   672   1142       1    0.726 0.01122        0.704        0.748
##   673   1141       1    0.725 0.01123        0.703        0.747
##   674   1140       1    0.725 0.01124        0.703        0.747
##   675   1139       2    0.723 0.01125        0.701        0.746
##   680   1137       1    0.723 0.01126        0.701        0.745
##   683   1136       1    0.722 0.01127        0.700        0.744
##   684   1135       1    0.722 0.01128        0.699        0.744
##   685   1134       1    0.721 0.01129        0.699        0.743
##   686   1133       1    0.720 0.01129        0.698        0.742
##   687   1132       1    0.720 0.01130        0.698        0.742
##   692   1131       3    0.718 0.01133        0.696        0.740
##   693   1128       1    0.717 0.01133        0.695        0.739
##   696   1127       1    0.716 0.01134        0.694        0.739
##   697   1126       1    0.716 0.01135        0.694        0.738
```

```
##   700   1125       2    0.715 0.01136        0.692        0.737
##   701   1123       1    0.714 0.01137        0.692        0.736
##   702   1122       2    0.713 0.01139        0.690        0.735
##   706   1120       1    0.712 0.01140        0.690        0.734
##   708   1119       1    0.711 0.01140        0.689        0.734
##   709   1118       2    0.710 0.01142        0.688        0.732
##   711   1116       1    0.709 0.01143        0.687        0.732
##   712   1115       2    0.708 0.01144        0.686        0.731
##   716   1113       1    0.708 0.01145        0.685        0.730
##   717   1112       1    0.707 0.01145        0.684        0.729
##   718   1111       1    0.706 0.01146        0.684        0.729
##   721   1110       1    0.706 0.01147        0.683        0.728
##   723   1109       1    0.705 0.01148        0.683        0.728
##   730   1108       2    0.704 0.01149        0.681        0.726
##   731   1106       1    0.703 0.01150        0.681        0.726
##   736   1105       1    0.702 0.01151        0.680        0.725
##   739   1104       2    0.701 0.01152        0.679        0.724
##   742   1102       1    0.701 0.01153        0.678        0.723
##   743   1101       2    0.699 0.01154        0.677        0.722
##   748   1099       1    0.699 0.01155        0.676        0.721
##   751   1098       1    0.698 0.01156        0.675        0.721
##   752   1097       1    0.697 0.01156        0.675        0.720
##   753   1096       1    0.697 0.01157        0.674        0.719
##   758   1095       1    0.696 0.01158        0.673        0.719
##   759   1094       1    0.695 0.01158        0.673        0.718
##   764   1093       1    0.695 0.01159        0.672        0.718
##   770   1092       1    0.694 0.01160        0.671        0.717
##   772   1091       1    0.694 0.01160        0.671        0.716
##   774   1090       2    0.692 0.01162        0.670        0.715
##   775   1088       1    0.692 0.01162        0.669        0.714
##   797   1087       2    0.690 0.01164        0.668        0.713
##   802   1085       2    0.689 0.01165        0.666        0.712
##   803   1083       1    0.688 0.01166        0.666        0.711
##   805   1082       1    0.688 0.01166        0.665        0.711
##   806   1081       1    0.687 0.01167        0.664        0.710
##   811   1080       1    0.687 0.01168        0.664        0.709
##   827   1079       1    0.686 0.01168        0.663        0.709
##   828   1078       1    0.685 0.01169        0.662        0.708
##   832   1077       1    0.685 0.01170        0.662        0.708
##   833   1076       2    0.683 0.01171        0.660        0.706
##   835   1074       1    0.683 0.01172        0.660        0.706
##   840   1073       1    0.682 0.01172        0.659        0.705
##   844   1072       1    0.681 0.01173        0.658        0.704
##   845   1070       1    0.681 0.01173        0.658        0.704
##   846   1068       1    0.680 0.01174        0.657        0.703
##   849   1067       1    0.680 0.01175        0.657        0.703
##   854   1066       1    0.679 0.01175        0.656        0.702
##   855   1065       1    0.678 0.01176        0.655        0.701
##   862   1064       1    0.678 0.01177        0.655        0.701
##   863   1063       1    0.677 0.01177        0.654        0.700
##   871   1062       1    0.676 0.01178        0.653        0.699
##   874   1061       1    0.676 0.01178        0.653        0.699
##   875   1060       1    0.675 0.01179        0.652        0.698
##   883   1059       2    0.674 0.01180        0.651        0.697
```

```
##   884   1057       1    0.673 0.01181        0.650        0.696
##   885   1055       1    0.673 0.01181        0.649        0.696
##   887   1054       3    0.671 0.01183        0.647        0.694
##   890   1050       1    0.670 0.01184        0.647        0.693
##   891   1049       1    0.669 0.01184        0.646        0.693
##   900   1048       1    0.669 0.01185        0.645        0.692
##   902   1047       1    0.668 0.01186        0.645        0.691
##   904   1046       1    0.667 0.01186        0.644        0.691
##   905   1045       2    0.666 0.01187        0.643        0.689
##   909   1043       1    0.666 0.01188        0.642        0.689
##   911   1042       1    0.665 0.01189        0.642        0.688
##   912   1041       1    0.664 0.01189        0.641        0.688
##   916   1040       1    0.664 0.01190        0.640        0.687
##   922   1039       1    0.663 0.01190        0.640        0.686
##   924   1038       1    0.662 0.01191        0.639        0.686
##   928   1037       1    0.662 0.01191        0.638        0.685
##   929   1036       1    0.661 0.01192        0.638        0.684
##   930   1035       1    0.660 0.01192        0.637        0.684
##   931   1034       1    0.660 0.01193        0.636        0.683
##   936   1033       2    0.659 0.01194        0.635        0.682
##   938   1031       1    0.658 0.01195        0.634        0.681
##   939   1029       1    0.657 0.01195        0.634        0.681
##   940   1028       1    0.657 0.01196        0.633        0.680
##   942   1027       1    0.656 0.01196        0.632        0.679
##   944   1026       1    0.655 0.01197        0.632        0.679
##   952   1025       1    0.655 0.01197        0.631        0.678
##   957   1024       1    0.654 0.01198        0.631        0.678
##   959   1023       1    0.653 0.01198        0.630        0.677
##   960   1022       1    0.653 0.01199        0.629        0.676
##   961   1021       4    0.650 0.01201        0.627        0.674
##   966   1017       1    0.650 0.01202        0.626        0.673
##   968   1016       2    0.648 0.01203        0.625        0.672
##   969   1014       1    0.648 0.01203        0.624        0.671
##   975   1013       1    0.647 0.01204        0.623        0.671
##   976   1012       1    0.646 0.01204        0.623        0.670
##   977   1011       1    0.646 0.01205        0.622        0.669
##   997   1010       1    0.645 0.01205        0.621        0.669
##  1020   1009       1    0.644 0.01206        0.621        0.668
##  1022   1008       1    0.644 0.01206        0.620        0.667
##  1024   1007       1    0.643 0.01207        0.620        0.667
##  1025   1006       1    0.643 0.01207        0.619        0.666
##  1026   1005       1    0.642 0.01208        0.618        0.666
##  1029   1004       1    0.641 0.01208        0.618        0.665
##  1032   1003       1    0.641 0.01209        0.617        0.664
##  1034   1002       1    0.640 0.01209        0.616        0.664
##  1037   1001       2    0.639 0.01210        0.615        0.662
##  1041    999       1    0.638 0.01211        0.614        0.662
##  1042    998       1    0.637 0.01211        0.614        0.661
##  1048    997       1    0.637 0.01212        0.613        0.661
##  1052    996       1    0.636 0.01212        0.612        0.660
##  1055    995       1    0.635 0.01212        0.612        0.659
##  1057    994       1    0.635 0.01213        0.611        0.659
##  1070    993       1    0.634 0.01213        0.610        0.658
##  1079    992       1    0.634 0.01214        0.610        0.657
```

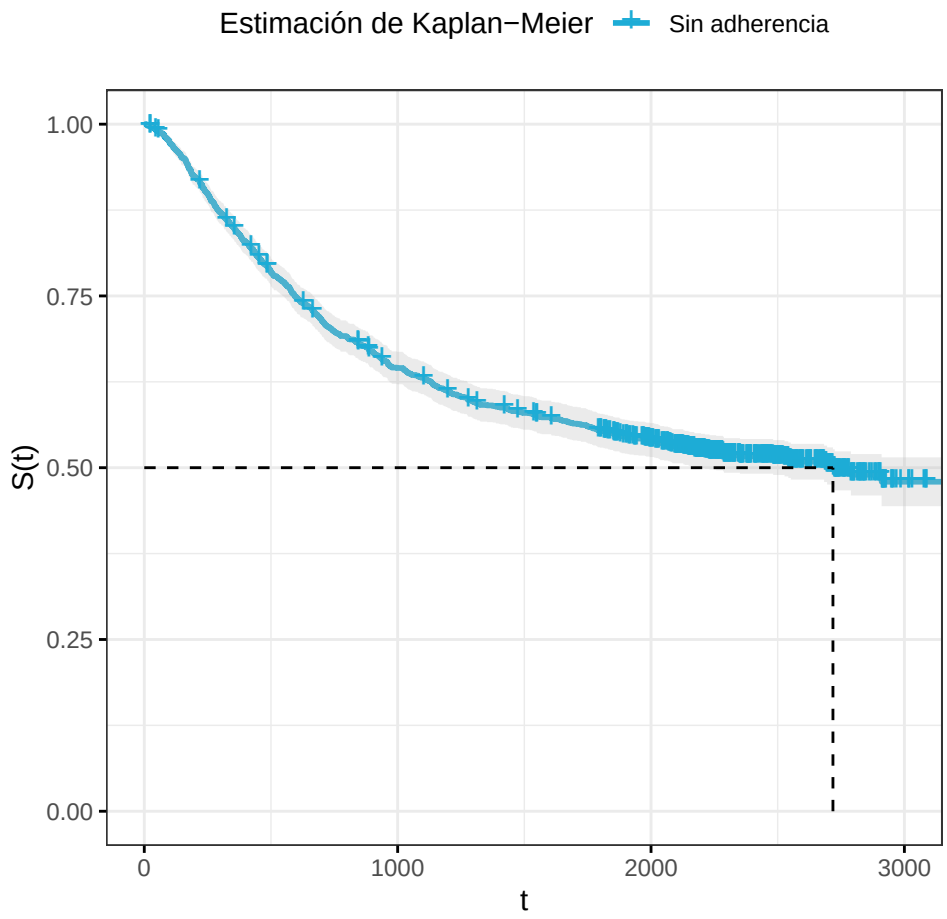
```
##  1081    991       1    0.633 0.01214        0.609        0.657
##  1083    990       1    0.632 0.01215        0.608        0.656
##  1089    989       1    0.632 0.01215        0.608        0.655
##  1092    988       1    0.631 0.01216        0.607        0.655
##  1103    987       1    0.630 0.01216        0.607        0.654
##  1105    985       1    0.630 0.01217        0.606        0.654
##  1106    984       1    0.629 0.01217        0.605        0.653
##  1112    983       1    0.628 0.01217        0.605        0.652
##  1114    982       1    0.628 0.01218        0.604        0.652
##  1117    981       1    0.627 0.01218        0.603        0.651
##  1122    980       2    0.626 0.01219        0.602        0.650
##  1130    978       1    0.625 0.01220        0.601        0.649
##  1133    977       1    0.625 0.01220        0.601        0.649
##  1134    976       1    0.624 0.01220        0.600        0.648
##  1135    975       1    0.623 0.01221        0.599        0.647
##  1136    974       1    0.623 0.01221        0.599        0.647
##  1138    973       1    0.622 0.01222        0.598        0.646
##  1139    972       2    0.621 0.01223        0.597        0.645
##  1145    970       2    0.619 0.01223        0.596        0.643
##  1151    968       1    0.619 0.01224        0.595        0.643
##  1154    967       1    0.618 0.01224        0.594        0.642
##  1159    966       2    0.617 0.01225        0.593        0.641
##  1161    964       1    0.616 0.01225        0.592        0.640
##  1166    963       1    0.616 0.01226        0.592        0.640
##  1178    962       2    0.614 0.01227        0.590        0.638
##  1183    960       1    0.614 0.01227        0.590        0.638
##  1186    959       1    0.613 0.01227        0.589        0.637
##  1191    958       1    0.612 0.01228        0.588        0.637
##  1195    957       1    0.612 0.01228        0.588        0.636
##  1198    956       1    0.611 0.01229        0.587        0.635
##  1201    954       1    0.611 0.01229        0.586        0.635
##  1207    953       1    0.610 0.01229        0.586        0.634
##  1209    952       1    0.609 0.01230        0.585        0.633
##  1211    951       1    0.609 0.01230        0.585        0.633
##  1212    950       1    0.608 0.01230        0.584        0.632
##  1216    949       1    0.607 0.01231        0.583        0.631
##  1219    948       1    0.607 0.01231        0.583        0.631
##  1233    947       1    0.606 0.01232        0.582        0.630
##  1236    946       1    0.605 0.01232        0.581        0.630
##  1237    945       1    0.605 0.01232        0.581        0.629
##  1246    944       2    0.603 0.01233        0.579        0.628
##  1252    942       1    0.603 0.01233        0.579        0.627
##  1262    941       1    0.602 0.01234        0.578        0.626
##  1273    940       1    0.602 0.01234        0.577        0.626
##  1274    939       1    0.601 0.01234        0.577        0.625
##  1276    938       2    0.600 0.01235        0.575        0.624
##  1277    936       1    0.599 0.01235        0.575        0.623
##  1279    935       1    0.598 0.01236        0.574        0.623
##  1290    932       1    0.598 0.01236        0.573        0.622
##  1295    931       2    0.596 0.01237        0.572        0.621
##  1298    929       1    0.596 0.01237        0.572        0.620
##  1302    928       1    0.595 0.01237        0.571        0.619
##  1306    927       1    0.595 0.01238        0.570        0.619
##  1313    926       1    0.594 0.01238        0.570        0.618
```

```
##  1314    925       1    0.593 0.01238        0.569        0.617
##  1323    923       1    0.593 0.01239        0.568        0.617
##  1325    922       1    0.592 0.01239        0.568        0.616
##  1327    921       1    0.591 0.01239        0.567        0.616
##  1353    920       1    0.591 0.01240        0.566        0.615
##  1375    919       1    0.590 0.01240        0.566        0.614
##  1387    918       1    0.589 0.01240        0.565        0.614
##  1388    917       1    0.589 0.01241        0.564        0.613
##  1399    916       1    0.588 0.01241        0.564        0.612
##  1405    915       1    0.587 0.01241        0.563        0.612
##  1424    912       1    0.587 0.01242        0.562        0.611
##  1432    911       1    0.586 0.01242        0.562        0.610
##  1436    910       1    0.586 0.01242        0.561        0.610
##  1437    909       1    0.585 0.01242        0.561        0.609
##  1439    908       1    0.584 0.01243        0.560        0.609
##  1446    907       1    0.584 0.01243        0.559        0.608
##  1447    906       1    0.583 0.01243        0.559        0.607
##  1455    905       1    0.582 0.01244        0.558        0.607
##  1475    902       1    0.582 0.01244        0.557        0.606
##  1482    901       1    0.581 0.01244        0.557        0.605
##  1488    900       1    0.580 0.01245        0.556        0.605
##  1495    899       1    0.580 0.01245        0.555        0.604
##  1521    898       1    0.579 0.01245        0.555        0.603
##  1530    897       1    0.578 0.01245        0.554        0.603
##  1535    896       1    0.578 0.01246        0.553        0.602
##  1539    893       1    0.577 0.01246        0.553        0.602
##  1548    892       2    0.576 0.01247        0.551        0.600
##  1550    889       1    0.575 0.01247        0.551        0.600
##  1551    887       1    0.575 0.01247        0.550        0.599
##  1561    886       1    0.574 0.01247        0.549        0.598
##  1568    885       1    0.573 0.01248        0.549        0.598
##  1606    884       2    0.572 0.01248        0.547        0.596
##  1607    882       1    0.571 0.01248        0.547        0.596
##  1620    880       1    0.571 0.01249        0.546        0.595
##  1637    879       1    0.570 0.01249        0.546        0.594
##  1644    878       1    0.569 0.01249        0.545        0.594
##  1647    877       1    0.569 0.01250        0.544        0.593
##  1652    876       1    0.568 0.01250        0.544        0.593
##  1668    875       2    0.567 0.01250        0.542        0.591
##  1671    873       1    0.566 0.01251        0.542        0.591
##  1679    872       1    0.565 0.01251        0.541        0.590
##  1687    871       1    0.565 0.01251        0.540        0.589
##  1692    870       1    0.564 0.01251        0.540        0.589
##  1709    869       1    0.563 0.01252        0.539        0.588
##  1723    868       2    0.562 0.01252        0.538        0.587
##  1743    866       1    0.562 0.01252        0.537        0.586
##  1745    865       1    0.561 0.01252        0.536        0.585
##  1749    864       1    0.560 0.01253        0.536        0.585
##  1752    863       1    0.560 0.01253        0.535        0.584
##  1759    862       1    0.559 0.01253        0.534        0.584
##  1767    861       1    0.558 0.01253        0.534        0.583
##  1768    860       1    0.558 0.01254        0.533        0.582
##  1772    859       1    0.557 0.01254        0.532        0.582
##  1783    858       1    0.556 0.01254        0.532        0.581
```

```
##  1786    857       1    0.556 0.01254        0.531        0.580
##  1788    856       1    0.555 0.01254        0.530        0.580
##  1790    855       1    0.554 0.01255        0.530        0.579
##  1798    852       1    0.554 0.01255        0.529        0.578
##  1812    847       1    0.553 0.01255        0.529        0.578
##  1818    842       1    0.552 0.01255        0.528        0.577
##  1829    832       1    0.552 0.01256        0.527        0.576
##  1831    831       1    0.551 0.01256        0.527        0.576
##  1839    827       1    0.550 0.01256        0.526        0.575
##  1850    826       1    0.550 0.01256        0.525        0.574
##  1851    825       1    0.549 0.01257        0.524        0.574
##  1856    820       1    0.548 0.01257        0.524        0.573
##  1875    810       1    0.548 0.01257        0.523        0.572
##  1876    809       1    0.547 0.01257        0.522        0.572
##  1879    808       1    0.546 0.01258        0.522        0.571
##  1884    805       1    0.546 0.01258        0.521        0.570
##  1896    802       1    0.545 0.01258        0.520        0.570
##  1907    798       1    0.544 0.01258        0.520        0.569
##  1915    795       1    0.544 0.01259        0.519        0.568
##  1932    788       1    0.543 0.01259        0.518        0.568
##  1950    782       1    0.542 0.01259        0.518        0.567
##  1976    775       1    0.542 0.01260        0.517        0.566
##  1981    768       1    0.541 0.01260        0.516        0.566
##  1995    759       1    0.540 0.01260        0.515        0.565
##  2012    744       1    0.539 0.01261        0.515        0.564
##  2018    743       1    0.539 0.01261        0.514        0.563
##  2028    736       1    0.538 0.01262        0.513        0.563
##  2031    731       1    0.537 0.01262        0.513        0.562
##  2035    730       1    0.537 0.01262        0.512        0.561
##  2036    729       1    0.536 0.01263        0.511        0.561
##  2052    724       1    0.535 0.01263        0.510        0.560
##  2067    714       1    0.534 0.01264        0.510        0.559
##  2074    709       1    0.534 0.01264        0.509        0.558
##  2079    700       1    0.533 0.01265        0.508        0.558
##  2083    698       1    0.532 0.01265        0.507        0.557
##  2085    695       1    0.531 0.01266        0.506        0.556
##  2127    654       1    0.530 0.01266        0.506        0.555
##  2128    653       1    0.530 0.01267        0.505        0.554
##  2133    645       1    0.529 0.01268        0.504        0.554
##  2148    628       1    0.528 0.01268        0.503        0.553
##  2152    624       1    0.527 0.01269        0.502        0.552
##  2171    592       2    0.525 0.01271        0.500        0.550
##  2197    547       1    0.524 0.01272        0.499        0.549
##  2213    529       1    0.523 0.01274        0.498        0.548
##  2231    511       1    0.522 0.01275        0.497        0.547
##  2257    483       1    0.521 0.01277        0.496        0.546
##  2284    453       1    0.520 0.01280        0.495        0.545
##  2287    450       1    0.519 0.01282        0.494        0.544
##  2288    449       1    0.518 0.01284        0.493        0.543
##  2351    393       1    0.517 0.01288        0.491        0.542
##  2482    307       1    0.515 0.01295        0.489        0.540
##  2527    265       1    0.513 0.01304        0.487        0.538
##  2542    249       1    0.511 0.01315        0.485        0.537
##  2552    240       1    0.509 0.01327        0.483        0.535
```

```
##   2683     168       1    0.506 0.01353        0.479        0.532
##   2695     162       1    0.503 0.01380        0.475        0.530
##   2718     144       1    0.499 0.01414        0.471        0.527
##   2725     136       1    0.495 0.01451        0.467        0.524
##   2789      88       1    0.490 0.01539        0.460        0.520
##   2910      48       1    0.480 0.01814        0.444        0.515
```

La gráfica es la siguiente



En caso de que exista adherencia:

Para el cálculo de la función de supervivencia, se tiene el apartado *survival*

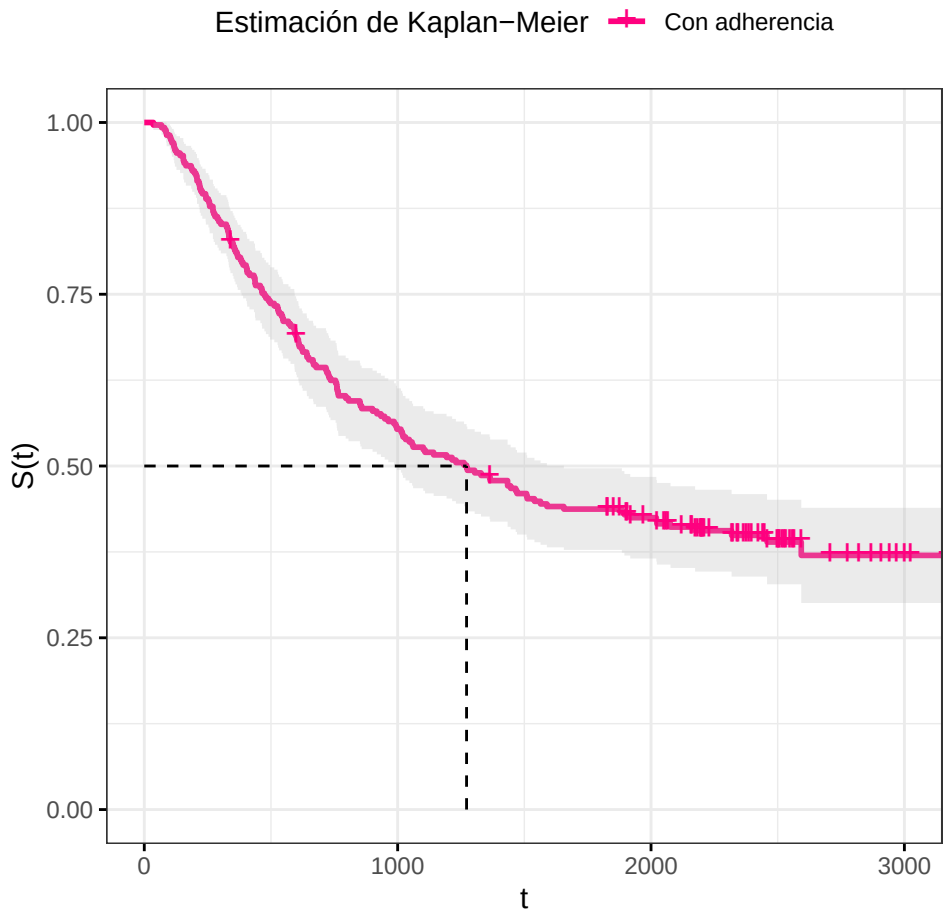
```
## Call: survfit(formula = Surv(data_ad2$time, data_ad2$status) ~ 1, data = data_ad2,
##     type = "kaplan-meier", conf.type = "plain", conf.int = 0.95)
##
##  time n.risk n.event survival std.err lower 95% CI upper 95% CI
##    36    270       1    0.996 0.00370        0.989        1.000
##    68    269       1    0.993 0.00522        0.982        1.000
##    80    268       1    0.989 0.00638        0.976        1.000
##    86    267       1    0.985 0.00735        0.971        1.000
##    88    266       1    0.981 0.00820        0.965        0.998
```

```
##   101   265       1    0.978 0.00897        0.960        0.995
##   105   264       1    0.974 0.00967        0.955        0.993
##   109   263       1    0.970 0.01032        0.950        0.991
##   116   262       1    0.967 0.01092        0.945        0.988
##   118   261       1    0.963 0.01149        0.940        0.985
##   121   260       1    0.959 0.01203        0.936        0.983
##   127   259       1    0.956 0.01254        0.931        0.980
##   141   258       1    0.952 0.01303        0.926        0.977
##   154   257       2    0.944 0.01394        0.917        0.972
##   157   255       1    0.941 0.01437        0.913        0.969
##   164   254       1    0.937 0.01478        0.908        0.966
##   185   253       1    0.933 0.01518        0.904        0.963
##   189   252       1    0.930 0.01557        0.899        0.960
##   198   251       1    0.926 0.01594        0.895        0.957
##   204   250       1    0.922 0.01630        0.890        0.954
##   208   249       2    0.915 0.01699        0.882        0.948
##   215   247       1    0.911 0.01732        0.877        0.945
##   218   246       1    0.907 0.01764        0.873        0.942
##   219   245       1    0.904 0.01795        0.869        0.939
##   223   244       1    0.900 0.01826        0.864        0.936
##   229   243       1    0.896 0.01855        0.860        0.933
##   242   242       1    0.893 0.01884        0.856        0.930
##   243   241       1    0.889 0.01913        0.851        0.926
##   253   240       1    0.885 0.01940        0.847        0.923
##   257   239       1    0.881 0.01967        0.843        0.920
##   258   238       1    0.878 0.01993        0.839        0.917
##   271   237       2    0.870 0.02044        0.830        0.910
##   274   235       1    0.867 0.02069        0.826        0.907
##   279   234       1    0.863 0.02093        0.822        0.904
##   289   233       1    0.859 0.02116        0.818        0.901
##   294   232       1    0.856 0.02139        0.814        0.897
##   302   231       1    0.852 0.02162        0.809        0.894
##   324   230       1    0.848 0.02184        0.805        0.891
##   328   229       1    0.844 0.02206        0.801        0.888
##   331   228       1    0.841 0.02227        0.797        0.884
##   333   227       1    0.837 0.02248        0.793        0.881
##   334   226       1    0.833 0.02268        0.789        0.878
##   337   225       1    0.830 0.02288        0.785        0.874
##   340   224       1    0.826 0.02308        0.781        0.871
##   349   222       1    0.822 0.02327        0.777        0.868
##   352   221       1    0.818 0.02346        0.773        0.864
##   356   220       1    0.815 0.02365        0.768        0.861
##   360   219       1    0.811 0.02383        0.764        0.858
##   366   218       1    0.807 0.02401        0.760        0.854
##   369   217       1    0.804 0.02418        0.756        0.851
##   380   216       1    0.800 0.02436        0.752        0.848
##   384   215       1    0.796 0.02453        0.748        0.844
##   390   214       1    0.792 0.02469        0.744        0.841
##   402   213       1    0.789 0.02486        0.740        0.837
##   405   212       1    0.785 0.02501        0.736        0.834
##   406   211       1    0.781 0.02517        0.732        0.831
##   415   210       1    0.778 0.02532        0.728        0.827
##   433   209       1    0.774 0.02548        0.724        0.824
##   437   208       2    0.766 0.02577        0.716        0.817
```

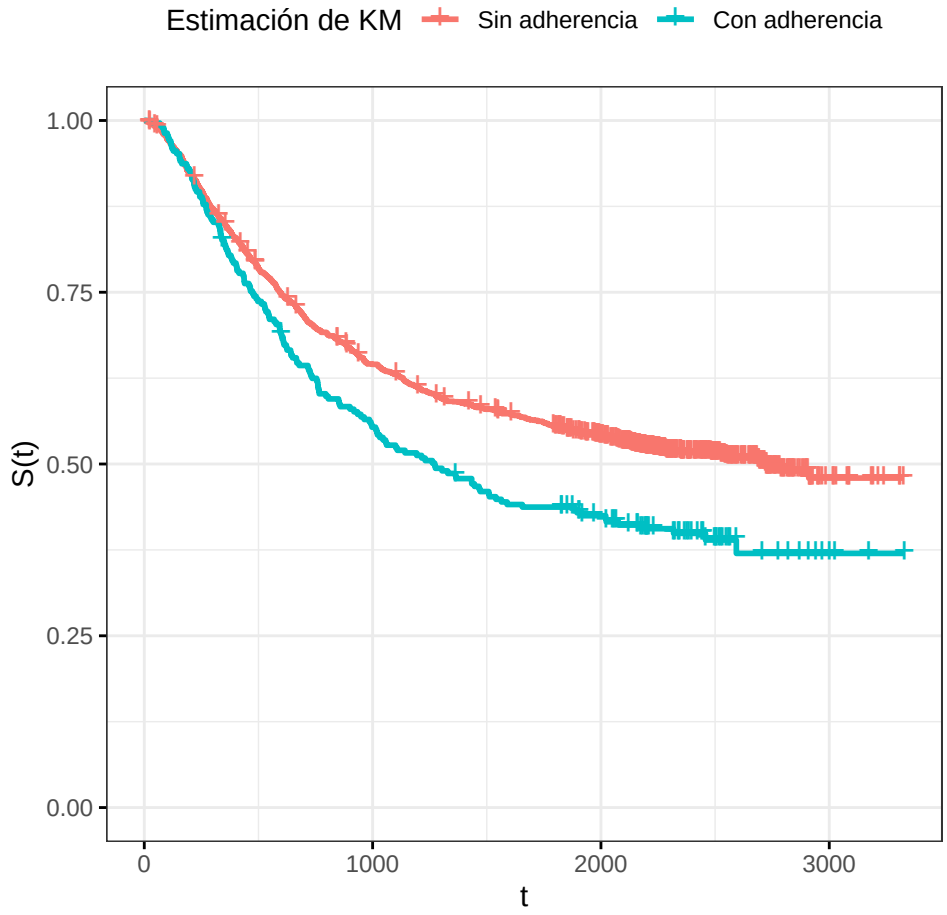
```
##   439   206       1   0.763 0.02591       0.712       0.813
##   458   205       1   0.759 0.02605       0.708       0.810
##   464   204       1   0.755 0.02619       0.704       0.807
##   465   203       1   0.752 0.02632       0.700       0.803
##   474   202       1   0.748 0.02645       0.696       0.800
##   480   201       1   0.744 0.02658       0.692       0.796
##   490   200       1   0.740 0.02671       0.688       0.793
##   497   199       1   0.737 0.02683       0.684       0.789
##   513   198       1   0.733 0.02695       0.680       0.786
##   526   197       1   0.729 0.02707       0.676       0.782
##   528   196       1   0.725 0.02719       0.672       0.779
##   532   195       1   0.722 0.02730       0.668       0.775
##   542   194       1   0.718 0.02741       0.664       0.772
##   546   193       1   0.714 0.02752       0.660       0.768
##   548   192       1   0.711 0.02763       0.656       0.765
##   569   191       1   0.707 0.02773       0.653       0.761
##   577   190       1   0.703 0.02784       0.649       0.758
##   592   189       1   0.699 0.02794       0.645       0.754
##   593   188       1   0.696 0.02803       0.641       0.751
##   594   187       1   0.692 0.02813       0.637       0.747
##   599   186       1   0.688 0.02822       0.633       0.744
##   602   184       1   0.685 0.02832       0.629       0.740
##   608   183       1   0.681 0.02841       0.625       0.736
##   609   182       1   0.677 0.02850       0.621       0.733
##   612   181       1   0.673 0.02858       0.617       0.729
##   622   180       1   0.670 0.02867       0.613       0.726
##   625   179       1   0.666 0.02875       0.609       0.722
##   641   178       1   0.662 0.02883       0.606       0.719
##   642   177       1   0.658 0.02891       0.602       0.715
##   649   176       1   0.655 0.02899       0.598       0.711
##   666   175       1   0.651 0.02906       0.594       0.708
##   668   174       1   0.647 0.02914       0.590       0.704
##   678   173       1   0.643 0.02921       0.586       0.701
##   717   172       1   0.640 0.02927       0.582       0.697
##   720   171       1   0.636 0.02934       0.578       0.693
##   726   170       1   0.632 0.02941       0.575       0.690
##   729   169       1   0.628 0.02947       0.571       0.686
##   735   168       1   0.625 0.02953       0.567       0.683
##   755   167       1   0.621 0.02959       0.563       0.679
##   759   166       1   0.617 0.02965       0.559       0.675
##   760   165       1   0.613 0.02970       0.555       0.672
##   761   164       1   0.610 0.02976       0.551       0.668
##   765   163       1   0.606 0.02981       0.548       0.664
##   766   162       1   0.602 0.02986       0.544       0.661
##   795   161       1   0.598 0.02991       0.540       0.657
##   806   160       1   0.595 0.02995       0.536       0.653
##   851   159       1   0.591 0.03000       0.532       0.650
##   853   158       1   0.587 0.03004       0.528       0.646
##   858   157       1   0.584 0.03008       0.525       0.642
##   901   156       1   0.580 0.03012       0.521       0.639
##   918   155       1   0.576 0.03015       0.517       0.635
##   934   154       1   0.572 0.03019       0.513       0.631
##   949   153       1   0.569 0.03022       0.509       0.628
##   963   152       1   0.565 0.03026       0.506       0.624
```

```
##   986     151       1    0.561 0.03029        0.502        0.620
##   993     150       1    0.557 0.03031        0.498        0.617
##   997     149       1    0.554 0.03034        0.494        0.613
##  1013     148       1    0.550 0.03036        0.490        0.609
##  1018     147       1    0.546 0.03039        0.487        0.606
##  1021     146       1    0.542 0.03041        0.483        0.602
##  1031     145       1    0.539 0.03043        0.479        0.598
##  1046     144       1    0.535 0.03045        0.475        0.595
##  1057     143       1    0.531 0.03046        0.471        0.591
##  1061     142       1    0.527 0.03048        0.468        0.587
##  1101     141       1    0.524 0.03049        0.464        0.583
##  1108     140       1    0.520 0.03050        0.460        0.580
##  1142     139       1    0.516 0.03051        0.456        0.576
##  1193     138       1    0.512 0.03052        0.453        0.572
##  1215     137       1    0.509 0.03052        0.449        0.569
##  1230     136       1    0.505 0.03053        0.445        0.565
##  1262     135       1    0.501 0.03053        0.441        0.561
##  1272     134       1    0.498 0.03053        0.438        0.557
##  1275     133       1    0.494 0.03053        0.434        0.554
##  1304     132       1    0.490 0.03052        0.430        0.550
##  1329     131       1    0.486 0.03052        0.426        0.546
##  1363     130       1    0.483 0.03051        0.423        0.542
##  1365     128       1    0.479 0.03051        0.419        0.539
##  1434     127       2    0.471 0.03049        0.411        0.531
##  1446     125       1    0.467 0.03048        0.408        0.527
##  1466     124       1    0.464 0.03046        0.404        0.523
##  1471     123       1    0.460 0.03045        0.400        0.520
##  1509     122       1    0.456 0.03043        0.397        0.516
##  1511     121       1    0.452 0.03041        0.393        0.512
##  1540     120       1    0.449 0.03039        0.389        0.508
##  1564     119       1    0.445 0.03037        0.385        0.504
##  1589     118       1    0.441 0.03034        0.382        0.501
##  1656     117       1    0.437 0.03032        0.378        0.497
##  1885     106       1    0.433 0.03031        0.374        0.493
##  1895     105       1    0.429 0.03030        0.370        0.488
##  1918     100       1    0.425 0.03030        0.365        0.484
##  2021      96       1    0.420 0.03031        0.361        0.480
##  2023      95       1    0.416 0.03031        0.357        0.475
##  2077      86       1    0.411 0.03034        0.352        0.471
##  2174      79       1    0.406 0.03040        0.346        0.465
##  2318      60       1    0.399 0.03064        0.339        0.459
##  2458      41       1    0.389 0.03140        0.328        0.451
##  2593      20       1    0.370 0.03535        0.301        0.439
```

Para la gráfica:



Si se recopilan ambas gráficas:



Se puede observar que la curva de las personas que tienen adherencia de cáncer en otras partes de su cuerpo no se cruza con la curva de las personas que no tienen adherencia.

Es por eso que gráficamente se podría concluir que no tienen la misma supervivencia.

Elaborando las pruebas, se tienen las hipótesis:

$$H_0 : S_j(t) = S_k(t) \text{ Para toda } t > 0 \text{ y para toda j, k}$$

$$vs$$

$$H_a : S_j(t) \neq S_k(t) \text{ para alguna } t > 0 \text{ y para alguna } j \neq t$$

Prueba log-rank (Mantel-Haenszel):

```
## Call:
## survdiff(formula = Surv(colon$time, colon$status) ~ colon$adhere,
##     data = colon, rho = 0)
##
##                    N Observed Expected (O-E)^2/E (O-E)^2/V
## colon$adhere=0 1588      759      797      1.78      13.3
```

```
## colon$adhere=1  270      161      123     11.49      13.3
##
##  Chisq= 13.3  on 1 degrees of freedom, p= 3e-04
```

Se obtiene un $p - value = 3e^{-4} < 0.05 = \alpha$ por lo que se rechaza H_0 a un nivel de confianza del 95 %, esto implica que si hay evidencia estadistica para decir que las supervivencias cambian según si existe o no adherencia de cáncer en otras zonas del paciente.

Prueba de Wilcoxon - Peto-Peto:

```
## Call:
## survdiff(formula = Surv(colon$time, colon$status) ~ colon$adhere,
##     data = colon, rho = 1)
##
##                    N Observed Expected (O-E)^2/E (O-E)^2/V
## colon$adhere=0 1588      570    597.1      1.21      11.3
## colon$adhere=1  270      121     93.9      7.70      11.3
##
##  Chisq= 11.3  on 1 degrees of freedom, p= 8e-04
```

Se obtiene un $p - value = 8e^{-4} < 0.05 = \alpha$ por lo que se rechaza H_0 a un nivel de confianza del 95 %, esto quiere decir que existe evidencia estadistica de que las supervivencias no son las mismas para personas que tengan adherencia de cáncer en otras partes del cuerpo.

Para ambas pruebas se rechaza la hipotesis nula, es decir, se puede concluir que la supervivencia no es la misma si se presenta adherencia de cáncer en otras partes del cuerpo.

Por lo tanto el tiempo de supervivencia es diferente si el paciente tiene adherencia de cáncer en otras partes de su cuerpo.

Características adicionales.

Para calcular la falla de los pacientes:

```
## Call: survfit(formula = survObject ~ 1, type = "kaplan-meier", conf.type = "plain",
##     conf.int = 0.95)
##
##  time n.risk n.event survival  std.err lower 95% CI upper 95% CI
##     8   1858       1    0.999 0.000538        0.998        1.000
##     9   1857       1    0.999 0.000761        0.997        1.000
##    19   1856       1    0.998 0.000931        0.997        1.000
##    20   1855       1    0.998 0.001075        0.996        1.000
##    23   1854       1    0.997 0.001202        0.995        1.000
##    24   1852       1    0.997 0.001316        0.994        0.999
##    28   1850       1    0.996 0.001422        0.993        0.999
##    34   1849       1    0.996 0.001520        0.993        0.999
##    35   1848       1    0.995 0.001611        0.992        0.998
##    36   1847       1    0.995 0.001698        0.991        0.998
##    38   1846       1    0.994 0.001781        0.991        0.998
##    40   1845       1    0.994 0.001859        0.990        0.997
##    43   1844       1    0.993 0.001935        0.989        0.997
##    45   1843       2    0.992 0.002077        0.988        0.996
##    49   1840       1    0.991 0.002145        0.987        0.996
##    52   1839       1    0.991 0.002211        0.987        0.995
```

```
##    56   1838       1    0.990 0.002274        0.986        0.995
##    59   1836       1    0.990 0.002336        0.985        0.994
##    62   1835       2    0.989 0.002455        0.984        0.993
##    63   1833       1    0.988 0.002512        0.983        0.993
##    68   1832       1    0.988 0.002568        0.983        0.993
##    72   1831       2    0.987 0.002676        0.981        0.992
##    77   1829       2    0.985 0.002780        0.980        0.991
##    78   1827       1    0.985 0.002830        0.979        0.990
##    79   1826       2    0.984 0.002928        0.978        0.990
##    80   1824       3    0.982 0.003069        0.976        0.988
##    85   1821       2    0.981 0.003159        0.975        0.987
##    86   1819       2    0.980 0.003246        0.974        0.986
##    88   1817       1    0.980 0.003289        0.973        0.986
##    91   1816       2    0.978 0.003372        0.972        0.985
##    93   1814       1    0.978 0.003413        0.971        0.985
##    94   1813       1    0.977 0.003454        0.971        0.984
##    98   1812       3    0.976 0.003572        0.969        0.983
##    99   1809       2    0.975 0.003649        0.968        0.982
##   100   1807       1    0.974 0.003686        0.967        0.981
##   101   1806       2    0.973 0.003760        0.966        0.980
##   102   1804       1    0.973 0.003797        0.965        0.980
##   103   1803       1    0.972 0.003833        0.964        0.979
##   105   1802       1    0.971 0.003869        0.964        0.979
##   106   1801       1    0.971 0.003904        0.963        0.979
##   108   1800       1    0.970 0.003939        0.963        0.978
##   109   1799       1    0.970 0.003973        0.962        0.978
##   111   1798       1    0.969 0.004008        0.961        0.977
##   113   1797       4    0.967 0.004141        0.959        0.975
##   116   1793       3    0.965 0.004238        0.957        0.974
##   118   1790       1    0.965 0.004270        0.957        0.973
##   119   1789       1    0.964 0.004302        0.956        0.973
##   121   1788       2    0.963 0.004364        0.955        0.972
##   122   1786       2    0.962 0.004425        0.954        0.971
##   125   1784       1    0.962 0.004456        0.953        0.970
##   127   1783       2    0.961 0.004515        0.952        0.969
##   129   1781       1    0.960 0.004545        0.951        0.969
##   131   1780       1    0.960 0.004574        0.951        0.969
##   132   1779       1    0.959 0.004603        0.950        0.968
##   133   1778       1    0.958 0.004632        0.949        0.968
##   134   1777       1    0.958 0.004661        0.949        0.967
##   136   1776       1    0.957 0.004690        0.948        0.967
##   138   1775       1    0.957 0.004718        0.948        0.966
##   139   1774       1    0.956 0.004746        0.947        0.966
##   141   1773       2    0.955 0.004801        0.946        0.965
##   143   1771       1    0.955 0.004829        0.945        0.964
##   144   1770       1    0.954 0.004856        0.945        0.964
##   145   1769       2    0.953 0.004910        0.943        0.963
##   146   1767       2    0.952 0.004964        0.942        0.962
##   147   1765       1    0.951 0.004990        0.942        0.961
##   150   1764       1    0.951 0.005016        0.941        0.961
##   154   1763       2    0.950 0.005068        0.940        0.960
##   157   1761       3    0.948 0.005145        0.938        0.958
##   160   1758       1    0.948 0.005170        0.938        0.958
##   161   1757       2    0.947 0.005220        0.936        0.957
```

```
##   164   1755       1    0.946 0.005245        0.936        0.956
##   165   1754       4    0.944 0.005343        0.933        0.954
##   166   1750       2    0.943 0.005391        0.932        0.953
##   167   1748       1    0.942 0.005415        0.932        0.953
##   168   1747       1    0.942 0.005439        0.931        0.952
##   169   1746       1    0.941 0.005462        0.931        0.952
##   171   1745       2    0.940 0.005509        0.929        0.951
##   173   1743       3    0.939 0.005578        0.928        0.949
##   174   1740       3    0.937 0.005646        0.926        0.948
##   175   1737       1    0.936 0.005669        0.925        0.947
##   176   1736       2    0.935 0.005713        0.924        0.946
##   179   1734       1    0.935 0.005735        0.924        0.946
##   181   1733       1    0.934 0.005757        0.923        0.945
##   183   1732       2    0.933 0.005801        0.922        0.944
##   185   1730       5    0.930 0.005908        0.919        0.942
##   186   1725       2    0.929 0.005950        0.918        0.941
##   187   1723       1    0.929 0.005971        0.917        0.941
##   188   1722       1    0.928 0.005992        0.917        0.940
##   189   1721       2    0.927 0.006034        0.915        0.939
##   191   1719       3    0.926 0.006095        0.914        0.938
##   196   1716       1    0.925 0.006115        0.913        0.937
##   198   1715       1    0.924 0.006135        0.912        0.937
##   199   1714       1    0.924 0.006155        0.912        0.936
##   201   1713       2    0.923 0.006195        0.911        0.935
##   203   1711       1    0.922 0.006215        0.910        0.935
##   204   1710       1    0.922 0.006235        0.910        0.934
##   205   1709       1    0.921 0.006255        0.909        0.934
##   206   1708       1    0.921 0.006274        0.908        0.933
##   208   1707       3    0.919 0.006332        0.907        0.932
##   215   1704       3    0.917 0.006390        0.905        0.930
##   216   1701       1    0.917 0.006409        0.904        0.930
##   218   1700       4    0.915 0.006484        0.902        0.927
##   219   1696       3    0.913 0.006539        0.900        0.926
##   221   1692       1    0.913 0.006558        0.900        0.925
##   222   1691       1    0.912 0.006576        0.899        0.925
##   223   1690       1    0.912 0.006594        0.899        0.924
##   224   1689       1    0.911 0.006612        0.898        0.924
##   226   1688       1    0.910 0.006630        0.897        0.923
##   227   1687       1    0.910 0.006648        0.897        0.923
##   228   1686       1    0.909 0.006666        0.896        0.922
##   229   1685       2    0.908 0.006702        0.895        0.921
##   230   1683       5    0.906 0.006790        0.892        0.919
##   232   1678       1    0.905 0.006807        0.892        0.918
##   235   1677       1    0.905 0.006824        0.891        0.918
##   237   1676       2    0.903 0.006859        0.890        0.917
##   238   1674       3    0.902 0.006910        0.888        0.915
##   241   1671       1    0.901 0.006927        0.888        0.915
##   242   1670       2    0.900 0.006960        0.887        0.914
##   243   1668       1    0.900 0.006977        0.886        0.913
##   245   1667       2    0.899 0.007010        0.885        0.912
##   246   1665       1    0.898 0.007027        0.884        0.912
##   248   1664       1    0.898 0.007043        0.884        0.911
##   250   1663       1    0.897 0.007060        0.883        0.911
##   251   1662       1    0.896 0.007076        0.883        0.910
```

```
##   252   1661       1    0.896 0.007092        0.882        0.910
##   253   1660       2    0.895 0.007125        0.881        0.909
##   255   1658       1    0.894 0.007141        0.880        0.908
##   256   1657       2    0.893 0.007173        0.879        0.907
##   257   1655       2    0.892 0.007205        0.878        0.906
##   258   1653       1    0.892 0.007221        0.877        0.906
##   259   1652       2    0.891 0.007252        0.876        0.905
##   260   1650       2    0.889 0.007283        0.875        0.904
##   261   1648       1    0.889 0.007299        0.875        0.903
##   262   1647       1    0.888 0.007314        0.874        0.903
##   263   1646       2    0.887 0.007345        0.873        0.902
##   264   1644       2    0.886 0.007376        0.872        0.901
##   269   1642       1    0.886 0.007391        0.871        0.900
##   271   1641       3    0.884 0.007437        0.869        0.899
##   273   1638       1    0.883 0.007452        0.869        0.898
##   274   1637       2    0.882 0.007481        0.868        0.897
##   275   1635       1    0.882 0.007496        0.867        0.897
##   276   1634       3    0.880 0.007541        0.865        0.895
##   279   1631       4    0.878 0.007599        0.863        0.893
##   280   1627       1    0.878 0.007613        0.863        0.892
##   283   1626       2    0.876 0.007642        0.861        0.891
##   285   1624       1    0.876 0.007657        0.861        0.891
##   286   1623       3    0.874 0.007699        0.859        0.889
##   289   1620       1    0.874 0.007713        0.859        0.889
##   290   1619       2    0.873 0.007742        0.858        0.888
##   291   1617       1    0.872 0.007756        0.857        0.887
##   293   1616       1    0.872 0.007769        0.856        0.887
##   294   1615       2    0.871 0.007797        0.855        0.886
##   296   1613       2    0.869 0.007825        0.854        0.885
##   300   1611       1    0.869 0.007839        0.854        0.884
##   302   1610       1    0.868 0.007852        0.853        0.884
##   303   1609       1    0.868 0.007866        0.852        0.883
##   304   1608       2    0.867 0.007893        0.851        0.882
##   308   1606       1    0.866 0.007907        0.851        0.882
##   311   1605       1    0.866 0.007920        0.850        0.881
##   313   1604       2    0.865 0.007947        0.849        0.880
##   314   1602       2    0.864 0.007974        0.848        0.879
##   315   1600       2    0.862 0.008000        0.847        0.878
##   316   1598       1    0.862 0.008013        0.846        0.878
##   322   1597       3    0.860 0.008052        0.844        0.876
##   323   1594       1    0.860 0.008066        0.844        0.876
##   324   1593       1    0.859 0.008078        0.843        0.875
##   325   1592       1    0.859 0.008091        0.843        0.875
##   326   1591       1    0.858 0.008104        0.842        0.874
##   328   1589       1    0.858 0.008117        0.842        0.873
##   329   1588       1    0.857 0.008130        0.841        0.873
##   330   1587       2    0.856 0.008156        0.840        0.872
##   331   1585       1    0.855 0.008168        0.839        0.871
##   333   1584       1    0.855 0.008181        0.839        0.871
##   334   1583       1    0.854 0.008194        0.838        0.870
##   335   1582       1    0.854 0.008206        0.838        0.870
##   336   1581       2    0.853 0.008231        0.837        0.869
##   337   1579       3    0.851 0.008269        0.835        0.867
##   340   1576       1    0.851 0.008281        0.834        0.867
```

```
##   341   1574       1    0.850 0.008293        0.834        0.866
##   342   1573       1    0.849 0.008306        0.833        0.866
##   343   1572       1    0.849 0.008318        0.833        0.865
##   344   1571       1    0.848 0.008330        0.832        0.865
##   348   1570       2    0.847 0.008355        0.831        0.864
##   349   1568       2    0.846 0.008379        0.830        0.863
##   352   1566       2    0.845 0.008403        0.829        0.862
##   354   1564       1    0.845 0.008415        0.828        0.861
##   355   1563       2    0.844 0.008439        0.827        0.860
##   356   1560       3    0.842 0.008474        0.825        0.859
##   360   1557       2    0.841 0.008498        0.824        0.857
##   362   1555       2    0.840 0.008521        0.823        0.856
##   363   1553       1    0.839 0.008533        0.822        0.856
##   365   1552       2    0.838 0.008556        0.821        0.855
##   366   1550       2    0.837 0.008579        0.820        0.854
##   369   1548       1    0.837 0.008591        0.820        0.853
##   370   1547       1    0.836 0.008602        0.819        0.853
##   372   1546       2    0.835 0.008625        0.818        0.852
##   374   1544       1    0.834 0.008636        0.817        0.851
##   376   1543       1    0.834 0.008648        0.817        0.851
##   378   1542       1    0.833 0.008659        0.816        0.850
##   379   1541       1    0.833 0.008670        0.816        0.850
##   380   1540       2    0.832 0.008692        0.815        0.849
##   381   1538       1    0.831 0.008704        0.814        0.848
##   382   1537       2    0.830 0.008726        0.813        0.847
##   384   1535       3    0.828 0.008759        0.811        0.846
##   386   1532       2    0.827 0.008781        0.810        0.845
##   389   1530       2    0.826 0.008803        0.809        0.843
##   390   1528       1    0.826 0.008813        0.808        0.843
##   392   1527       1    0.825 0.008824        0.808        0.842
##   393   1526       1    0.825 0.008835        0.807        0.842
##   398   1525       1    0.824 0.008846        0.807        0.841
##   400   1524       1    0.824 0.008856        0.806        0.841
##   401   1523       1    0.823 0.008867        0.806        0.840
##   402   1522       2    0.822 0.008888        0.804        0.839
##   405   1520       1    0.821 0.008899        0.804        0.839
##   406   1519       2    0.820 0.008920        0.803        0.838
##   408   1517       1    0.820 0.008930        0.802        0.837
##   409   1516       1    0.819 0.008941        0.802        0.837
##   411   1515       2    0.818 0.008962        0.801        0.836
##   413   1513       3    0.817 0.008993        0.799        0.834
##   415   1510       2    0.815 0.009013        0.798        0.833
##   417   1508       1    0.815 0.009024        0.797        0.833
##   420   1507       1    0.814 0.009034        0.797        0.832
##   421   1506       1    0.814 0.009044        0.796        0.832
##   422   1504       2    0.813 0.009064        0.795        0.830
##   428   1502       1    0.812 0.009074        0.794        0.830
##   429   1501       1    0.812 0.009084        0.794        0.829
##   430   1500       2    0.811 0.009104        0.793        0.828
##   431   1498       1    0.810 0.009114        0.792        0.828
##   433   1497       2    0.809 0.009134        0.791        0.827
##   434   1495       1    0.808 0.009144        0.790        0.826
##   435   1494       1    0.808 0.009154        0.790        0.826
##   437   1493       2    0.807 0.009174        0.789        0.825
```

```
##   438   1491       3    0.805 0.009203        0.787        0.823
##   439   1488       2    0.804 0.009222        0.786        0.822
##   440   1486       1    0.804 0.009232        0.785        0.822
##   441   1485       1    0.803 0.009242        0.785        0.821
##   443   1484       2    0.802 0.009261        0.784        0.820
##   444   1482       1    0.801 0.009270        0.783        0.820
##   448   1481       2    0.800 0.009289        0.782        0.818
##   449   1479       1    0.800 0.009299        0.782        0.818
##   454   1476       3    0.798 0.009327        0.780        0.816
##   458   1473       2    0.797 0.009346        0.779        0.815
##   459   1471       1    0.796 0.009355        0.778        0.815
##   460   1470       1    0.796 0.009365        0.778        0.814
##   461   1469       1    0.795 0.009374        0.777        0.814
##   462   1468       1    0.795 0.009383        0.776        0.813
##   464   1467       1    0.794 0.009392        0.776        0.813
##   465   1466       3    0.793 0.009420        0.774        0.811
##   466   1463       2    0.792 0.009438        0.773        0.810
##   469   1461       1    0.791 0.009447        0.773        0.810
##   472   1460       1    0.791 0.009456        0.772        0.809
##   474   1459       2    0.789 0.009474        0.771        0.808
##   475   1457       1    0.789 0.009483        0.770        0.807
##   476   1456       1    0.788 0.009492        0.770        0.807
##   480   1455       1    0.788 0.009501        0.769        0.806
##   482   1454       1    0.787 0.009510        0.769        0.806
##   484   1453       1    0.787 0.009519        0.768        0.805
##   485   1452       2    0.786 0.009537        0.767        0.804
##   486   1449       1    0.785 0.009546        0.766        0.804
##   489   1447       1    0.785 0.009554        0.766        0.803
##   490   1446       2    0.783 0.009572        0.765        0.802
##   491   1444       2    0.782 0.009589        0.764        0.801
##   493   1442       1    0.782 0.009598        0.763        0.801
##   495   1441       1    0.781 0.009607        0.762        0.800
##   496   1440       1    0.781 0.009615        0.762        0.800
##   497   1439       1    0.780 0.009624        0.761        0.799
##   498   1438       2    0.779 0.009641        0.760        0.798
##   499   1436       4    0.777 0.009675        0.758        0.796
##   503   1432       1    0.776 0.009684        0.757        0.795
##   504   1431       1    0.776 0.009692        0.757        0.795
##   505   1430       1    0.775 0.009700        0.756        0.794
##   506   1429       1    0.775 0.009709        0.756        0.794
##   510   1428       2    0.774 0.009725        0.755        0.793
##   511   1426       1    0.773 0.009734        0.754        0.792
##   512   1425       1    0.773 0.009742        0.754        0.792
##   513   1424       1    0.772 0.009750        0.753        0.791
##   522   1423       1    0.772 0.009759        0.752        0.791
##   523   1422       1    0.771 0.009767        0.752        0.790
##   525   1421       1    0.770 0.009775        0.751        0.790
##   526   1420       1    0.770 0.009783        0.751        0.789
##   527   1419       1    0.769 0.009791        0.750        0.789
##   528   1418       1    0.769 0.009799        0.750        0.788
##   529   1417       1    0.768 0.009807        0.749        0.788
##   532   1416       2    0.767 0.009824        0.748        0.786
##   534   1414       1    0.767 0.009832        0.747        0.786
##   536   1413       1    0.766 0.009840        0.747        0.785
```

```
##   537   1412       1    0.766 0.009848        0.746        0.785
##   540   1411       1    0.765 0.009855        0.746        0.784
##   542   1410       1    0.764 0.009863        0.745        0.784
##   543   1409       2    0.763 0.009879        0.744        0.783
##   546   1407       1    0.763 0.009887        0.743        0.782
##   547   1406       1    0.762 0.009895        0.743        0.782
##   548   1405       1    0.762 0.009903        0.742        0.781
##   550   1404       1    0.761 0.009911        0.742        0.781
##   553   1403       1    0.761 0.009918        0.741        0.780
##   554   1402       2    0.760 0.009934        0.740        0.779
##   555   1400       1    0.759 0.009942        0.740        0.779
##   559   1399       1    0.759 0.009949        0.739        0.778
##   560   1398       1    0.758 0.009957        0.738        0.777
##   561   1397       1    0.757 0.009965        0.738        0.777
##   563   1396       2    0.756 0.009980        0.737        0.776
##   565   1394       1    0.756 0.009987        0.736        0.775
##   569   1393       1    0.755 0.009995        0.736        0.775
##   570   1392       1    0.755 0.010002        0.735        0.774
##   573   1391       3    0.753 0.010025        0.733        0.773
##   576   1388       2    0.752 0.010040        0.732        0.772
##   577   1386       1    0.751 0.010047        0.732        0.771
##   578   1385       3    0.750 0.010069        0.730        0.770
##   580   1382       2    0.749 0.010084        0.729        0.769
##   581   1380       1    0.748 0.010091        0.728        0.768
##   582   1379       1    0.748 0.010098        0.728        0.767
##   583   1378       2    0.747 0.010113        0.727        0.766
##   587   1376       1    0.746 0.010120        0.726        0.766
##   589   1375       1    0.745 0.010127        0.726        0.765
##   591   1374       2    0.744 0.010142        0.725        0.764
##   592   1372       1    0.744 0.010149        0.724        0.764
##   593   1371       3    0.742 0.010170        0.722        0.762
##   594   1368       2    0.741 0.010184        0.721        0.761
##   595   1366       1    0.741 0.010191        0.721        0.761
##   599   1365       2    0.740 0.010205        0.720        0.760
##   601   1362       1    0.739 0.010212        0.719        0.759
##   602   1361       3    0.737 0.010232        0.717        0.757
##   603   1358       1    0.737 0.010239        0.717        0.757
##   604   1357       1    0.736 0.010246        0.716        0.756
##   608   1356       2    0.735 0.010260        0.715        0.755
##   609   1354       1    0.735 0.010267        0.715        0.755
##   612   1353       1    0.734 0.010273        0.714        0.754
##   613   1352       1    0.734 0.010280        0.713        0.754
##   614   1351       1    0.733 0.010287        0.713        0.753
##   615   1350       1    0.732 0.010293        0.712        0.753
##   616   1349       2    0.731 0.010307        0.711        0.752
##   617   1347       1    0.731 0.010313        0.711        0.751
##   622   1346       2    0.730 0.010327        0.710        0.750
##   625   1344       1    0.729 0.010333        0.709        0.749
##   628   1343       1    0.729 0.010340        0.708        0.749
##   629   1341       1    0.728 0.010346        0.708        0.748
##   632   1340       1    0.728 0.010353        0.707        0.748
##   636   1339       1    0.727 0.010359        0.707        0.747
##   638   1338       1    0.726 0.010366        0.706        0.747
##   641   1337       1    0.726 0.010372        0.706        0.746
```

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##   642   1336       2    0.725 0.010385        0.705        0.745
##   643   1334       2    0.724 0.010398        0.703        0.744
##   647   1332       1    0.723 0.010405        0.703        0.744
##   649   1331       1    0.723 0.010411        0.702        0.743
##   653   1330       1    0.722 0.010417        0.702        0.743
##   654   1329       1    0.722 0.010424        0.701        0.742
##   657   1328       1    0.721 0.010430        0.701        0.741
##   659   1327       2    0.720 0.010442        0.700        0.740
##   663   1325       3    0.718 0.010461        0.698        0.739
##   664   1322       1    0.718 0.010467        0.697        0.738
##   665   1321       1    0.717 0.010473        0.697        0.738
##   666   1319       1    0.717 0.010480        0.696        0.737
##   668   1318       1    0.716 0.010486        0.696        0.737
##   669   1317       1    0.716 0.010492        0.695        0.736
##   670   1316       1    0.715 0.010498        0.695        0.736
##   672   1315       1    0.715 0.010504        0.694        0.735
##   673   1314       1    0.714 0.010510        0.693        0.735
##   674   1313       1    0.713 0.010516        0.693        0.734
##   675   1312       2    0.712 0.010528        0.692        0.733
##   678   1310       1    0.712 0.010534        0.691        0.732
##   680   1309       1    0.711 0.010540        0.691        0.732
##   683   1308       1    0.711 0.010546        0.690        0.731
##   684   1307       1    0.710 0.010552        0.690        0.731
##   685   1306       1    0.710 0.010558        0.689        0.730
##   686   1305       1    0.709 0.010564        0.688        0.730
##   687   1304       1    0.709 0.010570        0.688        0.729
##   692   1303       3    0.707 0.010587        0.686        0.728
##   693   1300       1    0.706 0.010593        0.686        0.727
##   696   1299       1    0.706 0.010599        0.685        0.727
##   697   1298       1    0.705 0.010605        0.685        0.726
##   700   1297       2    0.704 0.010616        0.683        0.725
##   701   1295       1    0.704 0.010622        0.683        0.724
##   702   1294       2    0.703 0.010633        0.682        0.723
##   706   1292       1    0.702 0.010639        0.681        0.723
##   708   1291       1    0.701 0.010645        0.681        0.722
##   709   1290       2    0.700 0.010656        0.680        0.721
##   711   1288       1    0.700 0.010662        0.679        0.721
##   712   1287       2    0.699 0.010673        0.678        0.720
##   716   1285       1    0.698 0.010678        0.677        0.719
##   717   1284       2    0.697 0.010689        0.676        0.718
##   718   1282       1    0.697 0.010695        0.676        0.718
##   720   1281       1    0.696 0.010700        0.675        0.717
##   721   1280       1    0.696 0.010706        0.675        0.716
##   723   1279       1    0.695 0.010711        0.674        0.716
##   726   1278       1    0.694 0.010716        0.673        0.715
##   729   1277       1    0.694 0.010722        0.673        0.715
##   730   1276       2    0.693 0.010733        0.672        0.714
##   731   1274       1    0.692 0.010738        0.671        0.713
##   735   1273       1    0.692 0.010743        0.671        0.713
##   736   1272       1    0.691 0.010749        0.670        0.712
##   739   1271       2    0.690 0.010759        0.669        0.711
##   742   1269       1    0.690 0.010764        0.668        0.711
##   743   1268       2    0.688 0.010775        0.667        0.710
##   748   1266       1    0.688 0.010780        0.667        0.709
```

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##   751   1265       1    0.687 0.010785        0.666        0.708
##   752   1264       1    0.687 0.010790        0.666        0.708
##   753   1263       1    0.686 0.010796        0.665        0.707
##   755   1262       1    0.686 0.010801        0.665        0.707
##   758   1261       1    0.685 0.010806        0.664        0.706
##   759   1260       2    0.684 0.010816        0.663        0.705
##   760   1258       1    0.684 0.010821        0.662        0.705
##   761   1257       1    0.683 0.010826        0.662        0.704
##   764   1256       1    0.682 0.010831        0.661        0.704
##   765   1255       1    0.682 0.010836        0.661        0.703
##   766   1254       1    0.681 0.010841        0.660        0.703
##   770   1253       1    0.681 0.010846        0.660        0.702
##   772   1252       1    0.680 0.010851        0.659        0.702
##   774   1251       2    0.679 0.010861        0.658        0.700
##   775   1249       1    0.679 0.010866        0.657        0.700
##   795   1248       1    0.678 0.010871        0.657        0.699
##   797   1247       2    0.677 0.010880        0.656        0.698
##   802   1245       2    0.676 0.010890        0.655        0.697
##   803   1243       1    0.675 0.010895        0.654        0.697
##   805   1242       1    0.675 0.010900        0.653        0.696
##   806   1241       2    0.674 0.010909        0.652        0.695
##   811   1239       1    0.673 0.010914        0.652        0.695
##   827   1238       1    0.673 0.010919        0.651        0.694
##   828   1237       1    0.672 0.010923        0.651        0.694
##   832   1236       1    0.672 0.010928        0.650        0.693
##   833   1235       2    0.670 0.010937        0.649        0.692
##   835   1233       1    0.670 0.010942        0.648        0.691
##   840   1232       1    0.669 0.010947        0.648        0.691
##   844   1231       1    0.669 0.010951        0.647        0.690
##   845   1229       1    0.668 0.010956        0.647        0.690
##   846   1227       1    0.668 0.010961        0.646        0.689
##   849   1226       1    0.667 0.010965        0.646        0.689
##   851   1225       1    0.667 0.010970        0.645        0.688
##   853   1224       1    0.666 0.010974        0.645        0.688
##   854   1223       1    0.666 0.010979        0.644        0.687
##   855   1222       1    0.665 0.010983        0.644        0.687
##   858   1221       1    0.664 0.010988        0.643        0.686
##   862   1220       1    0.664 0.010992        0.642        0.685
##   863   1219       1    0.663 0.010997        0.642        0.685
##   871   1218       1    0.663 0.011001        0.641        0.684
##   874   1217       1    0.662 0.011006        0.641        0.684
##   875   1216       1    0.662 0.011010        0.640        0.683
##   883   1215       2    0.661 0.011019        0.639        0.682
##   884   1213       1    0.660 0.011023        0.639        0.682
##   885   1211       1    0.660 0.011028        0.638        0.681
##   887   1210       3    0.658 0.011041        0.636        0.680
##   890   1206       1    0.657 0.011045        0.636        0.679
##   891   1205       1    0.657 0.011049        0.635        0.679
##   900   1204       1    0.656 0.011053        0.635        0.678
##   901   1203       1    0.656 0.011058        0.634        0.677
##   902   1202       1    0.655 0.011062        0.634        0.677
##   904   1201       1    0.655 0.011066        0.633        0.676
##   905   1200       2    0.654 0.011075        0.632        0.675
##   909   1198       1    0.653 0.011079        0.631        0.675
```

```
##   911   1197       1    0.653 0.011083        0.631        0.674
##   912   1196       1    0.652 0.011087        0.630        0.674
##   916   1195       1    0.651 0.011091        0.630        0.673
##   918   1194       1    0.651 0.011095        0.629        0.673
##   922   1193       1    0.650 0.011100        0.629        0.672
##   924   1192       1    0.650 0.011104        0.628        0.672
##   928   1191       1    0.649 0.011108        0.627        0.671
##   929   1190       1    0.649 0.011112        0.627        0.670
##   930   1189       1    0.648 0.011116        0.626        0.670
##   931   1188       1    0.648 0.011120        0.626        0.669
##   934   1187       1    0.647 0.011124        0.625        0.669
##   936   1186       2    0.646 0.011132        0.624        0.668
##   938   1184       1    0.645 0.011136        0.624        0.667
##   939   1182       1    0.645 0.011140        0.623        0.667
##   940   1181       1    0.644 0.011144        0.622        0.666
##   942   1180       1    0.644 0.011148        0.622        0.666
##   944   1179       1    0.643 0.011151        0.621        0.665
##   949   1178       1    0.643 0.011155        0.621        0.665
##   952   1177       1    0.642 0.011159        0.620        0.664
##   957   1176       1    0.642 0.011163        0.620        0.663
##   959   1175       1    0.641 0.011167        0.619        0.663
##   960   1174       1    0.640 0.011171        0.619        0.662
##   961   1173       4    0.638 0.011186        0.616        0.660
##   963   1169       1    0.638 0.011190        0.616        0.660
##   966   1168       1    0.637 0.011193        0.615        0.659
##   968   1167       2    0.636 0.011201        0.614        0.658
##   969   1165       1    0.636 0.011205        0.614        0.658
##   975   1164       1    0.635 0.011208        0.613        0.657
##   976   1163       1    0.634 0.011212        0.613        0.656
##   977   1162       1    0.634 0.011215        0.612        0.656
##   986   1161       1    0.633 0.011219        0.611        0.655
##   993   1160       1    0.633 0.011223        0.611        0.655
##   997   1159       2    0.632 0.011230        0.610        0.654
##  1013   1157       1    0.631 0.011233        0.609        0.653
##  1018   1156       1    0.631 0.011237        0.609        0.653
##  1020   1155       1    0.630 0.011241        0.608        0.652
##  1021   1154       1    0.630 0.011244        0.608        0.652
##  1022   1153       1    0.629 0.011248        0.607        0.651
##  1024   1152       1    0.628 0.011251        0.606        0.651
##  1025   1151       1    0.628 0.011254        0.606        0.650
##  1026   1150       1    0.627 0.011258        0.605        0.649
##  1029   1149       1    0.627 0.011261        0.605        0.649
##  1031   1148       1    0.626 0.011265        0.604        0.648
##  1032   1147       1    0.626 0.011268        0.604        0.648
##  1034   1146       1    0.625 0.011272        0.603        0.647
##  1037   1145       2    0.624 0.011278        0.602        0.646
##  1041   1143       1    0.624 0.011282        0.601        0.646
##  1042   1142       1    0.623 0.011285        0.601        0.645
##  1046   1141       1    0.622 0.011288        0.600        0.645
##  1048   1140       1    0.622 0.011292        0.600        0.644
##  1052   1139       1    0.621 0.011295        0.599        0.644
##  1055   1138       1    0.621 0.011298        0.599        0.643
##  1057   1137       2    0.620 0.011305        0.598        0.642
##  1061   1135       1    0.619 0.011308        0.597        0.641
```

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##  1070   1134       1    0.619 0.011311        0.596        0.641
##  1079   1133       1    0.618 0.011314        0.596        0.640
##  1081   1132       1    0.618 0.011317        0.595        0.640
##  1083   1131       1    0.617 0.011321        0.595        0.639
##  1089   1130       1    0.616 0.011324        0.594        0.639
##  1092   1129       1    0.616 0.011327        0.594        0.638
##  1101   1128       1    0.615 0.011330        0.593        0.638
##  1103   1127       1    0.615 0.011333        0.593        0.637
##  1105   1125       1    0.614 0.011336        0.592        0.637
##  1106   1124       1    0.614 0.011339        0.592        0.636
##  1108   1123       1    0.613 0.011342        0.591        0.635
##  1112   1122       1    0.613 0.011345        0.590        0.635
##  1114   1121       1    0.612 0.011348        0.590        0.634
##  1117   1120       1    0.612 0.011351        0.589        0.634
##  1122   1119       2    0.610 0.011357        0.588        0.633
##  1130   1117       1    0.610 0.011360        0.588        0.632
##  1133   1116       1    0.609 0.011363        0.587        0.632
##  1134   1115       1    0.609 0.011366        0.587        0.631
##  1135   1114       1    0.608 0.011369        0.586        0.631
##  1136   1113       1    0.608 0.011372        0.585        0.630
##  1138   1112       1    0.607 0.011375        0.585        0.629
##  1139   1111       2    0.606 0.011381        0.584        0.628
##  1142   1109       1    0.606 0.011384        0.583        0.628
##  1145   1108       2    0.604 0.011389        0.582        0.627
##  1151   1106       1    0.604 0.011392        0.582        0.626
##  1154   1105       1    0.603 0.011395        0.581        0.626
##  1159   1104       2    0.602 0.011400        0.580        0.625
##  1161   1102       1    0.602 0.011403        0.579        0.624
##  1166   1101       1    0.601 0.011406        0.579        0.624
##  1178   1100       2    0.600 0.011411        0.578        0.622
##  1183   1098       1    0.600 0.011414        0.577        0.622
##  1186   1097       1    0.599 0.011417        0.577        0.621
##  1191   1096       1    0.598 0.011419        0.576        0.621
##  1193   1095       1    0.598 0.011422        0.576        0.620
##  1195   1094       1    0.597 0.011425        0.575        0.620
##  1198   1093       1    0.597 0.011427        0.574        0.619
##  1201   1091       1    0.596 0.011430        0.574        0.619
##  1207   1090       1    0.596 0.011432        0.573        0.618
##  1209   1089       1    0.595 0.011435        0.573        0.618
##  1211   1088       1    0.595 0.011438        0.572        0.617
##  1212   1087       1    0.594 0.011440        0.572        0.616
##  1215   1086       1    0.594 0.011443        0.571        0.616
##  1216   1085       1    0.593 0.011445        0.571        0.615
##  1219   1084       1    0.592 0.011448        0.570        0.615
##  1230   1083       1    0.592 0.011450        0.569        0.614
##  1233   1082       1    0.591 0.011453        0.569        0.614
##  1236   1081       1    0.591 0.011455        0.568        0.613
##  1237   1080       1    0.590 0.011458        0.568        0.613
##  1246   1079       2    0.589 0.011462        0.567        0.612
##  1252   1077       1    0.589 0.011465        0.566        0.611
##  1262   1076       2    0.588 0.011470        0.565        0.610
##  1272   1074       1    0.587 0.011472        0.564        0.609
##  1273   1073       1    0.586 0.011474        0.564        0.609
##  1274   1072       1    0.586 0.011477        0.563        0.608
```

```
##  1275   1071       1    0.585 0.011479        0.563        0.608
##  1276   1070       2    0.584 0.011483        0.562        0.607
##  1277   1068       1    0.584 0.011486        0.561        0.606
##  1279   1067       1    0.583 0.011488        0.561        0.606
##  1290   1064       1    0.583 0.011490        0.560        0.605
##  1295   1063       2    0.581 0.011495        0.559        0.604
##  1298   1061       1    0.581 0.011497        0.558        0.603
##  1302   1060       1    0.580 0.011499        0.558        0.603
##  1304   1059       1    0.580 0.011501        0.557        0.602
##  1306   1058       1    0.579 0.011504        0.557        0.602
##  1313   1057       1    0.579 0.011506        0.556        0.601
##  1314   1056       1    0.578 0.011508        0.556        0.601
##  1323   1054       1    0.578 0.011510        0.555        0.600
##  1325   1053       1    0.577 0.011512        0.555        0.600
##  1327   1052       1    0.577 0.011514        0.554        0.599
##  1329   1051       1    0.576 0.011516        0.553        0.599
##  1353   1050       1    0.575 0.011518        0.553        0.598
##  1363   1049       1    0.575 0.011521        0.552        0.597
##  1365   1047       1    0.574 0.011523        0.552        0.597
##  1375   1046       1    0.574 0.011525        0.551        0.596
##  1387   1045       1    0.573 0.011527        0.551        0.596
##  1388   1044       1    0.573 0.011529        0.550        0.595
##  1399   1043       1    0.572 0.011531        0.550        0.595
##  1405   1042       1    0.572 0.011533        0.549        0.594
##  1424   1039       1    0.571 0.011535        0.548        0.594
##  1432   1038       1    0.571 0.011537        0.548        0.593
##  1434   1037       2    0.569 0.011541        0.547        0.592
##  1436   1035       1    0.569 0.011543        0.546        0.591
##  1437   1034       1    0.568 0.011545        0.546        0.591
##  1439   1033       1    0.568 0.011547        0.545        0.590
##  1446   1032       2    0.567 0.011550        0.544        0.589
##  1447   1030       1    0.566 0.011552        0.543        0.589
##  1455   1029       1    0.566 0.011554        0.543        0.588
##  1466   1028       1    0.565 0.011556        0.542        0.588
##  1471   1027       1    0.564 0.011558        0.542        0.587
##  1475   1024       1    0.564 0.011560        0.541        0.587
##  1482   1023       1    0.563 0.011562        0.541        0.586
##  1488   1022       1    0.563 0.011563        0.540        0.585
##  1495   1021       1    0.562 0.011565        0.540        0.585
##  1509   1020       1    0.562 0.011567        0.539        0.584
##  1511   1019       1    0.561 0.011569        0.538        0.584
##  1521   1018       1    0.561 0.011570        0.538        0.583
##  1530   1017       1    0.560 0.011572        0.537        0.583
##  1535   1016       1    0.559 0.011574        0.537        0.582
##  1539   1013       1    0.559 0.011576        0.536        0.582
##  1540   1012       1    0.558 0.011577        0.536        0.581
##  1548   1011       2    0.557 0.011581        0.535        0.580
##  1550   1008       1    0.557 0.011583        0.534        0.579
##  1551   1006       1    0.556 0.011584        0.533        0.579
##  1561   1005       1    0.556 0.011586        0.533        0.578
##  1564   1004       1    0.555 0.011588        0.532        0.578
##  1568   1003       1    0.555 0.011589        0.532        0.577
##  1589   1002       1    0.554 0.011591        0.531        0.577
##  1606   1001       2    0.553 0.011594        0.530        0.576
```

```
##  1607    999       1    0.552 0.011596       0.530       0.575
##  1620    997       1    0.552 0.011597       0.529       0.574
##  1637    996       1    0.551 0.011599       0.528       0.574
##  1644    995       1    0.551 0.011600       0.528       0.573
##  1647    994       1    0.550 0.011602       0.527       0.573
##  1652    993       1    0.550 0.011604       0.527       0.572
##  1656    992       1    0.549 0.011605       0.526       0.572
##  1668    991       2    0.548 0.011608       0.525       0.571
##  1671    989       1    0.547 0.011610       0.525       0.570
##  1679    988       1    0.547 0.011611       0.524       0.570
##  1687    987       1    0.546 0.011612       0.523       0.569
##  1692    986       1    0.546 0.011614       0.523       0.568
##  1709    985       1    0.545 0.011615       0.522       0.568
##  1723    984       2    0.544 0.011618       0.521       0.567
##  1743    982       1    0.543 0.011619       0.521       0.566
##  1745    981       1    0.543 0.011621       0.520       0.566
##  1749    980       1    0.542 0.011622       0.520       0.565
##  1752    979       1    0.542 0.011623       0.519       0.565
##  1759    978       1    0.541 0.011625       0.518       0.564
##  1767    977       1    0.541 0.011626       0.518       0.563
##  1768    976       1    0.540 0.011627       0.517       0.563
##  1772    975       1    0.540 0.011629       0.517       0.562
##  1783    974       1    0.539 0.011630       0.516       0.562
##  1786    973       1    0.538 0.011631       0.516       0.561
##  1788    972       1    0.538 0.011632       0.515       0.561
##  1790    971       1    0.537 0.011633       0.515       0.560
##  1798    968       1    0.537 0.011635       0.514       0.560
##  1812    963       1    0.536 0.011636       0.513       0.559
##  1818    958       1    0.536 0.011637       0.513       0.558
##  1829    942       1    0.535 0.011639       0.512       0.558
##  1831    941       1    0.535 0.011640       0.512       0.557
##  1839    937       1    0.534 0.011642       0.511       0.557
##  1850    936       1    0.533 0.011643       0.511       0.556
##  1851    935       1    0.533 0.011645       0.510       0.556
##  1856    928       1    0.532 0.011647       0.509       0.555
##  1875    918       1    0.532 0.011648       0.509       0.555
##  1876    915       1    0.531 0.011650       0.508       0.554
##  1879    914       1    0.531 0.011652       0.508       0.553
##  1884    911       1    0.530 0.011653       0.507       0.553
##  1885    910       1    0.529 0.011655       0.507       0.552
##  1895    907       1    0.529 0.011657       0.506       0.552
##  1896    906       1    0.528 0.011659       0.505       0.551
##  1907    898       1    0.528 0.011661       0.505       0.550
##  1915    895       1    0.527 0.011662       0.504       0.550
##  1918    894       1    0.526 0.011664       0.504       0.549
##  1932    886       1    0.526 0.011666       0.503       0.549
##  1950    880       1    0.525 0.011668       0.502       0.548
##  1976    871       1    0.525 0.011670       0.502       0.547
##  1981    864       1    0.524 0.011673       0.501       0.547
##  1995    855       1    0.523 0.011675       0.501       0.546
##  2012    840       1    0.523 0.011678       0.500       0.546
##  2018    839       1    0.522 0.011681       0.499       0.545
##  2021    834       1    0.522 0.011683       0.499       0.544
##  2023    833       1    0.521 0.011686       0.498       0.544
```

```
##  2028    828       1    0.520 0.011689        0.497        0.543
##  2031    823       1    0.520 0.011692        0.497        0.543
##  2035    822       1    0.519 0.011695        0.496        0.542
##  2036    821       1    0.518 0.011697        0.495        0.541
##  2052    814       1    0.518 0.011700        0.495        0.541
##  2067    800       1    0.517 0.011704        0.494        0.540
##  2074    795       1    0.516 0.011707        0.493        0.539
##  2077    786       1    0.516 0.011710        0.493        0.539
##  2079    785       1    0.515 0.011714        0.492        0.538
##  2083    783       1    0.514 0.011717        0.491        0.537
##  2085    780       1    0.514 0.011721        0.491        0.537
##  2127    737       1    0.513 0.011726        0.490        0.536
##  2128    736       1    0.512 0.011731        0.489        0.535
##  2133    728       1    0.512 0.011736        0.489        0.535
##  2148    711       1    0.511 0.011741        0.488        0.534
##  2152    707       1    0.510 0.011747        0.487        0.533
##  2171    671       2    0.509 0.011761        0.486        0.532
##  2174    668       1    0.508 0.011768        0.485        0.531
##  2197    618       1    0.507 0.011778        0.484        0.530
##  2213    591       1    0.506 0.011789        0.483        0.529
##  2231    571       1    0.505 0.011801        0.482        0.529
##  2257    543       1    0.504 0.011816        0.481        0.528
##  2284    513       1    0.504 0.011834        0.480        0.527
##  2287    510       1    0.503 0.011852        0.479        0.526
##  2288    509       1    0.502 0.011870        0.478        0.525
##  2318    480       1    0.500 0.011891        0.477        0.524
##  2351    446       1    0.499 0.011917        0.476        0.523
##  2458    365       1    0.498 0.011963        0.475        0.521
##  2482    346       1    0.497 0.012015        0.473        0.520
##  2527    294       1    0.495 0.012092        0.471        0.519
##  2542    276       1    0.493 0.012180        0.469        0.517
##  2552    265       1    0.491 0.012276        0.467        0.515
##  2593    235       1    0.489 0.012400        0.465        0.513
##  2683    187       1    0.487 0.012606        0.462        0.511
##  2695    181       1    0.484 0.012820        0.459        0.509
##  2718    162       1    0.481 0.013084        0.455        0.506
##  2725    154       1    0.478 0.013367        0.452        0.504
##  2789    105       1    0.473 0.013992        0.446        0.501
##  2910     59       1    0.465 0.015888        0.434        0.496
```

```
## Call: survfit(formula = survObject ~ 1, type = "kaplan-meier", conf.type = "plain",
##     conf.int = 0.95)
##
##         n events rmean* se(rmean) median 0.95LCL 0.95UCL
## [1,] 1858    920   2010      31.9   2351    2012    2910
##     * restricted mean with upper limit =  3329
```

En este caso, la estimación de la supervivencia media es infinita porque la curva de supervivencia no alcanza la línea del 50 % antes del final del estudio.

3. Análisis de riesgos.

Ajuste un modelo de riesgos proporcionales de Cox.

En este caso se busca definir la contribucion de las variables que fueron identificadas en el punto anterior al tiempo de supervivencia de los sujetos.

```
## Warning in coxph.fit(X, Y, istrat, offset, init, control, weights = weights, :
## Loglik converged before variable 3,8,57,62,82 ; coefficient may be infinite.
```

```
## Call:
## coxph(formula = Surv(time, status) ~ factor(rx) + factor(age) +
##     factor(obstruct) + factor(perfor) + factor(adhere) + factor(nodes) +
##     factor(differ) + factor(extent) + factor(surg) + factor(node4) +
##     factor(etype), data = colon)
##
##   n= 1776, number of events= 876
##    (82 observations deleted due to missingness)
##
##                          coef  exp(coef)   se(coef)      z Pr(>|z|)
## factor(rx)2         6.104e-02  1.063e+00  8.483e-02  0.720  0.47183
## factor(rx)3        -4.173e-01  6.588e-01  9.267e-02 -4.503 6.69e-06 ***
## factor(age)22      -1.763e+01  2.205e-08  2.143e+03 -0.008  0.99344
## factor(age)25      -2.072e+00  1.260e-01  1.256e+00 -1.649  0.09918 .
## factor(age)26              NA         NA  0.000e+00     NA       NA
## factor(age)27      -5.911e-01  5.537e-01  9.022e-01 -0.655  0.51238
## factor(age)28      -6.723e-01  5.105e-01  1.047e+00 -0.642  0.52063
## factor(age)29      -1.757e+01  2.347e-08  2.207e+03 -0.008  0.99365
## factor(age)30      -1.424e+00  2.407e-01  8.649e-01 -1.647  0.09958 .
## factor(age)31      -1.467e+00  2.306e-01  1.074e+00 -1.366  0.17186
## factor(age)32      -1.751e+00  1.736e-01  8.667e-01 -2.020  0.04335 *
## factor(age)33      -2.311e+00  9.915e-02  8.983e-01 -2.573  0.01009 *
## factor(age)34      -1.830e-01  8.328e-01  8.272e-01 -0.221  0.82495
## factor(age)35      -1.471e+00  2.298e-01  1.037e+00 -1.418  0.15613
## factor(age)36      -2.001e+00  1.352e-01  8.118e-01 -2.465  0.01371 *
## factor(age)37      -2.387e+00  9.193e-02  1.042e+00 -2.290  0.02202 *
## factor(age)38      -8.410e-01  4.313e-01  8.040e-01 -1.046  0.29555
## factor(age)39      -2.292e+00  1.010e-01  8.210e-01 -2.792  0.00524 **
## factor(age)40      -1.306e+00  2.710e-01  8.071e-01 -1.617  0.10578
## factor(age)41      -8.572e-01  4.243e-01  8.182e-01 -1.048  0.29478
## factor(age)42      -2.674e+00  6.897e-02  9.077e-01 -2.946  0.00322 **
## factor(age)43      -2.661e+00  6.988e-02  8.472e-01 -3.141  0.00168 **
## factor(age)44      -1.134e+00  3.217e-01  7.988e-01 -1.420  0.15565
## factor(age)45      -1.786e+00  1.677e-01  8.020e-01 -2.227  0.02597 *
## factor(age)46      -1.803e+00  1.649e-01  7.814e-01 -2.307  0.02106 *
## factor(age)47      -1.477e+00  2.284e-01  7.901e-01 -1.869  0.06162 .
## factor(age)48      -2.365e+00  9.392e-02  8.185e-01 -2.890  0.00385 **
## factor(age)49      -2.284e+00  1.019e-01  8.100e-01 -2.820  0.00481 **
## factor(age)50      -1.483e+00  2.270e-01  7.839e-01 -1.891  0.05856 .
## factor(age)51      -1.902e+00  1.492e-01  7.995e-01 -2.379  0.01736 *
## factor(age)52      -2.015e+00  1.333e-01  7.896e-01 -2.553  0.01069 *
## factor(age)53      -1.782e+00  1.683e-01  7.795e-01 -2.286  0.02225 *
```

```
## factor(age)54     -1.467e+00  2.307e-01  7.868e-01 -1.864  0.06229 .
## factor(age)55     -2.091e+00  1.236e-01  7.748e-01 -2.699  0.00696 **
## factor(age)56     -1.936e+00  1.443e-01  7.705e-01 -2.512  0.01200 *
## factor(age)57     -1.764e+00  1.713e-01  7.678e-01 -2.298  0.02157 *
## factor(age)58     -2.370e+00  9.351e-02  7.795e-01 -3.040  0.00237 **
## factor(age)59     -1.753e+00  1.732e-01  7.688e-01 -2.280  0.02258 *
## factor(age)60     -1.563e+00  2.094e-01  7.685e-01 -2.034  0.04190 *
## factor(age)61     -1.709e+00  1.811e-01  7.633e-01 -2.239  0.02519 *
## factor(age)62     -1.373e+00  2.533e-01  7.724e-01 -1.778  0.07548 .
## factor(age)63     -2.230e+00  1.075e-01  7.798e-01 -2.860  0.00424 **
## factor(age)64     -1.744e+00  1.749e-01  7.623e-01 -2.287  0.02218 *
## factor(age)65     -1.843e+00  1.583e-01  7.747e-01 -2.379  0.01735 *
## factor(age)66     -1.437e+00  2.376e-01  7.701e-01 -1.866  0.06205 .
## factor(age)67     -1.873e+00  1.536e-01  7.775e-01 -2.409  0.01598 *
## factor(age)68     -1.554e+00  2.113e-01  7.597e-01 -2.046  0.04074 *
## factor(age)69     -1.572e+00  2.075e-01  7.772e-01 -2.023  0.04306 *
## factor(age)70     -1.353e+00  2.585e-01  7.556e-01 -1.790  0.07339 .
## factor(age)71     -1.315e+00  2.684e-01  7.702e-01 -1.708  0.08767 .
## factor(age)72     -1.829e+00  1.606e-01  7.777e-01 -2.351  0.01870 *
## factor(age)73     -1.304e+00  2.714e-01  7.856e-01 -1.660  0.09693 .
## factor(age)74     -2.176e+00  1.135e-01  7.717e-01 -2.820  0.00481 **
## factor(age)75     -2.449e+00  8.637e-02  8.354e-01 -2.931  0.00337 **
## factor(age)76     -1.507e+00  2.215e-01  7.781e-01 -1.937  0.05274 .
## factor(age)77     -1.932e+00  1.449e-01  8.087e-01 -2.389  0.01692 *
## factor(age)78     -1.721e+01  3.350e-08  9.264e+02 -0.019  0.98518
## factor(age)79     -8.995e-01  4.068e-01  8.193e-01 -1.098  0.27227
## factor(age)80     -8.457e-01  4.293e-01  8.050e-01 -1.050  0.29350
## factor(age)81     -3.367e-01  7.141e-01  8.252e-01 -0.408  0.68328
## factor(age)82     -2.395e+00  9.121e-02  1.042e+00 -2.298  0.02157 *
## factor(age)83     -1.746e+01  2.613e-08  2.195e+03 -0.008  0.99365
## factor(age)85      1.035e+00  2.815e+00  1.043e+00  0.992  0.32119
## factor(obstruct)1  1.426e-01  1.153e+00  9.309e-02  1.532  0.12552
## factor(perfor)1    5.320e-02  1.055e+00  2.024e-01  0.263  0.79264
## factor(adhere)1    1.760e-01  1.192e+00  1.027e-01  1.714  0.08660 .
## factor(nodes)1    -1.967e+00  1.398e-01  6.027e-01 -3.264  0.00110 **
## factor(nodes)2    -1.665e+00  1.892e-01  6.023e-01 -2.764  0.00570 **
## factor(nodes)3    -1.442e+00  2.365e-01  6.059e-01 -2.380  0.01732 *
## factor(nodes)4    -1.341e+00  2.616e-01  6.015e-01 -2.229  0.02579 *
## factor(nodes)5    -1.454e+00  2.337e-01  6.774e-01 -2.146  0.03190 *
## factor(nodes)6    -1.655e+00  1.910e-01  6.858e-01 -2.414  0.01578 *
## factor(nodes)7    -1.610e+00  1.998e-01  6.828e-01 -2.359  0.01835 *
## factor(nodes)8    -9.231e-01  3.973e-01  6.881e-01 -1.341  0.17976
## factor(nodes)9    -1.710e+00  1.809e-01  7.023e-01 -2.434  0.01492 *
## factor(nodes)10   -1.692e+00  1.841e-01  7.214e-01 -2.346  0.01897 *
## factor(nodes)11   -1.436e+00  2.379e-01  7.472e-01 -1.922  0.05467 .
## factor(nodes)12   -1.911e+00  1.479e-01  7.254e-01 -2.635  0.00841 **
## factor(nodes)13   -8.740e-01  4.173e-01  7.411e-01 -1.179  0.23828
## factor(nodes)14   -9.002e-01  4.065e-01  7.701e-01 -1.169  0.24242
## factor(nodes)15   -1.120e+00  3.264e-01  7.542e-01 -1.484  0.13771
## factor(nodes)16   -1.785e+01  1.767e-08  2.235e+03 -0.008  0.99363
## factor(nodes)17   -8.132e-01  4.434e-01  8.618e-01 -0.944  0.34538
## factor(nodes)19   -1.962e+00  1.406e-01  9.156e-01 -2.143  0.03215 *
## factor(nodes)20   -1.212e+00  2.975e-01  8.578e-01 -1.413  0.15751
## factor(nodes)22   -1.227e+00  2.932e-01  1.007e+00 -1.218  0.22310
```

```
## factor(nodes)24           NA         NA  0.000e+00     NA       NA
## factor(nodes)27    4.709e-01  1.601e+00  1.049e+00  0.449  0.65361
## factor(nodes)33   -2.627e+00  7.227e-02  1.035e+00 -2.538  0.01116 *
## factor(differ)2   -6.184e-02  9.400e-01  1.260e-01 -0.491  0.62361
## factor(differ)3    3.063e-01  1.358e+00  1.496e-01  2.048  0.04059 *
## factor(extent)2    1.229e-01  1.131e+00  4.057e-01  0.303  0.76200
## factor(extent)3    7.591e-01  2.136e+00  3.869e-01  1.962  0.04977 *
## factor(extent)4    1.224e+00  3.400e+00  4.186e-01  2.924  0.00346 **
## factor(surg)1      2.569e-01  1.293e+00  8.121e-02  3.163  0.00156 **
## factor(node4)1     7.718e-01  2.164e+00  2.872e-01  2.687  0.00720 **
## factor(etype)2    -3.200e-01  7.261e-01  6.817e-02 -4.694 2.68e-06 ***
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
##                   exp(coef) exp(-coef) lower .95 upper .95
## factor(rx)2       1.063e+00  9.408e-01  0.900118    1.2552
## factor(rx)3       6.588e-01  1.518e+00  0.549396    0.7900
## factor(age)22     2.205e-08  4.536e+07  0.000000       Inf
## factor(age)25     1.260e-01  7.938e+00  0.010735    1.4783
## factor(age)26            NA         NA        NA        NA
## factor(age)27     5.537e-01  1.806e+00  0.094482    3.2454
## factor(age)28     5.105e-01  1.959e+00  0.065634    3.9710
## factor(age)29     2.347e-08  4.261e+07  0.000000       Inf
## factor(age)30     2.407e-01  4.155e+00  0.044178    1.3110
## factor(age)31     2.306e-01  4.337e+00  0.028100    1.8919
## factor(age)32     1.736e-01  5.761e+00  0.031749    0.9490
## factor(age)33     9.915e-02  1.009e+01  0.017049    0.5767
## factor(age)34     8.328e-01  1.201e+00  0.164588    4.2138
## factor(age)35     2.298e-01  4.352e+00  0.030100    1.7539
## factor(age)36     1.352e-01  7.396e+00  0.027541    0.6638
## factor(age)37     9.193e-02  1.088e+01  0.011920    0.7090
## factor(age)38     4.313e-01  2.319e+00  0.089200    2.0851
## factor(age)39     1.010e-01  9.898e+00  0.020213    0.5050
## factor(age)40     2.710e-01  3.690e+00  0.055716    1.3185
## factor(age)41     4.243e-01  2.357e+00  0.085358    2.1094
## factor(age)42     6.897e-02  1.450e+01  0.011641    0.4086
## factor(age)43     6.988e-02  1.431e+01  0.013282    0.3677
## factor(age)44     3.217e-01  3.109e+00  0.067216    1.5395
## factor(age)45     1.677e-01  5.964e+00  0.034823    0.8075
## factor(age)46     1.649e-01  6.065e+00  0.035646    0.7625
## factor(age)47     2.284e-01  4.379e+00  0.048542    1.0745
## factor(age)48     9.392e-02  1.065e+01  0.018884    0.4671
## factor(age)49     1.019e-01  9.815e+00  0.020829    0.4984
## factor(age)50     2.270e-01  4.405e+00  0.048846    1.0552
## factor(age)51     1.492e-01  6.700e+00  0.031141    0.7153
## factor(age)52     1.333e-01  7.504e+00  0.028352    0.6263
## factor(age)53     1.683e-01  5.942e+00  0.036522    0.7755
## factor(age)54     2.307e-01  4.335e+00  0.049352    1.0782
## factor(age)55     1.236e-01  8.093e+00  0.027062    0.5642
## factor(age)56     1.443e-01  6.930e+00  0.031872    0.6534
## factor(age)57     1.713e-01  5.837e+00  0.038037    0.7715
## factor(age)58     9.351e-02  1.069e+01  0.020294    0.4309
## factor(age)59     1.732e-01  5.773e+00  0.038384    0.7816
## factor(age)60     2.094e-01  4.775e+00  0.046442    0.9443
```

```
## factor(age)61     1.811e-01  5.522e+00  0.040566    0.8085
## factor(age)62     2.533e-01  3.947e+00  0.055746    1.1513
## factor(age)63     1.075e-01  9.302e+00  0.023315    0.4957
## factor(age)64     1.749e-01  5.718e+00  0.039255    0.7792
## factor(age)65     1.583e-01  6.316e+00  0.034688    0.7227
## factor(age)66     2.376e-01  4.208e+00  0.052532    1.0751
## factor(age)67     1.536e-01  6.509e+00  0.033475    0.7051
## factor(age)68     2.113e-01  4.732e+00  0.047678    0.9366
## factor(age)69     2.075e-01  4.818e+00  0.045239    0.9521
## factor(age)70     2.585e-01  3.869e+00  0.058783    1.1367
## factor(age)71     2.684e-01  3.726e+00  0.059321    1.2143
## factor(age)72     1.606e-01  6.225e+00  0.034986    0.7376
## factor(age)73     2.714e-01  3.684e+00  0.058205    1.2658
## factor(age)74     1.135e-01  8.810e+00  0.025010    0.5151
## factor(age)75     8.637e-02  1.158e+01  0.016797    0.4441
## factor(age)76     2.215e-01  4.514e+00  0.048204    1.0180
## factor(age)77     1.449e-01  6.901e+00  0.029699    0.7071
## factor(age)78     3.350e-08  2.985e+07  0.000000       Inf
## factor(age)79     4.068e-01  2.458e+00  0.081650    2.0266
## factor(age)80     4.293e-01  2.330e+00  0.088613    2.0796
## factor(age)81     7.141e-01  1.400e+00  0.141695    3.5992
## factor(age)82     9.121e-02  1.096e+01  0.011831    0.7032
## factor(age)83     2.613e-08  3.827e+07  0.000000       Inf
## factor(age)85     2.815e+00  3.552e-01  0.364274   21.7528
## factor(obstruct)1 1.153e+00  8.671e-01  0.960947    1.3841
## factor(perfor)1   1.055e+00  9.482e-01  0.709344    1.5680
## factor(adhere)1   1.192e+00  8.386e-01  0.975010    1.4584
## factor(nodes)1    1.398e-01  7.152e+00  0.042914    0.4556
## factor(nodes)2    1.892e-01  5.286e+00  0.058095    0.6160
## factor(nodes)3    2.365e-01  4.229e+00  0.072106    0.7754
## factor(nodes)4    2.616e-01  3.823e+00  0.080459    0.8504
## factor(nodes)5    2.337e-01  4.278e+00  0.061958    0.8818
## factor(nodes)6    1.910e-01  5.235e+00  0.049817    0.7325
## factor(nodes)7    1.998e-01  5.005e+00  0.052407    0.7617
## factor(nodes)8    3.973e-01  2.517e+00  0.103124    1.5305
## factor(nodes)9    1.809e-01  5.527e+00  0.045675    0.7166
## factor(nodes)10   1.841e-01  5.432e+00  0.044769    0.7569
## factor(nodes)11   2.379e-01  4.203e+00  0.055010    1.0292
## factor(nodes)12   1.479e-01  6.763e+00  0.035680    0.6128
## factor(nodes)13   4.173e-01  2.396e+00  0.097634    1.7835
## factor(nodes)14   4.065e-01  2.460e+00  0.089863    1.8388
## factor(nodes)15   3.264e-01  3.063e+00  0.074438    1.4315
## factor(nodes)16   1.767e-08  5.658e+07  0.000000       Inf
## factor(nodes)17   4.434e-01  2.255e+00  0.081895    2.4011
## factor(nodes)19   1.406e-01  7.112e+00  0.023368    0.8460
## factor(nodes)20   2.975e-01  3.362e+00  0.055372    1.5980
## factor(nodes)22   2.932e-01  3.411e+00  0.040738    2.1103
## factor(nodes)24          NA         NA        NA        NA
## factor(nodes)27   1.601e+00  6.245e-01  0.204798   12.5220
## factor(nodes)33   7.227e-02  1.384e+01  0.009499    0.5499
## factor(differ)2   9.400e-01  1.064e+00  0.734327    1.2034
## factor(differ)3   1.358e+00  7.362e-01  1.013203    1.8210
## factor(extent)2   1.131e+00  8.844e-01  0.510509    2.5045
## factor(extent)3   2.136e+00  4.681e-01  1.000777    4.5601
```

```
## factor(extent)4   3.400e+00  2.941e-01  1.496946    7.7228
## factor(surg)1     1.293e+00  7.735e-01  1.102623    1.5159
## factor(node4)1    2.164e+00  4.622e-01  1.232323    3.7987
## factor(etype)2    7.261e-01  1.377e+00  0.635323    0.8300
##
## Concordance= 0.706  (se = 0.008 )
## Likelihood ratio test= 484.5  on 95 df,   p=<2e-16
## Wald test            = 459.5  on 95 df,   p=<2e-16
## Score (logrank) test = 537.7  on 95 df,   p=<2e-16
```

¿Cuál es la estimación puntual para los coeficientes de regresion?

```
##       factor(rx)2       factor(rx)3     factor(age)22     factor(age)25
##        0.06103643       -0.41731407      -17.63010113       -2.07165145
##     factor(age)26     factor(age)27     factor(age)28     factor(age)29
##                NA       -0.59105998       -0.67232749      -17.56750717
##     factor(age)30     factor(age)31     factor(age)32     factor(age)33
##       -1.42438245       -1.46721128       -1.75109404       -2.31108020
##     factor(age)34     factor(age)35     factor(age)36     factor(age)37
##       -0.18296851       -1.47069833       -2.00091623       -2.38675020
##     factor(age)38     factor(age)39     factor(age)40     factor(age)41
##       -0.84102361       -2.29229069       -1.30551019       -0.85723932
##     factor(age)42     factor(age)43     factor(age)44     factor(age)45
##       -2.67411938       -2.66090992       -1.13420322       -1.78567666
##     factor(age)46     factor(age)47     factor(age)48     factor(age)49
##       -1.80261456       -1.47674974       -2.36529977       -2.28386526
##     factor(age)50     factor(age)51     factor(age)52     factor(age)53
##       -1.48268630       -1.90216727       -2.01548896       -1.78205421
##     factor(age)54     factor(age)55     factor(age)56     factor(age)57
##       -1.46672658       -2.09095133       -1.93579502       -1.76428777
##     factor(age)58     factor(age)59     factor(age)60     factor(age)61
##       -2.36966033       -1.75323393       -1.56340807       -1.70872698
##     factor(age)62     factor(age)63     factor(age)64     factor(age)65
##       -1.37301893       -2.23027104       -1.74357429       -1.84303970
##     factor(age)66     factor(age)67     factor(age)68     factor(age)69
##       -1.43697058       -1.87316283       -1.55437969       -1.57245753
##     factor(age)70     factor(age)71     factor(age)72     factor(age)73
##       -1.35287688       -1.31529546       -1.82860291       -1.30403069
##     factor(age)74     factor(age)75     factor(age)76     factor(age)77
##       -2.17591061       -2.44909941       -1.50723774       -1.93160842
##     factor(age)78     factor(age)79     factor(age)80     factor(age)81
##      -17.21157411       -0.89948013       -0.84565497       -0.33668001
##     factor(age)82     factor(age)83     factor(age)85 factor(obstruct)1
##       -2.39454661      -17.46029652        1.03494537        0.14261464
##   factor(perfor)1   factor(adhere)1    factor(nodes)1    factor(nodes)2
##        0.05319636        0.17601941       -1.96735542       -1.66511073
##    factor(nodes)3    factor(nodes)4    factor(nodes)5    factor(nodes)6
##       -1.44200671       -1.34101954       -1.45356998       -1.65534054
##    factor(nodes)7    factor(nodes)8    factor(nodes)9   factor(nodes)10
##       -1.61043193       -0.92312124       -1.70970074       -1.69239430
##   factor(nodes)11   factor(nodes)12   factor(nodes)13   factor(nodes)14
##       -1.43575275       -1.91142012       -0.87398206       -0.90017743
##   factor(nodes)15   factor(nodes)16   factor(nodes)17   factor(nodes)19
```

```
##       -1.11954018      -17.85114043       -0.81320107       -1.96180672
##   factor(nodes)20   factor(nodes)22   factor(nodes)24   factor(nodes)27
##       -1.21246174       -1.22687593                NA        0.47087959
##   factor(nodes)33   factor(differ)2   factor(differ)3   factor(extent)2
##       -2.62732753       -0.06183545        0.30626067        0.12287824
##   factor(extent)3   factor(extent)4     factor(surg)1    factor(node4)1
##        0.75906571        1.22379891        0.25685364        0.77178174
##    factor(etype)2
##       -0.32000413
```

Interpretacion:

- El factor $rx = 2 = 0.06103643$ lo que indica que el fallecimiento tiene una relación que es directamente proporcional a la prescripción con levamisol.
- El factor $rx = 3 =$ -0.41731407 lo que indica que el fallecimiento tiene una relación que es inversamente proporcional a la prescripcion de levamisol + 5FU.
- En general, el factor *age* indica que el fallecimiento de una persona tiene una relación que es inversamente proporcional a la edad. Salvo la persona con mayor edad, la cual tiene una relación proporcional al fallecimiento.
- El factor $obstruct = 1$ 0.14261464 lo que indica que las personas que tengan obstrucción en el colon, tienen mayor riesgo de fallecer que aquellas que no tienen obstrucción.
- El factor $perfor = 1 = 0.05319636$ lo que quiere decir que las personas que tengan el colon perforado tienen mayor riesgo de fallecer que aquellas que no.
- El factor $adhere = 1 = 0.17601941$, lo que indica que las personas que tienen adherencia de cáncer en otras partes de su cuerpo, tienen mayor riesgo de morir.
- En general, el factor *nodes* indica que el fallecimiento de una persona tiene una relación que es inversamente proporcional a la cantidad de nodos que tenga.
- El factor $differ = 2 =$ -0.06183545, lo que indica que el fallecimiento de la persona está inversamente relacionado a que tenga un tumor moderado.
- El factor $differ = 3 = 0.30626067$ indica que el fallecimiento de la persona está directamente relacionado a que tenga un tumor maligno.
- El factor $extent = 2 = 0.12287824$ lo que indica que el fallecimiento de la persona está directamente relacionado a que sus músculos estén afectados por el cáncer.
- El factor $extent = 3 = 0.75906571$ lo que indica que el fallecimiento de la persona está directamente relacionado a que su tubo digestivo esté afectado por el cáncer.
- El factor $extent = 4 = 1.22379891$ lo que indica que el fallecimiento de la persona está muy directamente relacionado a que sus órganos estén afectados por el cáncer.
- El factor $surg = 1 = 0.25685364$ lo que indica que las personas que tienen un mayor de espera entre la cirugía y su estudio, tiene mayor riesgo de morir.
- El factor $node4 = 1 = 0.77178174$ lo cual indica que las personas que presentan más de 4 ganglios linfáticos infectados, tienen más riesgo de morir.

¿Las variables explicativas tienen o no efecto en el modelo?

```
## Call:
## coxph(formula = Surv(time, status) ~ factor(rx) + factor(age) +
##     factor(obstruct) + factor(perfor) + factor(adhere) + factor(nodes) +
##     factor(differ) + factor(extent) + factor(surg) + factor(node4) +
##     factor(etype), data = colon)
##
##   n= 1776, number of events= 876
##    (82 observations deleted due to missingness)
##
##                         coef  exp(coef)   se(coef)      z Pr(>|z|)
## factor(rx)2         6.104e-02  1.063e+00  8.483e-02  0.720  0.47183
## factor(rx)3        -4.173e-01  6.588e-01  9.267e-02 -4.503 6.69e-06 ***
## factor(age)22      -1.763e+01  2.205e-08  2.143e+03 -0.008  0.99344
## factor(age)25      -2.072e+00  1.260e-01  1.256e+00 -1.649  0.09918 .
## factor(age)26              NA         NA  0.000e+00     NA       NA
## factor(age)27      -5.911e-01  5.537e-01  9.022e-01 -0.655  0.51238
## factor(age)28      -6.723e-01  5.105e-01  1.047e+00 -0.642  0.52063
## factor(age)29      -1.757e+01  2.347e-08  2.207e+03 -0.008  0.99365
## factor(age)30      -1.424e+00  2.407e-01  8.649e-01 -1.647  0.09958 .
## factor(age)31      -1.467e+00  2.306e-01  1.074e+00 -1.366  0.17186
## factor(age)32      -1.751e+00  1.736e-01  8.667e-01 -2.020  0.04335 *
## factor(age)33      -2.311e+00  9.915e-02  8.983e-01 -2.573  0.01009 *
## factor(age)34      -1.830e-01  8.328e-01  8.272e-01 -0.221  0.82495
## factor(age)35      -1.471e+00  2.298e-01  1.037e+00 -1.418  0.15613
## factor(age)36      -2.001e+00  1.352e-01  8.118e-01 -2.465  0.01371 *
## factor(age)37      -2.387e+00  9.193e-02  1.042e+00 -2.290  0.02202 *
## factor(age)38      -8.410e-01  4.313e-01  8.040e-01 -1.046  0.29555
## factor(age)39      -2.292e+00  1.010e-01  8.210e-01 -2.792  0.00524 **
## factor(age)40      -1.306e+00  2.710e-01  8.071e-01 -1.617  0.10578
## factor(age)41      -8.572e-01  4.243e-01  8.182e-01 -1.048  0.29478
## factor(age)42      -2.674e+00  6.897e-02  9.077e-01 -2.946  0.00322 **
## factor(age)43      -2.661e+00  6.988e-02  8.472e-01 -3.141  0.00168 **
## factor(age)44      -1.134e+00  3.217e-01  7.988e-01 -1.420  0.15565
## factor(age)45      -1.786e+00  1.677e-01  8.020e-01 -2.227  0.02597 *
## factor(age)46      -1.803e+00  1.649e-01  7.814e-01 -2.307  0.02106 *
## factor(age)47      -1.477e+00  2.284e-01  7.901e-01 -1.869  0.06162 .
## factor(age)48      -2.365e+00  9.392e-02  8.185e-01 -2.890  0.00385 **
## factor(age)49      -2.284e+00  1.019e-01  8.100e-01 -2.820  0.00481 **
## factor(age)50      -1.483e+00  2.270e-01  7.839e-01 -1.891  0.05856 .
## factor(age)51      -1.902e+00  1.492e-01  7.995e-01 -2.379  0.01736 *
## factor(age)52      -2.015e+00  1.333e-01  7.896e-01 -2.553  0.01069 *
## factor(age)53      -1.782e+00  1.683e-01  7.795e-01 -2.286  0.02225 *
## factor(age)54      -1.467e+00  2.307e-01  7.868e-01 -1.864  0.06229 .
## factor(age)55      -2.091e+00  1.236e-01  7.748e-01 -2.699  0.00696 **
## factor(age)56      -1.936e+00  1.443e-01  7.705e-01 -2.512  0.01200 *
## factor(age)57      -1.764e+00  1.713e-01  7.678e-01 -2.298  0.02157 *
## factor(age)58      -2.370e+00  9.351e-02  7.795e-01 -3.040  0.00237 **
## factor(age)59      -1.753e+00  1.732e-01  7.688e-01 -2.280  0.02258 *
## factor(age)60      -1.563e+00  2.094e-01  7.685e-01 -2.034  0.04190 *
## factor(age)61      -1.709e+00  1.811e-01  7.633e-01 -2.239  0.02519 *
## factor(age)62      -1.373e+00  2.533e-01  7.724e-01 -1.778  0.07548 .
## factor(age)63      -2.230e+00  1.075e-01  7.798e-01 -2.860  0.00424 **
```

```
## factor(age)64     -1.744e+00  1.749e-01  7.623e-01 -2.287  0.02218 *
## factor(age)65     -1.843e+00  1.583e-01  7.747e-01 -2.379  0.01735 *
## factor(age)66     -1.437e+00  2.376e-01  7.701e-01 -1.866  0.06205 .
## factor(age)67     -1.873e+00  1.536e-01  7.775e-01 -2.409  0.01598 *
## factor(age)68     -1.554e+00  2.113e-01  7.597e-01 -2.046  0.04074 *
## factor(age)69     -1.572e+00  2.075e-01  7.772e-01 -2.023  0.04306 *
## factor(age)70     -1.353e+00  2.585e-01  7.556e-01 -1.790  0.07339 .
## factor(age)71     -1.315e+00  2.684e-01  7.702e-01 -1.708  0.08767 .
## factor(age)72     -1.829e+00  1.606e-01  7.777e-01 -2.351  0.01870 *
## factor(age)73     -1.304e+00  2.714e-01  7.856e-01 -1.660  0.09693 .
## factor(age)74     -2.176e+00  1.135e-01  7.717e-01 -2.820  0.00481 **
## factor(age)75     -2.449e+00  8.637e-02  8.354e-01 -2.931  0.00337 **
## factor(age)76     -1.507e+00  2.215e-01  7.781e-01 -1.937  0.05274 .
## factor(age)77     -1.932e+00  1.449e-01  8.087e-01 -2.389  0.01692 *
## factor(age)78     -1.721e+01  3.350e-08  9.264e+02 -0.019  0.98518
## factor(age)79     -8.995e-01  4.068e-01  8.193e-01 -1.098  0.27227
## factor(age)80     -8.457e-01  4.293e-01  8.050e-01 -1.050  0.29350
## factor(age)81     -3.367e-01  7.141e-01  8.252e-01 -0.408  0.68328
## factor(age)82     -2.395e+00  9.121e-02  1.042e+00 -2.298  0.02157 *
## factor(age)83     -1.746e+01  2.613e-08  2.195e+03 -0.008  0.99365
## factor(age)85      1.035e+00  2.815e+00  1.043e+00  0.992  0.32119
## factor(obstruct)1  1.426e-01  1.153e+00  9.309e-02  1.532  0.12552
## factor(perfor)1    5.320e-02  1.055e+00  2.024e-01  0.263  0.79264
## factor(adhere)1    1.760e-01  1.192e+00  1.027e-01  1.714  0.08660 .
## factor(nodes)1    -1.967e+00  1.398e-01  6.027e-01 -3.264  0.00110 **
## factor(nodes)2    -1.665e+00  1.892e-01  6.023e-01 -2.764  0.00570 **
## factor(nodes)3    -1.442e+00  2.365e-01  6.059e-01 -2.380  0.01732 *
## factor(nodes)4    -1.341e+00  2.616e-01  6.015e-01 -2.229  0.02579 *
## factor(nodes)5    -1.454e+00  2.337e-01  6.774e-01 -2.146  0.03190 *
## factor(nodes)6    -1.655e+00  1.910e-01  6.858e-01 -2.414  0.01578 *
## factor(nodes)7    -1.610e+00  1.998e-01  6.828e-01 -2.359  0.01835 *
## factor(nodes)8    -9.231e-01  3.973e-01  6.881e-01 -1.341  0.17976
## factor(nodes)9    -1.710e+00  1.809e-01  7.023e-01 -2.434  0.01492 *
## factor(nodes)10   -1.692e+00  1.841e-01  7.214e-01 -2.346  0.01897 *
## factor(nodes)11   -1.436e+00  2.379e-01  7.472e-01 -1.922  0.05467 .
## factor(nodes)12   -1.911e+00  1.479e-01  7.254e-01 -2.635  0.00841 **
## factor(nodes)13   -8.740e-01  4.173e-01  7.411e-01 -1.179  0.23828
## factor(nodes)14   -9.002e-01  4.065e-01  7.701e-01 -1.169  0.24242
## factor(nodes)15   -1.120e+00  3.264e-01  7.542e-01 -1.484  0.13771
## factor(nodes)16   -1.785e+01  1.767e-08  2.235e+03 -0.008  0.99363
## factor(nodes)17   -8.132e-01  4.434e-01  8.618e-01 -0.944  0.34538
## factor(nodes)19   -1.962e+00  1.406e-01  9.156e-01 -2.143  0.03215 *
## factor(nodes)20   -1.212e+00  2.975e-01  8.578e-01 -1.413  0.15751
## factor(nodes)22   -1.227e+00  2.932e-01  1.007e+00 -1.218  0.22310
## factor(nodes)24           NA         NA  0.000e+00     NA       NA
## factor(nodes)27    4.709e-01  1.601e+00  1.049e+00  0.449  0.65361
## factor(nodes)33   -2.627e+00  7.227e-02  1.035e+00 -2.538  0.01116 *
## factor(differ)2   -6.184e-02  9.400e-01  1.260e-01 -0.491  0.62361
## factor(differ)3    3.063e-01  1.358e+00  1.496e-01  2.048  0.04059 *
## factor(extent)2    1.229e-01  1.131e+00  4.057e-01  0.303  0.76200
## factor(extent)3    7.591e-01  2.136e+00  3.869e-01  1.962  0.04977 *
## factor(extent)4    1.224e+00  3.400e+00  4.186e-01  2.924  0.00346 **
## factor(surg)1      2.569e-01  1.293e+00  8.121e-02  3.163  0.00156 **
## factor(node4)1     7.718e-01  2.164e+00  2.872e-01  2.687  0.00720 **
```

```
## factor(etype)2    -3.200e-01  7.261e-01  6.817e-02 -4.694 2.68e-06 ***
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
##                   exp(coef) exp(-coef) lower .95 upper .95
## factor(rx)2       1.063e+00  9.408e-01  0.900118    1.2552
## factor(rx)3       6.588e-01  1.518e+00  0.549396    0.7900
## factor(age)22     2.205e-08  4.536e+07  0.000000       Inf
## factor(age)25     1.260e-01  7.938e+00  0.010735    1.4783
## factor(age)26            NA         NA        NA        NA
## factor(age)27     5.537e-01  1.806e+00  0.094482    3.2454
## factor(age)28     5.105e-01  1.959e+00  0.065634    3.9710
## factor(age)29     2.347e-08  4.261e+07  0.000000       Inf
## factor(age)30     2.407e-01  4.155e+00  0.044178    1.3110
## factor(age)31     2.306e-01  4.337e+00  0.028100    1.8919
## factor(age)32     1.736e-01  5.761e+00  0.031749    0.9490
## factor(age)33     9.915e-02  1.009e+01  0.017049    0.5767
## factor(age)34     8.328e-01  1.201e+00  0.164588    4.2138
## factor(age)35     2.298e-01  4.352e+00  0.030100    1.7539
## factor(age)36     1.352e-01  7.396e+00  0.027541    0.6638
## factor(age)37     9.193e-02  1.088e+01  0.011920    0.7090
## factor(age)38     4.313e-01  2.319e+00  0.089200    2.0851
## factor(age)39     1.010e-01  9.898e+00  0.020213    0.5050
## factor(age)40     2.710e-01  3.690e+00  0.055716    1.3185
## factor(age)41     4.243e-01  2.357e+00  0.085358    2.1094
## factor(age)42     6.897e-02  1.450e+01  0.011641    0.4086
## factor(age)43     6.988e-02  1.431e+01  0.013282    0.3677
## factor(age)44     3.217e-01  3.109e+00  0.067216    1.5395
## factor(age)45     1.677e-01  5.964e+00  0.034823    0.8075
## factor(age)46     1.649e-01  6.065e+00  0.035646    0.7625
## factor(age)47     2.284e-01  4.379e+00  0.048542    1.0745
## factor(age)48     9.392e-02  1.065e+01  0.018884    0.4671
## factor(age)49     1.019e-01  9.815e+00  0.020829    0.4984
## factor(age)50     2.270e-01  4.405e+00  0.048846    1.0552
## factor(age)51     1.492e-01  6.700e+00  0.031141    0.7153
## factor(age)52     1.333e-01  7.504e+00  0.028352    0.6263
## factor(age)53     1.683e-01  5.942e+00  0.036522    0.7755
## factor(age)54     2.307e-01  4.335e+00  0.049352    1.0782
## factor(age)55     1.236e-01  8.093e+00  0.027062    0.5642
## factor(age)56     1.443e-01  6.930e+00  0.031872    0.6534
## factor(age)57     1.713e-01  5.837e+00  0.038037    0.7715
## factor(age)58     9.351e-02  1.069e+01  0.020294    0.4309
## factor(age)59     1.732e-01  5.773e+00  0.038384    0.7816
## factor(age)60     2.094e-01  4.775e+00  0.046442    0.9443
## factor(age)61     1.811e-01  5.522e+00  0.040566    0.8085
## factor(age)62     2.533e-01  3.947e+00  0.055746    1.1513
## factor(age)63     1.075e-01  9.302e+00  0.023315    0.4957
## factor(age)64     1.749e-01  5.718e+00  0.039255    0.7792
## factor(age)65     1.583e-01  6.316e+00  0.034688    0.7227
## factor(age)66     2.376e-01  4.208e+00  0.052532    1.0751
## factor(age)67     1.536e-01  6.509e+00  0.033475    0.7051
## factor(age)68     2.113e-01  4.732e+00  0.047678    0.9366
## factor(age)69     2.075e-01  4.818e+00  0.045239    0.9521
## factor(age)70     2.585e-01  3.869e+00  0.058783    1.1367
```

```
## factor(age)71     2.684e-01  3.726e+00  0.059321    1.2143
## factor(age)72     1.606e-01  6.225e+00  0.034986    0.7376
## factor(age)73     2.714e-01  3.684e+00  0.058205    1.2658
## factor(age)74     1.135e-01  8.810e+00  0.025010    0.5151
## factor(age)75     8.637e-02  1.158e+01  0.016797    0.4441
## factor(age)76     2.215e-01  4.514e+00  0.048204    1.0180
## factor(age)77     1.449e-01  6.901e+00  0.029699    0.7071
## factor(age)78     3.350e-08  2.985e+07  0.000000       Inf
## factor(age)79     4.068e-01  2.458e+00  0.081650    2.0266
## factor(age)80     4.293e-01  2.330e+00  0.088613    2.0796
## factor(age)81     7.141e-01  1.400e+00  0.141695    3.5992
## factor(age)82     9.121e-02  1.096e+01  0.011831    0.7032
## factor(age)83     2.613e-08  3.827e+07  0.000000       Inf
## factor(age)85     2.815e+00  3.552e-01  0.364274   21.7528
## factor(obstruct)1 1.153e+00  8.671e-01  0.960947    1.3841
## factor(perfor)1   1.055e+00  9.482e-01  0.709344    1.5680
## factor(adhere)1   1.192e+00  8.386e-01  0.975010    1.4584
## factor(nodes)1    1.398e-01  7.152e+00  0.042914    0.4556
## factor(nodes)2    1.892e-01  5.286e+00  0.058095    0.6160
## factor(nodes)3    2.365e-01  4.229e+00  0.072106    0.7754
## factor(nodes)4    2.616e-01  3.823e+00  0.080459    0.8504
## factor(nodes)5    2.337e-01  4.278e+00  0.061958    0.8818
## factor(nodes)6    1.910e-01  5.235e+00  0.049817    0.7325
## factor(nodes)7    1.998e-01  5.005e+00  0.052407    0.7617
## factor(nodes)8    3.973e-01  2.517e+00  0.103124    1.5305
## factor(nodes)9    1.809e-01  5.527e+00  0.045675    0.7166
## factor(nodes)10   1.841e-01  5.432e+00  0.044769    0.7569
## factor(nodes)11   2.379e-01  4.203e+00  0.055010    1.0292
## factor(nodes)12   1.479e-01  6.763e+00  0.035680    0.6128
## factor(nodes)13   4.173e-01  2.396e+00  0.097634    1.7835
## factor(nodes)14   4.065e-01  2.460e+00  0.089863    1.8388
## factor(nodes)15   3.264e-01  3.063e+00  0.074438    1.4315
## factor(nodes)16   1.767e-08  5.658e+07  0.000000       Inf
## factor(nodes)17   4.434e-01  2.255e+00  0.081895    2.4011
## factor(nodes)19   1.406e-01  7.112e+00  0.023368    0.8460
## factor(nodes)20   2.975e-01  3.362e+00  0.055372    1.5980
## factor(nodes)22   2.932e-01  3.411e+00  0.040738    2.1103
## factor(nodes)24          NA         NA        NA        NA
## factor(nodes)27   1.601e+00  6.245e-01  0.204798   12.5220
## factor(nodes)33   7.227e-02  1.384e+01  0.009499    0.5499
## factor(differ)2   9.400e-01  1.064e+00  0.734327    1.2034
## factor(differ)3   1.358e+00  7.362e-01  1.013203    1.8210
## factor(extent)2   1.131e+00  8.844e-01  0.510509    2.5045
## factor(extent)3   2.136e+00  4.681e-01  1.000777    4.5601
## factor(extent)4   3.400e+00  2.941e-01  1.496946    7.7228
## factor(surg)1     1.293e+00  7.735e-01  1.102623    1.5159
## factor(node4)1    2.164e+00  4.622e-01  1.232323    3.7987
## factor(etype)2    7.261e-01  1.377e+00  0.635323    0.8300
##
## Concordance= 0.706  (se = 0.008 )
## Likelihood ratio test= 484.5  on 95 df,   p=<2e-16
## Wald test            = 459.5  on 95 df,   p=<2e-16
## Score (logrank) test = 537.7  on 95 df,   p=<2e-16
```

Para cada variable se obtiene un $p-value$ que contrasta las hipotesis:

$$H_0 : (\beta = 0) \text{ no significativa vs } H_a : (\beta \neq 0) \text{ es significativa}$$

- Para factor(rx) los $p-value$ son distintos respecto al nivel de significancia, entonces no se rechazaría H_0, lo cual indica que la variable rx no tiene efecto en el modelo.

- Para factor(age) los $p-value$ son distintos respecto al nivel de significancia, entonces no se rechazaría H_0, lo cual indica que la variable *age* no tiene efecto en el modelo.
- Para factor(obstruct = 1) el $p-value$ es mayor respecto al nivel de significancia, entonces no se rechazaría H_0, lo cual indica que la variable *obstruct* no tiene efecto en el modelo.
- Para factor(perfor = 1) el $p-value$ es mayor respecto al nivel de significancia, entonces no se rechazaría H_0, lo cual indica que la variable $perfor$ no tiene efecto en el modelo.
- Para factor(adhere = 1) el $p-value$ es mayor respecto al nivel de significancia, entonces no se rechazaría H_0, lo cual indica que la variable *adhere* no tiene efecto en el modelo.
- Para factor(nodes) los $p-value$ son distintos respecto al nivel de significancia, entonces no se rechazaría H_0, lo cual indica que la variable *nodes* no tiene efecto en el modelo.
- Para factor(differ) los $p-value$ son distintos respecto al nivel de significancia, entonces no se rechazaría H_0, lo cual indica que la variable $differ$ no tiene efecto en el modelo.
- Para factor(extent) los $p-value$ son distintos respecto al nivel de significancia, entonces no se rechazaría H_0, lo cual indica que la variable *extent* no tiene efecto en el modelo.
- Para factor(surg = 1) el $p-value$ es menor respecto al nivel de significancia, entonces se rechazaría H_0, lo cual indica que la variable *surg* si tiene efecto en el modelo.
- Para factor(node4 = 1) el $p-value$ es menor respecto al nivel de significancia, entonces se rechazaría H_0, lo cual indica que la variable *node*4 si tiene efecto en el modelo.

Finalmente y de manera general para las pruebas del Cociente de Verosimilitud, de Wald, y de Score, al usar un nivel de significancia de 95 % se puede concluir que las variables explicativas tienen efecto en el modelo.

Es decir, las variables una vez que interactuan juntas tienen efecto en el modelo.

Por lo anterior se ajustará un nuevo modelo donde se removerán las variables no significativas:

```
## Call:
## coxph(formula = Surv(time, status) ~ factor(surg) + factor(node4),
##     data = colon)
##
##   n= 1858, number of events= 920
##
##                    coef exp(coef) se(coef)      z Pr(>|z|)
## factor(surg)1  0.27021   1.31024  0.07192  3.757 0.000172 ***
## factor(node4)1 0.91298   2.49173  0.06795 13.436  < 2e-16 ***
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
##                exp(coef) exp(-coef) lower .95 upper .95
## factor(surg)1      1.310     0.7632     1.138     1.509
## factor(node4)1     2.492     0.4013     2.181     2.847
##
## Concordance= 0.616  (se = 0.009 )
```

```
## Likelihood ratio test= 176.1  on 2 df,   p=<2e-16
## Wald test            = 191.9  on 2 df,   p=<2e-16
## Score (logrank) test = 204.2  on 2 df,   p=<2e-16
```

Así:

- Para $surg $ el $p - value = 000172 < 0.05$, por lo que si afecta al modelo.
- Para $node4$ el $p - value < 2e^{-16} < 0.05$, por lo que afecta al modelo.

De esta forma, se tienen que todas las variables afectan al modelo.

Intervalo de confianza para los coeficientes.

```
##                     2.5 %    97.5 %
## factor(surg)1  0.1292445 0.4111817
## factor(node4)1 0.7797986 1.0461549
```

De donde, las variables no contienen al cero en sus intervalos de confianza, por lo que son significativas en el modelo.

¿Cuál es la proporción del riesgo de falla?

```
## Call:
## coxph(formula = Surv(time, status) ~ factor(surg) + factor(node4),
##     data = colon)
##
##   n= 1858, number of events= 920
##
##                    coef exp(coef) se(coef)      z Pr(>|z|)
## factor(surg)1  0.27021   1.31024  0.07192  3.757 0.000172 ***
## factor(node4)1 0.91298   2.49173  0.06795 13.436  < 2e-16 ***
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
##                exp(coef) exp(-coef) lower .95 upper .95
## factor(surg)1      1.310     0.7632     1.138     1.509
## factor(node4)1     2.492     0.4013     2.181     2.847
##
## Concordance= 0.616  (se = 0.009 )
## Likelihood ratio test= 176.1  on 2 df,   p=<2e-16
## Wald test            = 191.9  on 2 df,   p=<2e-16
## Score (logrank) test = 204.2  on 2 df,   p=<2e-16
```

Se tiene que

- Para $factor(surg)1$ se tiene que $exp(coef) = 1.310$, lo que implica que el cambio de cociente de riesgos entre un paciente con una cirugía de mayor tiempo y otro que tenga una cirugía de menor tiempo es de 1.310. Una cirugía de más tiempo atrás implica un mayor riesgo de muerte.
- Para $factor(node4)1$ se tiene que $exp(coef) = 2.492$, lo que implica que el cambio de cociente de riesgos entre un paciente con más de 4 ganglios linfáticos afectados y otro que no, es de 2.492. Una paciente con más de 4 nodos implica un mayor riesgo de muerte.

¿Existen sujetos que tienen un mayor riesgo?

Las personas que tienen mayor riesgo de fallecimiento son las que presentan una cirugía de más tiempo atrás, asi como aquellos pacientes que tengan más de 4 ganglios linfáticos afectados.

Es valido tu modelo de acuerdo al supuesto de riesgos proporcionales?

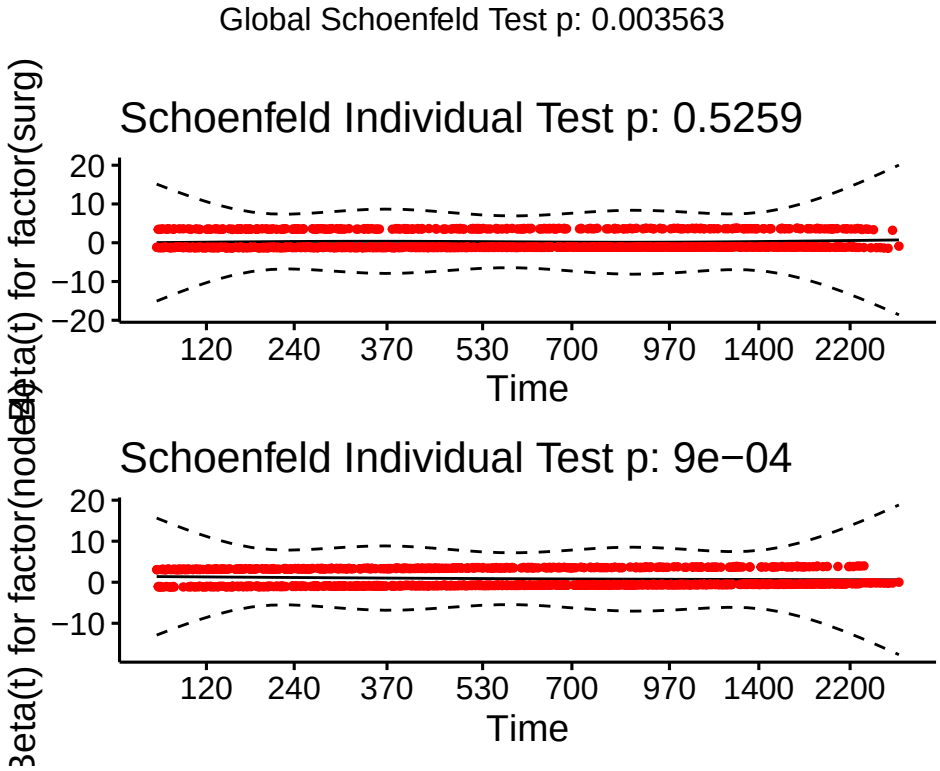
Se realizará la prueba que contrasta las hipotesis:

$$H_0: \text{ los riesgos son proporcionales vs } H_a: \text{ los riesgos no son proporcionales}$$

```
##                 chisq df       p
## factor(surg)    0.402  1 0.52588
## factor(node4) 10.984  1 0.00092
## GLOBAL        11.274  2 0.00356
```

Si se trabaja con un nivel de significancia de al 95 %, los $p - values < 0.05$ y por tanto, se rechazarían los riesgos proporcionales.

En este caso se escogerá un nivel de significancia al 99 %, para asi concluir que los riesgos son proporcionales y entonces los residuales se verian como:



Se tomó esta medida debido a que con otros modelos propuestos los $p - values$ seguían siendo menores que 0.05.

Conclusión.

El cáncer colorrectal es la segunda causa principal de muerte por cáncer en México y el tercero más frecuente dentro de la patología oncológica en la población general, afectando en igual proporción a hombres y mujeres.

A pesar de ser un problema en pacientes de edad avanzada con una media de diagnóstico de 50.8 años, cada día se detectan casos en gente más joven, de ahí la importancia de realizar un diagnóstico oportuno, lo que representa un gran reto en el conocimiento de la patología y actualización en el manejo adecuado, con la finalidad de aumentar la sobrevida y mejorar, en lo posible, la calidad de vida.

Referencias:

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