

# Package: mlmRev (via r-universe)

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**Version** 1.0-9

**Title** Examples from Multilevel Modelling Software Review

**Description** Data and examples from a multilevel modelling software review as well as other well-known data sets from the multilevel modelling literature.

**Depends** lme4, R (>= 2.10)

**Suggests** lattice

**LazyData** yes

**License** GPL (>= 2)

**NeedsCompilation** no

**URL** <https://github.com/annahuynhly/mlmRev>

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bdf *Language Scores of 8-Graders in The Netherlands*

---

## Description

The bdf data frame has 2287 rows and 25 columns of language scores from grade 8 pupils in elementary schools in The Netherlands.

## Usage

```
data(bdf)
```

## Format

**schoolNR** a factor denoting the school.

**pupilNR** a factor denoting the pupil.

**IQ.verb** a numeric vector of verbal IQ scores

**IQ.perf** a numeric vector of IQ scores.

**sex** Sex of the student.

**Minority** a factor indicating if the student is a member of a minority group.

**repeatgr** an ordered factor indicating if one or more grades have been repeated.

**aritPRET** a numeric vector

**classNR** a numeric vector

**aritPOST** a numeric vector

**langPRET** a numeric vector

**langPOST** a numeric vector

**ses** a numeric vector of socioeconomic status indicators.

**denomina** a factor indicating of the school is a public school, a Protestant private school, a Catholic private school, or a non-denominational private school.

**schoolSES** a numeric vector

**satiprin** a numeric vector

**natitest** a factor with levels 0 and 1

**meetings** a numeric vector  
**currmeet** a numeric vector  
**mixedgra** a factor indicating if the class is a mixed-grade class.  
**percmينو** a numeric vector  
**aritdiff** a numeric vector  
**homework** a numeric vector  
**classsiz** a numeric vector  
**groupsiz** a numeric vector

## References

Snijders, Tom and Bosker, Roel (1999) *Multilevel Analysis: An Introduction to Basic and Advanced Multilevel Modeling*, Sage.

## Examples

```
summary(bdf)
```

---

Chem97

*Scores on A-level Chemistry in 1997*

---

## Description

Scores on the 1997 A-level Chemistry examination in Britain. Students are grouped into schools within local education authorities. In addition some demographic and pre-test information is provided.

## Usage

```
data(Chem97)
```

## Format

A data frame with 31022 observations on the following 8 variables.

**lea** Local Education Authority - a factor  
**school** School identifier - a factor  
**student** Student identifier - a factor  
**score** Point score on A-level Chemistry in 1997  
**gender** Student's gender  
**age** Age in month, centred at 222 months or 18.5 years  
**gcsescore** Average GCSE score of individual.  
**gsecnt** Average GCSE score of individual, centered at mean.

**Details**

This data set is relatively large with 31,022 individuals in 2,280 schools. Note that while this is used, illustratively, to fit Normal response models, the distribution of the response is not well described by a Normal distribution.

**Source**

<https://www.bristol.ac.uk/cmm/learning/mmssoftware/data-rev.html>

**References**

Yang, M., Fielding, A. and Goldstein, H. (2002). Multilevel ordinal models for examination grades (submitted to *Statistical Modelling*).

**Examples**

```
str(Chem97)
summary(Chem97)
(fm1 <- lmer(score ~ (1|school) + (1|lea), Chem97))
(fm2 <- lmer(score ~ gcsecnt + (1|school) + (1|lea), Chem97))
```

---

Contraception

*Contraceptive use in Bangladesh*

---

**Description**

These data on the use of contraception by women in urban and rural areas come from the 1988 Bangladesh Fertility Survey.

**Usage**

```
data(Contraception)
```

**Format**

A data frame with 1934 observations on the following 6 variables.

**woman** Identifying code for each woman - a factor

**district** Identifying code for each district - a factor

**use** Contraceptive use at time of survey

**livch** Number of living children at time of survey - an ordered factor. Levels are 0, 1, 2, 3+

**age** Age of woman at time of survey (in years), centred around mean.

**urban** Type of region of residence - a factor. Levels are urban and rural

**Source**

<https://www.bristol.ac.uk/cmm/learning/mmssoftware/data-rev.html>

## References

Huq, N. M., and Cleland, J. (1990). *Bangladesh Fertility Survey 1989 (Main Report)* Dhaka: National Institute of Population Research and Training.

## Examples

```
str(Contraception)
summary(Contraception)
(fm1 <- glmer(use ~ urban+age+livch+(1|district), Contraception, binomial))
(fm2 <- glmer(use ~ urban+age+livch+(urban|district), Contraception, binomial))
```

---

Early

*Early childhood intervention study*

---

## Description

Cognitive scores of infants in a study of early childhood intervention. The 103 infants from low income African American families were divided into a treatment group (58 infants) and a control group (45 infants). Starting at 0.5 years of age the infants in the treatment group were exposed to an enriched environment. Each infant's cognitive score on an age-specific, normalized scale was recorded at ages 1, 1.5, and 2 years.

## Usage

```
data(Early)
```

## Format

This groupedData object contains the following columns

**id** An ordered factor of the id number for each infant.

**cog** A numeric cognitive score.

**age** The age of the infant at the measurement.

**trt** A factor with two levels, "N" and "Y", indicating if the infant is in the early childhood intervention program.

## References

Singer, Judith D. and Willett, John B. (2003), *Applied Longitudinal Data Analysis*, Oxford University Press. (Ch. 3)

## Examples

```
str(Early)
```

---

egsingle

*US Sustaining Effects study*

---

### Description

A subset of the mathematics scores from the U.S. Sustaining Effects Study. The subset consists of information on 1721 students from 60 schools

### Usage

```
data(egsingle)
```

### Format

A data frame with 7230 observations on the following 12 variables.

**schoolid** a factor of school identifiers

**childid** a factor of student identifiers

**year** a numeric vector indicating the year of the test

**grade** a numeric vector indicating the student's grade

**math** a numeric vector of test scores on the IRT scale score metric

**retained** a factor with levels 0 1 indicating if the student has been retained in a grade.

**female** a factor with levels Female Male indicating the student's sex

**black** a factor with levels 0 1 indicating if the student is Black

**hispanic** a factor with levels 0 1 indicating if the student is Hispanic

**size** a numeric vector indicating the number of students enrolled in the school

**lowinc** a numeric vector giving the percentage of low-income students in the school

**mobility** a numeric vector

### Source

These data are distributed with the HLM software package (Bryk, Raudenbush and Congdon, 1996). Conversion to the R format is described in Doran and Lockwood (2004).

### References

Doran, Harold C. and Lockwood, J.R. (2004), *Fitting value-added models in R*, (submitted).

### Examples

```
str(egsingle)
(fm1 <- lmer(math~year*size+female+(1|childid)+(1|schoolid), egsingle))
```

---

Exam

*Exam scores from inner London*

---

## Description

Exam scores of 4,059 students from 65 schools in Inner London.

## Usage

```
data(Exam)
```

## Format

A data frame with 4059 observations on the following 9 variables.

**school** School ID - a factor.

**normexam** Normalized exam score.

**schgend** School gender - a factor. Levels are mixed, boys, and girls.

**schavg** School average of intake score.

**vr** Student level Verbal Reasoning (VR) score band at intake - a factor. Levels are bottom 25%, mid 50%, and top 25%.

**intake** Band of student's intake score - a factor. Levels are bottom 25%, mid 50% and top 25%./

**standLRT** Standardised LR test score.

**sex** Sex of the student - levels are F and M.

**type** School type - levels are Mxd and Sngl.

**student** Student id (within school) - a factor

## Source

<https://www.bristol.ac.uk/cmm/learning/mmssoftware/data-rev.html>

## References

Goldstein, H., Rasbash, J., et al (1993). A multilevel analysis of school examination results. *Oxford Review of Education* 19: 425-433

## Examples

```
str(Exam)
summary(Exam)
(fm1 <- lmer(normexam ~ standLRT + sex + schgend + (1|school), Exam))
(fm2 <- lmer(normexam ~ standLRT*sex + schgend + (1|school), Exam))
(fm3 <- lmer(normexam ~ standLRT*sex + schgend + (1|school), Exam))
```

---

Gcsemv

*GCSE exam score*

---

### Description

The GCSE exam scores on a science subject. Two components of the exam were chosen as outcome variables: written paper and course work. There are 1,905 students from 73 schools in England.

### Usage

```
data(Gcsemv)
```

### Format

A data frame with 1905 observations on the following 5 variables.

**school** School ID - a factor

**student** Student ID - a factor

**gender** Gender of student

**written** Total score on written paper

**course** Total score on coursework paper

### Source

<https://www.bristol.ac.uk/cmm/learning/mmssoftware/data-rev.html>

### References

Multivariate response models. (2000). In Rasbash, J., et al, *A user's guide to MLwiN*, Institute of Education, University of London.

### Examples

```
str(Gcsemv)
```

guImmun

*Immunization in Guatemala***Description**

Immunizations received by children in Guatemala.

**Usage**

```
data(guImmun)
```

**Format**

A data frame with 2159 observations on the following 13 variables.

**kid** a factor identifying the child

**mom** a factor identifying the family.

**comm** a factor identifying the community.

**immun** a factor indicating if the child received a complete set of immunizations. All children in this data frame received at least one immunization.

**kid2p** a factor indicating if the child was 2 years or older at the time of the survey.

**mom25p** a factor indicating if the mother was 25 years or older.

**ord** an factor indicating the child's birth's order within the family. Levels are 01 - first child, 23 - second or third child, 46 - fourth to sixth child, 7p - seventh or later child.

**ethn** a factor indicating the mother's ethnicity. Levels are L - Ladino, N - indigenous not speaking Spanish, and S - indigenous speaking Spanish.

**momEd** a factor describing the mother's level of education. Levels are N - not finished primary, P - finished primary, S - finished secondary

**husEd** a factor describing the husband's level of education. Levels are the same as for momEd plus U - unknown.

**momWork** a factor indicating if the mother had ever worked outside the home.

**rural** a factor indicating if the family's location is considered rural or urban.

**pcInd81** the percentage of indigenous population in the community at the 1981 census.

**Source**

The data was previously available at <https://web.archive.org/web/20220630033626/http://data.princeton.edu/multilevel/guImmun.dat>. But how one can find it on <https://grodriguez.github.io/research/guat>. Multiple indicator columns in the original data table have been collapsed to factors for this data frame.

**References**

Rodriguez, Germ?n and Goldman, Noreen (1995), "Improved estimation procedures for multilevel models with binary response: a case-study", *Journal of the Royal Statistical Society, Series A*, **164**, 339-355.

**Examples**

```
data(guImmun)
summary(guImmun)
```

---

guPrenat

*Prenatal care in Guatemala*


---

**Description**

Data on the prenatal care received by mothers in Guatemala.

**Usage**

```
data(guPrenat)
```

**Format**

A data frame with 2449 observations on the following 15 variables.

**kid** a factor identifying the birth

**mom** a factor identifying the mother or family

**cluster** a factor identifying the community

**prenat** a factor indicating if traditional or modern prenatal care was provided for the birth.

**childAge** an ordered factor of the child's age at the time of the survey.

**motherAge** a factor indicating if the mother was older or younger. The cut-off age is 25 years.

**birthOrd** an ordered factor for the birth's order within the family.

**indig** a factor indicating if the mother is Ladino, or indigenous not speaking Spanish, or indigenous speaking Spanish.

**momEd** a factor describing the mother's level of education.

**husEd** a factor describing the husband's level of education.

**husEmpl** a factor describing the husband's employment status.

**toilet** a factor indicating if there is a modern toilet in the house.

**TV** a factor indicating if there is a TV in the house and, if so, the frequency with which it is used.

**pcInd81** the percentage of indigenous population in the community at the 1981 census.

**ssDist** distance from the community to the nearest clinic.

**Source**

This data was previously available at <https://web.archive.org/web/20220630035028/https://data.princeton.edu/multilevel/guPrenat.dat>. But how one can find it on <https://grodriguez.github.io/research/guat>. Multiple indicator columns in the original data table have been collapsed to factors for this data frame.

## References

Rodriguez, Germ?n and Goldman, Noreen (1995), "Improved estimation procedures for multilevel models with binary response: a case-study", *Journal of the Royal Statistical Society, Series A*, **164**, 339-355.

## Examples

```
data(guPrenat)
summary(guPrenat)
```

---

Hsb82

*High School and Beyond - 1982*

---

## Description

Data from the 1982 study "High School and Beyond".

## Usage

```
data(Hsb82)
```

## Format

A data frame with 7185 observations on students including the following 8 variables.

**school** an ordered factor designating the school that the student attends.

**minrty** a factor with levels

**sx** a factor with levels Male and Female

**ses** a numeric vector of socio-economic scores

**mAch** a numeric vector of Mathematics achievement scores

**meansas** a numeric vector of mean ses for the school

**sector** a factor with levels Public and Catholic

**cses** a numeric vector of centered ses values where the centering is with respect to the meanses for the school.

## Details

Each row in this data frame contains the data for one student.

## References

Raudenbush, Stephen and Bryk, Anthony (2002), *Hierarchical Linear Models: Applications and Data Analysis Methods*, Sage (chapter 4).

## Examples

```
data(Hsb82)
summary(Hsb82)
```

---

Mmmec

*Malignant melanoma deaths in Europe*

---

### Description

Malignant Melanoma Mortality in the European Community associated with the impact of UV radiation exposure.

### Usage

```
data(Mmmec)
```

### Format

A data frame with 354 observations on the following 6 variables.

**nation** a factor with levels Belgium, W. Germany, Denmark, France, UK, Italy, Ireland, Luxembourg, and Netherlands

**region** Region ID - a factor.

**county** County ID - a factor.

**deaths** Number of male deaths due to MM during 1971–1980

**expected** Number of expected deaths.

**uvb** Centered measure of the UVB dose reaching the earth's surface in each county.

### Source

<https://www.bristol.ac.uk/cmm/learning/mmssoftware/data-rev.html>

### References

Langford, I.H., Bentham, G. and McDonald, A. 1998: Multilevel modelling of geographically aggregated health data: a case study on malignant melanoma mortality and UV exposure in the European community. *Statistics in Medicine* 17: 41-58.

### Examples

```
str(Mmmec)
summary(Mmmec)
(fm1 <- glmer(deaths ~ uvb + (1|region), Mmmec, poisson, offset = log(expected)))
```

---

Oxboys

*Heights of Boys in Oxford*

---

### Description

The Oxboys data frame has 234 rows and 4 columns.

### Format

This data frame contains the following columns:

**Subject** an ordered factor giving a unique identifier for each boy in the experiment

**age** a numeric vector giving the standardized age (dimensionless)

**height** a numeric vector giving the height of the boy (cm)

**Occasion** an ordered factor - the result of converting age from a continuous variable to a count so these slightly unbalanced data can be analyzed as balanced.

### Details

These data are described in Goldstein (1987) as data on the height of a selection of boys from Oxford, England versus a standardized age.

### Source

Pinheiro, J. C. and Bates, D. M. (2000) *Mixed-Effects Models in S and S-PLUS*, Springer, New York. (Appendix A.19)

### Examples

```
data(Oxboys)
```

---

s3bbx

*Covariates in the Rodriguez and Goldman simulation*

---

### Description

The s3bbx data frame has 2449 rows and 6 columns of the covariates in the simulation by Rodriguez and Goldman of multilevel dichotomous data.

### Usage

```
data(s3bbx)
```

**Format**

This data frame contains the following columns:

**child** a numeric vector identifying the child

**family** a numeric vector identifying the family

**community** a numeric vector identifying the community

**chldcov** a numeric vector of the child-level covariate

**famcov** a numeric vector of the family-level covariate

**commcov** a numeric vector of the community-level covariate

**Source**

This data was previously available at <https://web.archive.org/web/20070629024256/http://data.princeton.edu/multilevel/simul.htm>. Currently, it can be found somewhere on <https://grodriguez.github.io/research/simul>.

**References**

Rodríguez, Germán and Goldman, Noreen (1995) An assessment of estimation procedures for multilevel models with binary responses, *Journal of the Royal Statistical Society, Series A* **158**, 73–89.

**Examples**

```
str(s3bbx)
```

---

```
s3bby
```

*Responses simulated by Rodriguez and Goldman*

---

**Description**

A matrix of the results of 100 simulations of dichotomous multilevel data. The rows correspond to the 2449 births for which the covariates are given in [s3bbx](#). The elements of the matrix are all 0, indicating no modern prenatal care, or 1, indicating model prenatal care. These were simulated with "large" variances for both the family and the community random effects.

**Usage**

```
data(s3bby)
```

**Format**

An integer matrix with 2449 rows and 100 columns.

**Source**

This data was previously available at <https://web.archive.org/web/20070629024256/http://data.princeton.edu/multilevel/simul.htm>. Currently, it can be found somewhere on <https://grodriguez.github.io/research/simul>.

## References

Rodriguez, Germ?n and Goldman, Noreen (1995) An assessment of estimation procedures for multilevel models with binary responses, *Journal of the Royal Statistical Society, Series A* **158**, 73–89.

## Examples

```
str(s3bby)
```

---

ScotsSec	<i>Scottish secondary school scores</i>
----------	---

---

## Description

Scores attained by 3435 Scottish secondary school students on a standardized test taken at age 16. Both the primary school and the secondary school that the student attended have been recorded.

## Usage

```
data(ScotsSec)
```

## Format

A data frame with 3435 observations on the following 6 variables.

**verbal** The verbal reasoning score on a test taken by the students on entry to secondary school.

**attain** The score attained on the standardized test taken at age 16.

**primary** A factor indicating the primary school that the student attended.

**sex** A factor with levels M and F

**social** The student's social class on a numeric scale from low to high social class.

**second** A factor indicating the secondary school that the student attended.

## Details

These data are an example of cross-classified grouping factors.

## Source

<https://www.bristol.ac.uk/cmm/learning/mmssoftware/data-rev.html>

## References

Paterson, L. (1991). Socio economic status and educational attainment: a multidimensional and multilevel study. *Evaluation and Research in Education* **5**: 97-121.

## Examples

```
str(ScotsSec)
```

---

Socatt

*Social Attitudes Survey*

---

### Description

These data come from the British Social Attitudes (BSA) Survey started in 1983. The eligible persons were all adults aged 18 or over living in private households in Britain. The data consist of completed results of 264 respondents out of 410.

### Usage

```
data(Socatt)
```

### Format

A data frame with 1056 observations on the following 9 variables.

**district** District ID - a factor

**respond** Respondent code (within district) - a factor

**year** A factor with levels 1983, 1984, 1985, and 1986

**numpos** An ordered factor giving the number of positive answers to seven questions.

**party** Political party chosen - a factor. Levels are conservative, labour, Lib/SDP/Alliance, others, and none.

**class** Self assessed social class - a factor. Levels are middle, upper working, and lower working.

**gender** Respondent's sex. (1=male, 2=female)

**age** Age in years

**religion** Religion - a factor. Levels are Roman Catholic, Protestant/Church of England, others, and none.

### Details

These data are provided as an example of multilevel data with a multinomial response.

### Source

<https://www.bristol.ac.uk/cmm/learning/mmssoftware/data-rev.html>

### References

McGrath, K. and Waterton, J. (1986). *British Social Attitudes 1983-1986 panel survey*. London, Social and Community Planning Research.

### Examples

```
str(Socatt)
summary(Socatt)
```

---

 star

*Student Teacher Achievement Ratio (STAR) project data*


---

### Description

Data from Tennessee's Student Teacher Achievement Ratio (STAR) project which was a large-scale, four-year study of the effect of reduced class size.

### Usage

```
data(star)
```

### Format

A data frame with 26796 observations on the following 18 variables.

id a factor - student id number

sch a factor - school id number

gr grade - an ordered factor with levels K < 1 < 2 < 3

cltype class type - a factor with levels small, reg and reg+A. The last level indicates a regular class size with a teachers aide.

hdeg highest degree obtained by the teacher - an ordered factor with levels ASSOC < BS/BA < MS/MA/MEd < MA+ < Ed.S < Ed.D/Ph.D

clad career ladder position of the teacher - a factor with levels NOT APPR PROB PEND 1 2 3

exp a numeric vector - the total number of years of experience of the teacher

trace teacher's race - a factor with levels W, B, A, H, I and O representing white, black, Asian, Hispanic, Indian (Native American) and other

read the student's total reading scaled score

math the student's total math scaled score

ses socioeconomic status - a factor with levels F and N representing eligible for free lunches or not eligible

sctype school type - a factor with levels inner, suburb, rural and urban

sx student's sex - a factor with levels M F

eth student's ethnicity - a factor with the same levels as trace

birthq student's birth quarter - an ordered factor with levels 1977:1 < ... < 1982:2

birthy student's birth year - an ordered factor with levels 1977:1982

yrs number of years of schooling for the student - a numeric version of the grade gr with Kindergarten represented as 0. This variable was generated from gr and does not allow for a student being retained.

tch a factor - teacher id number

**Details**

Details of the original data source and the process of conversion to this representation are given in the vignette.

**References**

Word, E., Johnston, J., Bain, H.P., et al. (1994). *The State of Tennessee's Student/Teacher Achievement Ratio (STAR) Project: Technical Report 1985–1990*. Nashville: Tennessee State Department of Education.

**Examples**

```
str(star)
```

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